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Issue 106 | December 2019

Future of Land Management

In this issue

Welcome

Future of Land Management

There has been a long period of relative stability in land management policy in the UK, dominated by the two-pillar Common Agricultural Policy and by European environmental regulation. There have been notable successes under this regime, but not on the scale necessary to halt, let alone reverse the overall decline in biodiversity or solve other persistent environmental problems. The UK's likely exit from the EU means that we will be leaving this relatively stable policy framework and it is timely to look at some of the challenges we will face, the opportunities that may be available and some possible ways forward. This edition of *In Practice* contains a series of articles that can help us do that.

Key challenges explored in this edition of *In Practice* include:

- The need to respond to climate change, both by adapting the natural and human environment to the changing climate and by changing land management so it makes a net positive contribution to climate change mitigation.
- Finding creative, integrated solutions to ever greater competition for land, for food and renewable energy production, for landscape-scale conservation, for delivery of ecosystem services, for development and for access, recreation, health and wellbeing.
- Responding to the impacts of new diseases, such as ash dieback, and to invasive species.

Government policy will continue to be very important in setting the direction for the future of land management. It is likely to diverge across the UK. In England it will be interesting to see if the principle of payment only for public goods survives. Across the other countries it will be interesting to see whether environmental, economic and social considerations can be successfully integrated.

Other major uncertainties are:

- What appetite will the governments of the UK have for environmental regulation and how committed will they be to effective enforcement?
- What scale of funding will be available for land management funding now it has to compete head on with the NHS, schools and the police?
- What will the impact of trade policy be on UK agriculture?

Will Manley and Steve Pullan's articles (pages 26 and 30) explore some of the issues around the future direction of agricultural policy in England in more detail.

There has been much talk about increased private sector funding for the environment. This is becoming established practice in the water industry and is starting to happen through biodiversity offsetting, but otherwise there is little sign of hard cash. Government needs to provide robust frameworks to create and regulate more markets for environmental goods.

There are lots of fascinating debates going on about the best approach to environmental land management – land sharing versus land sparing; rewilding versus conservation of cultural landscapes. In truth, there is probably room for all of these. A key point that is often overlooked, but which comes out very clearly from Roger Crofts' article (page 6), is that most of the decisions relating to land management are made by land owners and managers. The single greatest priority should probably be to get them more engaged in and enthused about environmental land management.

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Information

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Front cover: Train passing through countryside near Greater Manchester

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Elections 2019

The 2019 elections are now complete, with elections having taken place for the Governing Board, Advisory Forum and across our Member Networks. You can find the full results in in the Members' area at: events.cieem.net/Portal/VolunteeringwithCIEEM/Elections.aspx

Calling all Employers!

You can now advertise your work placements, internships and traineeships for free on CIEEM's new Opportunities Board. Any employer who offers rewarding work placement opportunities in accordance with CIEEM's good practice guidance (cieem.net/new-guidelines-for-work-experience/) can submit their advert(s), which will be displayed for free on the website and promoted to Student and Graduate/Qualifying members.

To find out more and to advertise your first placement visit cieem.net/jobs/.

Health and Wellbeing

Following the publication of the report of the Health and Wellbeing Survey and the summer conference on the same theme, a small Working Group has been formed to look at the actions CIEEM can take to promote health and wellbeing in the profession. The Group is exploring a number of areas of activity including production of guidance, case studies, resources signposting, events and good practice knowledge-sharing. If you would like to join the Working Group please email sallyhayns@cieem.net.

Action 2030

In September, we declared a climate emergency and biodiversity crisis – but a declaration means nothing without action. That is why we have now launched Action 2030.

This new working group will devise ways in which we, as a profession, can address the climate emergency and biodiversity crisis.

Find out more at: cieem.net/action-2030/

CIEEM Awards Now Open for Nominations!

Our annual CIEEM Awards are your chance to inspire the next generation, to recognise the skills of your peers and to remind one another why we're here, doing what we do and striving every day to make a difference.

Our 11 different categories are designed to celebrate a range of organisations, projects and individuals who have made significant contributions to protecting the natural environment; from NGOs to Planning Authorities; and from innovators to those at the beginning of their journey!

We also have a brand new category for 2020 – our Action 2030 Award, which aims to recognise those who are having an impact in raising awareness, engaging others and/or leading action in relation to the climate emergency and/or biodiversity crisis.

To find out more about each Award, including nomination criteria and deadlines for nominations, please visit our Awards 2020 webpage (www.cieem.net/awards-2020).

Staff Changes

We are pleased to welcome **Joanna Oliver** and **Jamie Jowett** to the CIEEM team in Winchester. Joanna joins us as the new Professional Standards Administrator, and Jamie as the new Professional Development Administrator.

NEW LGBTQ+ Special Interest Group Launched

CIEEM has joined with partners the Landscape Institute, Design Council and Institute of Place Management (IPM), to launch a new networking group for LGBTQ+ members and allies.

#RainbowPlaces provides a platform for people to have conversations around their experiences, to develop and implement ideas of how to make the industry more inclusive, to raise awareness and visibility, to champion role models and 'proud' practices already providing inclusive workplaces, and to lead by example in building a network with LGBT+ professionals and allies across the landscape, place and environment sectors.

The SIG will be hosted by the Landscape Institute and supported by the other partner bodies.

Find out more at: cieem.net/new-lgbtq-special-interest-group-launched/

BNG Principles consultation

We are seeking views on how the Biodiversity Net Gain Good Practice Principles for Development (2016) are working to shape delivery and how they may potentially be improved. The online survey is open until 16 December 2019.

https://cieem.net/we-need-your-views-on-the-biodiversity-net-gain-good-practice-principles-for-development/

Conferences 2020		
4 March 2020	**Spring Conference 2020** Assessing and Mitigating Air Quality Impacts on Biodiversity	Sheffield
21-22 April 2020	**Irish Conference 2020** Conservation Approaches to Benefit National Biodiversity: Big Ideas for Big Challenges	Galway

In Practice themes

Edition	Theme	Article submission deadline
107 – March 2020	International Approaches	n/a
108 – June 2020	Open edition – all topics welcome	24 February 2020
109 – September 2020	Practical Action for Climate Change	25 May 2020
110 – December 2020	Nitrogen	24 August 2020

If you would like to contribute to one of these themes please contact the Editor at GillKerby@cieem.net.

Environment Bill launched in Parliament

Environment Secretary Theresa Villiers has now launched the long-awaited Environment Bill. The Bill includes requirements on Ministers to set legally binding targets, environmental principles of which Ministers must have due regard, a new environmental watchdog called the Office for Environmental Protection (OEP), duties on public bodies and a mandatory approach to biodiversity net gain. There are some notable exemptions in the Bill and there are concerns about the independence of the OEP.

https://cieem.net/what-you-need-to-know-about-the-new-environment-bill/

No Let-up in Net Loss of UK's Nature

The UK's wildlife continues to decline according to the State of Nature 2019 report. The latest findings show that since the 1970s, there has been a 13% decline in average abundance across wildlife studied and that the declines continue unabated. The State of Nature 2019 report also reveals that 41% of UK species studied have declined, 26% have increased and 33% shown little change since 1970, while 133 species assessed have already been lost from our shores since 1500.

https://cieem.net/no-let-up-in-net-loss-of-uks-nature/

Independent review calls for radical plan for England's National Parks

A major independent review, led by Julian Glover, has called for bold action for National Parks and Areas of Outstanding Natural Beauty (AONBs). Key recommendations include a new National Landscapes Service; new protections, responsibilities, titles and funding for AONBs; and a transformed approach to recover and enhance nature, working with farmers and conservation groups to reverse declines.

https://www.gov.uk/government/news/independent-review-calls-for-radical-plan-for-englands-national-parks

Glasgow to Host UN Climate Summit in 2020

The UK will host the COP26 United Nations Climate Change Summit in partnership with Italy. The event will be held at the Scottish Events Campus (SEC) in Glasgow at the end of next year and will produce an international response to the climate emergency. Up to 30,000 delegates are expected at the event including 200 world leaders.

https://www.bbc.co.uk/news/uk-scotland-glasgow-west-49650909

Report shows land management scheme pilot boosts environment outcomes

A new report published by Natural England and the Yorkshire Dales National Park Authority, shows a "Payment by Results" pilot is boosting local wildlife and motivating farmers to develop nature-friendly practices. 34 farmers took part who were given training and advice prior to selecting management options for their farm. Results show an increase in seed-bearing plants and wildflower species.

https://www.gov.uk/government/news/new-report-shows-pilot-scheme-farmers-boost-environment-outcomes

Chair of Natural Resources Wales confirmed

Minister for Environment, Energy and Rural Affairs, Lesley Griffiths announced that Sir David Henshaw has been confirmed as the chair of Natural Resources Wales. Sir David has been interim chair since November 2018. A pre-appointment hearing by the National Assembly's Climate Change, Environment and Rural Affairs Committee endorsed the appointment.

https://gov.wales/sir-david-henshaw-confirmed-chair-natural-resources-wales

UK Biodiversity Indicators 2019

The Department for Environment, Food & Rural Affairs (Defra) has published the annual report on the UK's progress towards meeting the biodiversity goals (Aichi targets) agreed in 2010. The report shows that 24 of the 41 indicators assessed are showing signs of improvement in the long term, while 12 are deteriorating. However, the report does indicate that progress is stalling, as only 18 are showing improvements in the short term.

https://cieem.net/uk-biodiversity-indicators-2019/

Scottish Government Programme 2019-2020

The Scottish Government has announced its programme for the period 2019-2020. It has been praised by environmental NGOs for its climate focus; however, it falls short of delivering an effective plan for environmental governance following Brexit. This follows a target to achieve net-zero carbon emissions being passed into law.

https://www.gov.scot/publications/protecting-scotlands-future-governments-programme-scotland-2019-20/pages/2/

Report on the Status of EU Protected Habitats and Species in Ireland

The National Parks and Wildlife Service has published the 2019 Article 17 reports outlining the status of EU protected habitats and species in Ireland. Many habitats are still in Unfavourable status with nearly half demonstrating ongoing declines, however there are also positive trends for plants and animal species, with over 70% stable or increasing.

https://www.npws.ie/sites/default/files/publications/pdf/NPWS_2019_Vol1_Summary_Article17.pdf

UN Climate Action Summit – September 2019

The UN Climate Action Summit was held in New York from 21-23 September 2019. The aim of the event was to showcase the best action plans to reduce emissions in line with the Paris Climate Agreement. Nine coalitions have been established, focusing on the following action areas such as transition to renewable energy; nature-based solutions and resilience and adaptation.

http://sdg.iisd.org/events/un-2019-climate-summit/

Land Management Conflicts and Solutions

Keywords: conflict resolution, ethics, land management, mechanisms

Roger Crofts FCIEEM

Arguments about land use continue. No one decision-making system is able to resolve these. This Viewpoint argues the case for improvements needed to provide a more informed basis for land management decision making in the UK to help stimulate debate in CIEEM.

Introduction

Land management is currently one of the most important issues for ecologists and environmental managers. Land demand for housing, new infrastructure and renewable energy installations continues unabated. Major uncertainties exist for agriculture post-Brexit. Continuing loss of biodiversity and the rapidity of climate change challenge current practices and create uncertainty. Focussing on single land uses will not resolve the conflicts because so many are interconnected and decisions on one will have consequences for others. There are no easy answers.

Recognising land use conflicts

There are many battles about the best use of land. It is needed for housing, new transport links and renewable energy installations. Simultaneously, there is demand for safeguarding the best agricultural land, and providing more space for nature. Some land uses are inherently in conflict with others, and some are complementary. For example, around the urban fringes housing and associated development conflicts with the safeguarding of the best quality agricultural land and the retention of public amenity. In the uplands there are conflicts between sheep rearing for food, moorland management for field sports, tree planting for home grown timber, electricity generation to reduce carbon emissions, and nature protection. It is challenging to find a way to accommodate these diverse land uses and to resolve conflicts between different users.

Figure 1. Grant-aided afforestation of vegetated moorland in 2018 causing loss of soil, water and nutrients justified under climate change policy. Photo credit Roger Crofts.

This is partly due to the mindsets and intransigence of the parties involved. Despite some dialogue counter opinions are often polarised: *Blame Somebody Else, Not Invented Here, Not in My Backyard, Not in Anybody's Backyard*. These well-known syndromes dog the debate about land use. Without changes in the mindsets of participants, conflict will continue. One way forward is to adopt behavioural change approaches.

Changing behaviours

A few years ago, following a seminar on land management with global experts, I worked with a lawyer and a psychologist on principles to improve land management through behavioural change (Hine *et al*. 2015). Our new paradigm comprised the following elements:

1. **Recognise varying behaviours amongst stakeholders**: their reaction to pressure for change can be used to induce behavioural change.
2. **Use an inclusive process to develop solutions**: engage in meaningful dialogue to bring all communities of interest together and shape common solutions.
3. **Develop an ethical charter for resource use and management** based on the 'public good argument'.
4. **Use multifaceted approaches to induce positive attitude change**: replacing the 'carrot and stick' approach with a combination of economic incentives (not subsidies), peer pressure, and applying behavioural change in practice.

5. **Develop policy to reflect local reality and high-level imperatives**: meeting of global and local inputs to replace top-down solutions.
6. **Ensure that all policy has multiple objectives** so that all stakeholders agree that land use is a multi-objective activity embracing ecosystem management, delivering environmental services, producing food and stimulating economic development.
7. **Exchange knowledge on an equal basis between all parties** changing from knowledge transfer from the 'expert' to knowledge sharing whereby practical experience is recognised as an equal partner.

This behavioural approach needs to be supported by an ethical basis, a set of basic principles and improvements in existing mechanisms.

Changing our philosophy

An ethical charter is needed. We can use the tenets of the Earth Charter (Earth Charter Initiative 2000) and the United Nation's Sustainable Development Goals (United Nations 2015). The Earth Charter principles are valid for addressing conflict resolution: respect and care for the community of life, ecological integrity, social and economic justice and democracy, non-violence and peace.

In practice, the sustainability ethic is not being adopted in the UK, maybe because development and prosperity are considered to be essential, even given the cost of natural resource depletion and intergenerational equity. For example, the current agricultural support system is still production focussed despite the Codes of Practice and greening elements.

Does who owns the land have a bearing on this? I doubt that it does, as I have observed both good practice and unacceptable practice among local communities, intergenerational owners, and governments. What matters is how the land is looked after: an intergenerational stewardship approach is needed, achieved through a combination of principles and mechanisms.

Adopting some basic principles

There is plenty of literature on good practice, including the Codes of Practice from within the UK government departments (e.g. Defra 2018). There is a role for CIEEM to lead a debate about the basic principles of land management from an environmental perspective. Below are three suggestions.

Figure 2. Loss of prime agricultural land to housing in East Lothian. Photo credit Roger Crofts.

Recognise **natural capital** as a fundamental component in valuing land**.** The current basis of development potential is surely outmoded. Recognising the value of the natural capital in land, such as the ecosystem functions and services provided, might encourage a less exploitative mentality.

Greater recognition of **protecting natural processes and features** Is needed. The arguments about exploitation in protected areas, such as gold and potash mining, remain unresolved, while both landscape quality and biodiversity continue to decline. An objective-based approach to management within all types of protected areas is a well-tested way forward using the IUCN Management Categories system (see Dudley 2008 for details; and Crofts *et al*. 2014 for implementation in the UK). In addition, we need to address how much land should be managed for nature. The Lawton report (Lawton *et al*. 2010) addressed this and more recent international campaigns have argued for *Nature Needs Half* (https://natureneedshalf.org/). But is this sufficient or should all of the land be managed with nature as well as society in mind?

Recognise natural diversity through both **biodiversity and geodiversity**. Biodiversity is recognised through the Convention on Biological Diversity, but geodiversity has no formal international status. However, the *nature's stage* concept (Anderson and Ferree 2010) provides a new basis for an integrated approach to remove another conflict if the interdependencies within nature are recognised and geoconservation becomes an equal partner with biodiversity conservation (Crofts 2017).

Improving existing mechanisms

Improvements can be made to existing mechanisms to reduce conflict.

Spatial land planning is undertaken through unconnected decision-making systems that are often unable to resolve conflict. The town and country planning system operates largely to favour development, with natural environment and community interests as secondary. The development of **regional spatial strategies**, trialled in England and Scotland, provides a way forward with active stakeholder participation. They need government encouragement to be widely adopted throughout the UK to provide an integrated approach to land use choices.

Placing **responsibilities and defining roles** of all owners, managers and users of land, alongside providing financial support for land operators, would be a step forward in reducing confusion and conflict. Existing codes of practice for agriculture and forestry are voluntary and not tied to receipt of public money. By contrast, the

Figure 3. 800-year-old oaks managed intergenerationally for nature and oak tree products at Dalkeith Oakwood SSSI. Photo credit Roger Crofts.

Figure 4. Integrated farm and water management in the Severn valley near Tewkesbury. Photo credit Roger Crofts.

Scottish Outdoor Access Code (Scottish Natural Heritage 2005) and the *Scottish Land Rights and Responsibilities Statement* (Scottish Government 2017) place unambiguous roles and responsibilities on all participants. Implementation has been mixed, but the approach is worthy of trialling throughout the UK.

The Landcare movement, developed in Australia and adopted in many countries, is based on the concept that owners and local communities should work together using their knowledge and experience to resolve conflicts and develop new ways of caring for the land (Catacutan 2009). These concepts should be part of the secondary schools' curriculum in the UK to inform future citizens about the combined effects of the climate emergency, biodiversity loss and continuing land degradation. It is termed **land literacy**: understanding all aspects of environmental, economic and social aspects of the land and its use.

Conclusion

Thinking fundamentally about how to reduce land management conflicts with an ethical basis, adopting some basic principles and improving mechanisms will, I hope, stimulate debate within CIEEM.

Acknowledgement

Thanks to Paul Goriup and Des Thompson for comments.

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About the Author

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Can Land Management Mitigate Climate Change?

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Keywords: global temperatures, land degradation, land management practices, rainfall patterns, soil erosion

Land management practices can reverse, mitigate and adapt to the impacts of climate change, but there needs to be robust evidence that these measures are practical and cost-effective. They also need to bring economic, social, ecological and environmental co-benefits in the short- and long-term.

The 2019 IPCC Special Report on *Climate Change and Land* presents the latest evidence on how climate change has significant impacts on global land resources (IPCC 2019). Anthropogenic climate change has been linked to land degradation including soil erosion, loss of organic matter and biodiversity, and landslides. These are major threats to soil resources that deliver vital ecosystem goods and services to society.

Figure 1. Severe soil erosion following an intense rainfall event in Herefordshire, UK.

Introduction

As far back as 2011, the UK Government's Chief Scientific Advisor, Sir John Beddington, highlighted the ever-increasing global demands made on our finite land resources (Government Office for Science 2011). We rely on land (and specifically soil) for many goods and services. These include providing safe, nutritious food to a growing global population (expected to reach 9 billion by 2050); supplying water for agriculture, industry and domestic use; generating enough energy to supply the growing population coming out of poverty; regulating greenhouse gas emissions; and reversing declining biodiversity and loss of ecosystems. These diverse and essential ecosystem goods and services are important because they affect individuals' health and wellbeing, and national economic status (Daily 1997).

The recently published IPCC Special Report on *Climate Change and Land* (IPCC 2019) questions whether these global challenges can be resolved, given the current (and future) impacts of climate change on the world's finite land resources. The Report presents the latest evidence on how global warming (caused by elevated levels of atmospheric greenhouse gases of carbon dioxide, methane and nitrous oxide) and associated climate change (CC) phenomena are already beginning to have significant impacts on global land resources.

Climate change impacts on land degradation

Since the pre-industrial period (1850-1900), land surface air temperatures have risen nearly twice as much as the global average temperature (IPCC 2018). The impacts of global warming and associated climate change will vary geographically, although in general our planet is becoming warmer. Anthropogenic climate change has been linked to the process of land degradation, defined as 'a negative trend in land condition, caused by direct or indirect human-induced processes, expressed as long-term reduction and as loss of at least one of the following: biological productivity, ecological integrity, or value to humans' (IPCC 2019). These degradation processes include soil erosion (Figure 1), compaction, loss of organic matter, loss of biodiversity, landslides and salinisation. These were identified as major threats to soil resources in Europe as far back as 2000 (Commission of the European Communities 2006). The last global assessment of soil degradation

(GLASOD) was carried out in 2009 (https://www.isric.org/projects/global-assessment-human-induced-soil-degradation-glasod), so there is a need to update this assessment to include the most recent climate change predictions, showing the areas most vulnerable to the consequences of climate change.

Hotter / warmer temperatures and land degradation

Warmer global temperatures will accelerate land degradation processes. Melting of ice caps and loss of sea ice is predicted to raise sea levels, causing coastal flooding and erosion. The loss of land through cliff and beach retreat results in loss of productive land and damage to properties, infrastructure and habitats (e.g. UK's East Anglian coast). Melting snow and ice on land lead to higher volumes of runoff that increase soil erosion risk. Global warming is also associated with more frequent, intense and longer duration tropical storms and hurricanes, (often initiated by critical sea temperatures of 26˚C) which can also lead to loss of productive land and livelihoods in coastal areas. Longer, more intense heat waves will lead to drying of land surfaces making the soil friable and prone to wind erosion, a major factor in the expansion of desertification. Drier soils are less likely to support a protective vegetation cover. Bare soil has a higher albedo, so atmospheric temperatures are further increased.

Whilst warmer temperatures can also be associated with more vegetation growth, this might be offset by a) less soil water available to plants in dried-out soils and b) a higher turnover (and less storage) of soil carbon through increased rates of soil microbial respiration (Crowther *et al.* 2019). Lower levels of soil carbon affect soil stability (erodibility), leading to more soil erosion. Soil carbon also determines the availability of water and nutrients to plants (leading to poor vegetation cover).

Increased rainfall and land degradation

According to reliable predictions, rainfall events will tend to become more frequent and intense, and will be of longer duration, but with large geographical variability (Murphy *et al*. 2018). This has a number of implications for land degradation processes. High intensity rainfall tends to have larger median drop sizes, falling at higher terminal velocities. This increases the kinetic energy of the rainfall and its erosivity (i.e. its ability to detach and transport soil particles/aggregates). Soil erosion by water is further accelerated as the more erosive rain falls on soils that are likely to be wetter (and thus more susceptible to erosion and compaction) due to the higher rainfall volume. This can cause irreversible loss of soil on-site. Eroded material is then transferred off-site by surface runoff to watercourses, where excessive sediment can have negative ecological and environmental consequences on aquatic ecosystems.

Within the eroded topsoil, higher

Figure 2. Exposing soils with high organic matter content to the atmosphere can lead to CO_2 emissions (near Holme Fen, Cambridgeshire).

Figure 3. Landslide due to heavy rains, Barley, Hertfordshire.

concentrations of organic matter / soil carbon are lost. Soil surfaces exposed by erosion may lose soil carbon to the atmosphere via oxidation (Figure 2; Lal 2003), demonstrating that land degradation processes can contribute to climate change, as well as vice versa.

Increased frequency, intensity and duration of rainfall events are also associated with higher incidence of landslides and mass movements (Figure 3; Bracegirdle *et al*. 2007). Rising groundwater levels lead to wetter soils with lower shear strength and higher pore water pressures that can trigger slope failure.

Decreased rainfall and land degradation

In other areas, a predicted decrease in rainfall means the frequency and intensity of droughts are predicted to increase. Drier soils will be susceptible to soil erosion by wind, leading to loss of soil on-site and air pollution (and associated impacts on human respiratory health) elsewhere (e.g. Sahara dust carried across the Atlantic). When peatlands dry out during droughts, the vast reserves of soil carbon they hold are exposed and emitted to the atmosphere, leading to further global warming (Figure 2). Vegetation growth will be reduced with less rainfall ('browning'), as plants become more water-stressed. Lack of protective vegetation cover increases erosion risk, leading to a negative feedback loop where eroded land cannot support vegetation that would otherwise protect land against erosion and desertification. Also, vegetation in drought prone areas will be prone to forest fires (as seen in the US and southern Europe in recent years), leading to further CO_2 emissions to the atmosphere and associated global warming.

Call for action?

The IPCC Report demonstrates the consequences of climate change induced land degradation from more frequent and extreme weather events (IPCC 2019). These impacts are hindering progress towards the United Nations Sustainable Development Goals, including Life below Water (SDG14) and Life on Land (SDG15) (IPBES 2018; Figure 4). It also warns that climate change induced land degradation is already beyond control in places (e.g. coastal erosion due to sea level rise; thawing of high latitude permafrost; and reduction in agricultural crop yields due to soil erosion). However, there is cause for optimism too. The Report makes recommendations on how governments and society as a whole can manage land to deal with these unprecedented issues. The Report also lists practical and cost-effective land management practices that reverse, mitigate and adapt to the impacts of climate change. Many of these can be adopted by land managers in the UK.

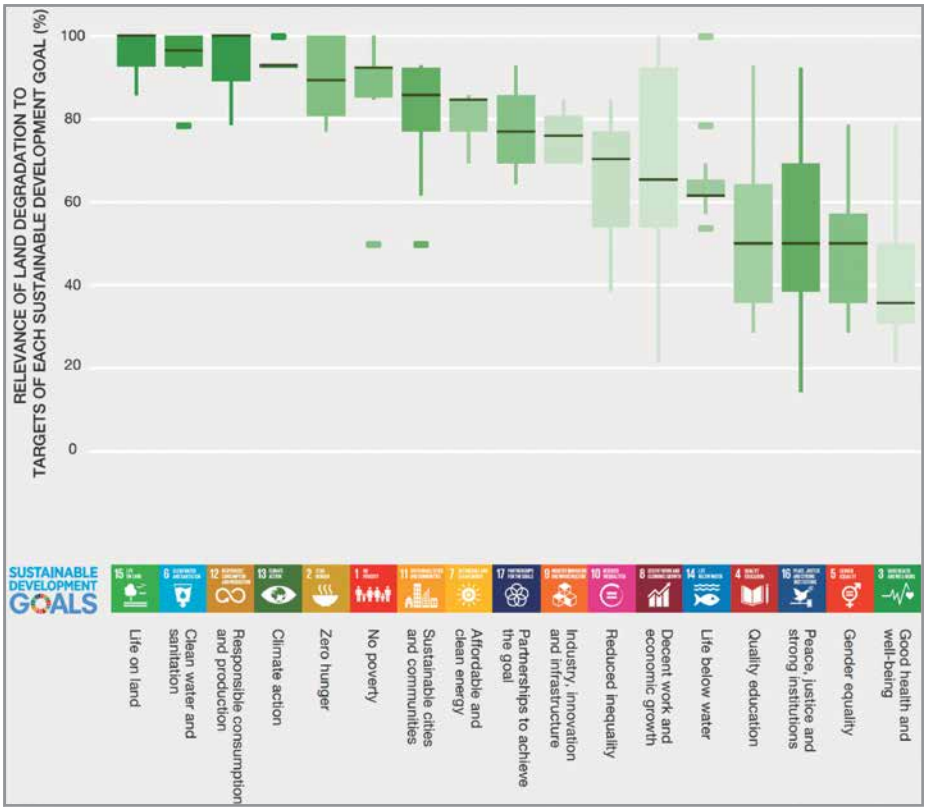

Figure 4. Relevance of land degradation to the United Nations Sustainable Development Goals (From IPBES 2018).

Land management practices to help reverse climate change

Some CO_2 can be taken out of the atmosphere through the process of photosynthesis. This reaction between CO_2, water and light can be promoted through land management practices that maximise vegetation cover. Converting atmospheric CO_2 to plant material will increase soil carbon storage through additions of organic matter from the plant roots and above-ground biomass, leading to more fertile and productive land. This can be achieved through land use change by planting more trees (afforestation) and avoiding tree removal through deforestation. In agricultural settings, planting trees on arable and pasture land can also maximize CO_2 uptake, through practices known as 'agroforestry'. The synergies between the different components can increase atmospheric CO_2 uptake and carbon storage in the soil. For example, deeper rooted perennial crops (e.g. trees and shrubs) are able to access soil nutrients at depth, which are unavailable to shallower rooted annual crops. During leaf fall, the nutrients assimilated in the leaves break down on the soil surface, where they then become available to the annual crops. The same principle applies to 'cover cropping', where soil is always covered with vegetation throughout the year to reduce CO_2 emissions from bare soil. As well as taking CO_2 out of the atmosphere, the cover crop is often incorporated into the soil, adding to soil organic matter and nutrient levels. 'Companion cropping' is used to ensure bare soil between wide row crops (e.g. maize) is vegetated to a) maximize photosynthesis and b) convert atmospheric CO_2 into soil organic matter (organic carbon).

Land management practices to mitigate climate change

Land management practices can also reduce CO_2 emissions to the atmosphere to mitigate climate change and its impacts. For example, minimal or even zero tillage practices cause relatively little disturbance of the soil, so minimising soil exposure to the atmosphere, unlike traditional inversion ploughing, where deeper soil layers are brought to the surface. Covering bare soil by leaving the previous seasons' crop residues on the ground will also avoid CO_2 emissions, as will planting a cover crop. Maintaining water levels in peatlands (i.e. avoiding drainage) and avoiding soil erosion (see below) can also prevent CO_2 emissions by reducing exposure of buried soil carbon to oxygen in the atmosphere.

Land management practices to adapt to climate change

Land management practices can adapt to the impacts of climate change. For example, the increased rates of soil erosion associated with extreme weather events can be controlled by soil conservation methods. Many of these measures were designed in response to the 1930s Dust Bowl in the US, where vast tracts of land suffered from catastrophic and irreversible soil loss. Some of these soil conservation measures are now used in the UK (Morgan 2005). Farmers are using cover crops and previous seasons' crop residues to ensure soils are protected at all times from more frequent, longer duration and higher intensity rainfall events. Field buffer strips are used to break up long slopes into shorter ones to reduce the build-up of surface water flow, which can lead to soil erosion. On engineered slopes such as cuttings and embankments, erosion control geotextiles are increasingly used to protect bare soil from rainfall and wind, until an adequate vegetation cover can be established. Where extreme weather has led to significant runoff and soil erosion, farmers have installed grassed waterways (Figure 5). These vegetated channels slow down the velocity of overland flow, encouraging the deposition of any eroded soil within the channel, rather than letting it run off into the local watercourses. Farmers are also using less intensive cultivation practices (such as zero tillage) that maintain soil structure and resistance to the erosive forces of rainfall, runoff and wind.

Climate change will also affect our ability to grow staple crops where they are grown today. They may become unsuitable and unsustainable because of the predicted increased incidence of droughts or flooding. This has huge implications for food security. One way to deal with this is by increasing the inputs of water, fertiliser, pesticides, etc., to support these crops, but this may make them uneconomic (especially given the already small margins on many agricultural commodities). Alternatively, new crops might be more suited to the 'new' climate conditions. 'Novel' crops such as vines, olives and even tea are already being introduced in southern England. Clearly there will be economic, environmental and social consequences of introducing new crops/changing land use to adapt to warmer, wetter winters and hotter, drier summers. For example, warmer temperatures have supported the introduction of maize into UK rotations. This spring sown, late harvested crop can cause severe soil damage through compaction and soil erosion on steep slopes in marginal areas (aggravated by extreme rainfall events). This suggests changing land use and/or crop type can bring unintended environmental, ecological, economic and social consequences.

Other land management measures to adapt to climate change have been incorporated into urban development and planning. They include engineering solutions such as Sustainable Urban Drainage (SUDs) schemes, flood proofing of buildings, integrated drainage systems to cope with more rainfall, and water conservation schemes to cope with less.

Implementation of land management practices to address climate change

Uptake of land management practices that address climate change impacts

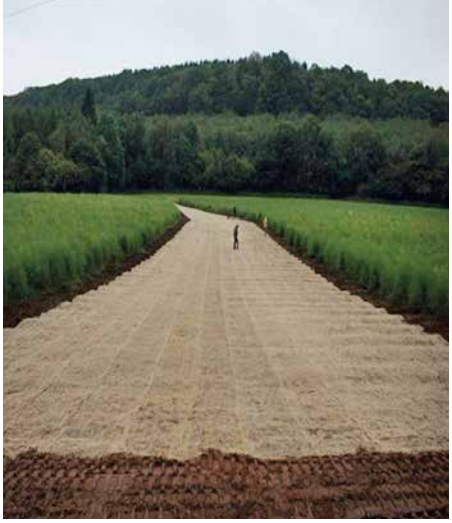

Figure 5. Use of grassed waterways to control soil erosion caused by extreme rainfall events, Herefordshire, UK.

will be challenging. First, there needs to be a sufficient body of robust evidence of the effectiveness of these measures in reversing, mitigating or adapting to climate change. This evidence is needed to inform cost-effective policies and practices. However, it may take several years to collate and quantify this evidence, and yet action is needed now. One way forward is to recognise that a number of land management practices to address climate change are well-known (as described in this article) and have been seen to be effective. In principle, there is very little risk that implementation of these measures will aggravate climate change or its effects. As a result, they should be recommended and their current use extended further, as the scientific evidence to justify them 'catches up'.

Second, these land management practices have to bring co-benefits to land managers and society as a whole, in both the short- and long-term. They are likely to incur financial costs in the short-term, so there should be incentives to encourage land managers to adopt them. Many practices (e.g. afforestation to sequester carbon) will only be effective in reducing CO_2 levels in the long-term; this planning horizon is often out of sync. with shorter-term political decisions that need to support and incentivise such schemes. Third, adoption of these practices by land managers requires adequate knowledge exchange, demonstration sites, advisory services, training, access to resources and more secure land tenure to prolong planning horizons. Finally, the consequences of introducing these measures (e.g. changing land use, SUDs) will have economic, social, ecological and environmental consequences that must be understood before implementation.

The IPCC warn that delay in addressing the impacts of climate change on land resources will increase the need for more widespread action in the future. As the impacts get worse with time, the number of cost-effective land management options available will reduce (IPCC 2019).

Conclusions

About a quarter of the Earth's ice-free land area is already subject to human-induced degradation (IPCC 2019). This brings negative ecological and environmental consequences. Climate change will aggravate land degradation processes that are already destroying finite and virtually irreplaceable natural capital that delivers a variety of essential ecosystem goods and services to society. Increased temperatures and heavier rainfall will accelerate the processes of soil erosion, compaction, loss of organic matter, loss of biodiversity, landslides and salinisation; many of which are irreversible. In turn, land degradation (such as removal of vegetation, draining of peatlands and soil erosion) can cause CO_2 emissions and associated climate change, leading to an escalating crisis. The IPCC have already reported that the net negative effects are likely to be significant and to increase over time. The extent and severity of climate change impacts are likely to vary over space and time, as will the ability of the environment and society to control, mitigate or adapt to these impacts. Land management policies and practices to reduce, mitigate and adapt to climate change are already known. Their use has been demonstrated in many UK land-based industries, from agriculture to civil engineering to urban design and planning. As far as policy is concerned, the upcoming Agriculture Bill (Defra 2017) and Environment Bill (Defra 2019) offer opportunities for politicians to incentivise land managers to adopt practical measures that will address the current climate crisis.

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Anticipating Future Climate Hazards to Improve Land Management in the UK

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JBA Consulting

Keywords: adaptation, adaptive pathways, climate change, ecosystem services, land use, Natural Capital

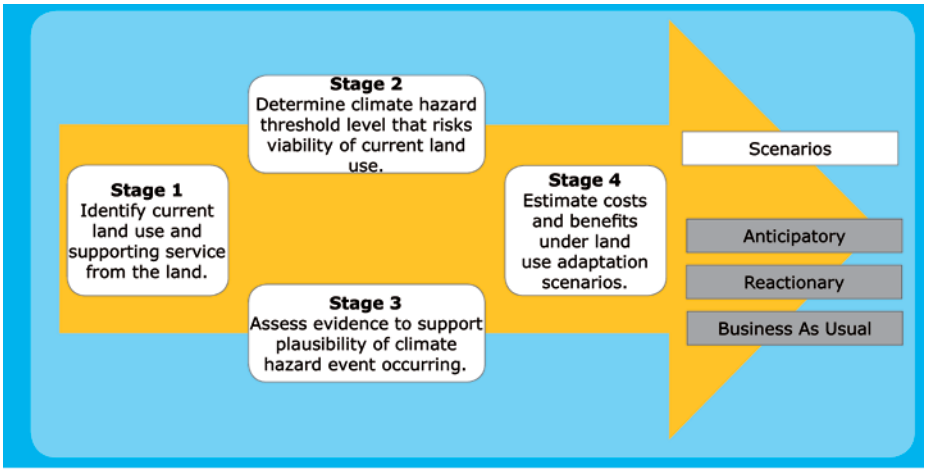
Where climate change presents a threat to current land use, adaptation in advance of the climate hazard event occurring delivers higher net benefits compared to waiting until the hazard has occurred. Work undertaken for the Committee on Climate Change (CCC) on the impacts of climate change on land uses at a landscape scale has demonstrated the natural capital benefits from anticipatory adaptive decision making. The work involved the development of an 'adaptive pathways' approach that considered climate change projections, management responses to climate hazards and natural capital accounting. This approach can support the development of land management policies which will create more resilient productive landscapes.

Photo 1 Severe flooding on the Somerset Levels in 2014.

Introduction

Question: With respect to the potential impacts of climate change on UK landscape and land uses up to 2100, is it possible to improve or at least maintain the natural capital value of these landscapes? More specifically, could adaptive decision-making pathways ensure landscapes continue to deliver valued services?

The Committee on Climate Change (CCC) asked these questions in early 2018 and presented their first report to Parliament later that year entitled *Land use: Reducing emissions and preparing for climate change* (Committee on Climate Change 2018). This article explains how these questions have been answered. It describes the research approach, the results, the CCC recommendations to Parliament and discusses how the approach can now support agricultural policy development. The 80-year reference period (2020-2100) aligns with the UKCP09 climate projections (Defra 2009) at the time of the research and beyond.



The decision framework developed comprised of four stages:

Stage 1. Identify the current land use management strategy and quantify what is produced or provided by the land.

Stage 2. Determine what level of climate hazard acts as a risk to the current land use.

Stage 3. Assess the evidence for the plausibility and timing of these hazards occurring.

Stage 4. Estimate the costs and benefits of alternative decision-making scenarios: (i) a business as usual (BAU) scenario, assuming no land-use change interventions; (ii) an anticipatory scenario, assuming land-use change happens before a climate hazard threshold event occurs; and (iii) a reactionary scenario, assuming land-use change occurs after the climate hazard threshold event.

Figure 1. Decision framework.

An adaptive pathways approach

An 'adaptive pathways' approach was used to investigate how the need for changes in land use and land management can be understood and analysed (JBA Consulting 2018). The first part of the analysis involved the development of a decision framework and a guide to decisions on long-term land use and management based on climate hazard thresholds.

A climate hazard threshold in this context relates to a given level of a climate hazard that, once reached, will make it cost-prohibitive to maintain the current land use and the ecosystem services it has provided to date. The four stages of the decision framework are shown in Figure 1 and the three decision-making scenarios that were considered are summarised in Figure 2.

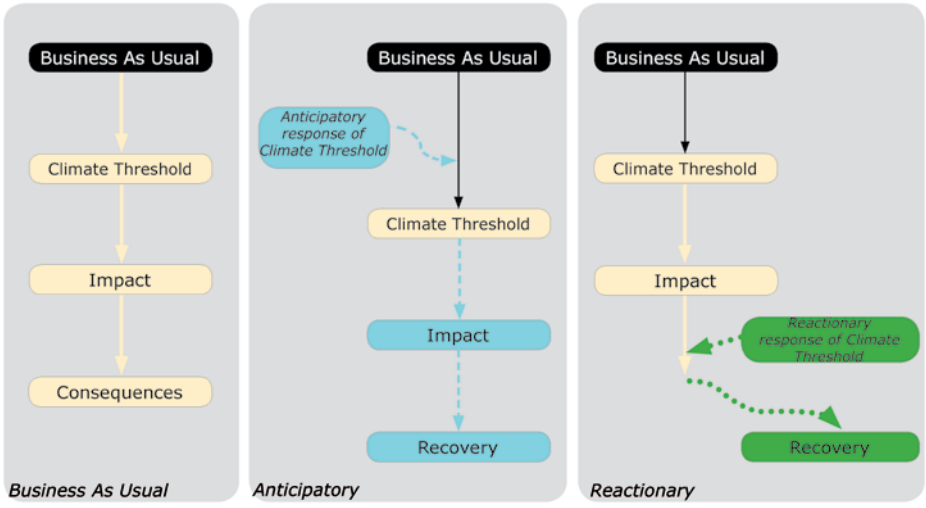


Figure 2. Anticipatory, reactionary and business as usual decision pathways.

Case studies

The decision framework was applied to four case studies to investigate the long-term impact on current land-use activities of reaching specific climate hazard thresholds and then assessing the effects of pursuing alternative land-use strategies. The case study locations were chosen to represent a varied mix of land uses in rural England (Figure 3):

1. Norfolk and Suffolk Broads, East Anglia; 3,200 km^2
2. The Petteril catchment, Cumbria; 160 km^2
3. Moor House and Upper Teesdale in the North Pennines (upland peatlands); 88 km^2
4. Somerset Levels and Moors; 2,500 km^2

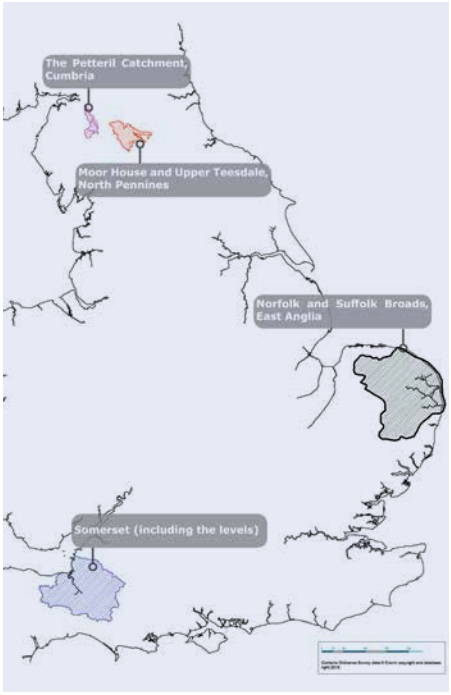


Figure 3. Case study locations.

Local experts at each location contributed to the research through stakeholder workshops. They included land managers, farmers, conservation body representatives, flood risk experts, regulators and academics, each of whom informed the work by providing a deeper understanding of local cultural traditions and current trends.

Natural Capital benefits assessed within the analysis included those relating to: agricultural production, timber production, carbon sequestration services, recreation,

water quality improvements, biodiversity and aesthetic amenity. Costs were assessed relating to ongoing costs of maintaining current land-use activities, recovery costs following a climate hazard threshold being reached and costs of land-use change. The climate hazard thresholds were determined from the stakeholder workshops by establishing at what magnitude certain climate hazards would cause land owners, managers, and the beneficiaries of the land to change the current land use.

Principal finding – anticipatory adaptive pathways deliver higher benefits

The case study analysis found that in scenarios where climate change presents a threat to current land use, following adaptive pathways which consider land-use change in advance of the climate hazard event occurring delivers higher net benefits compared to waiting until the hazard has occurred. For example, resilience to climate hazard events can be increased by a switch from arable land use to a mix of productive grassland for forage and to wet grasslands in high flood risk locations; by an increase in agroforestry; or by installing additional water level control measures into wet areas like the Somerset Levels and Moors.

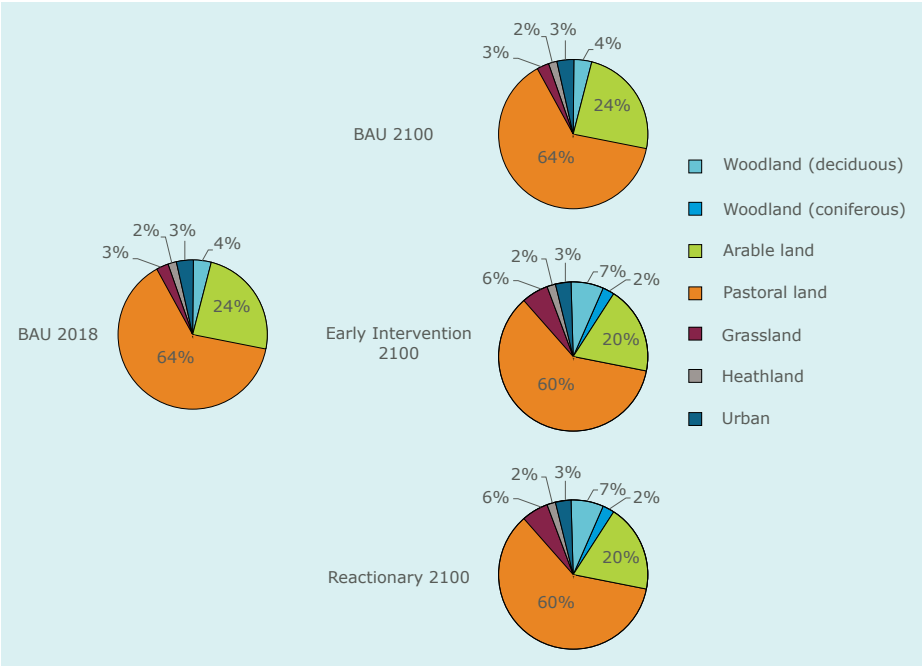


Figure 4. Land-use change modelled in the Petteril Catchment (BAU, business as usual).

The potential gains centre on avoiding escalating costs, maximising benefits and reducing the risk of irreversible change.

Although these results are hardly surprising, stakeholder engagement allowed us to i) understand how the beneficiaries across catchments could change their land use to minimise impacts from climate hazards and ii) determine outcomes for the wider natural capital assets and ecosystem services.

Figure 4 provides an example of how stakeholders might change their land use in the Petteril catchment based on

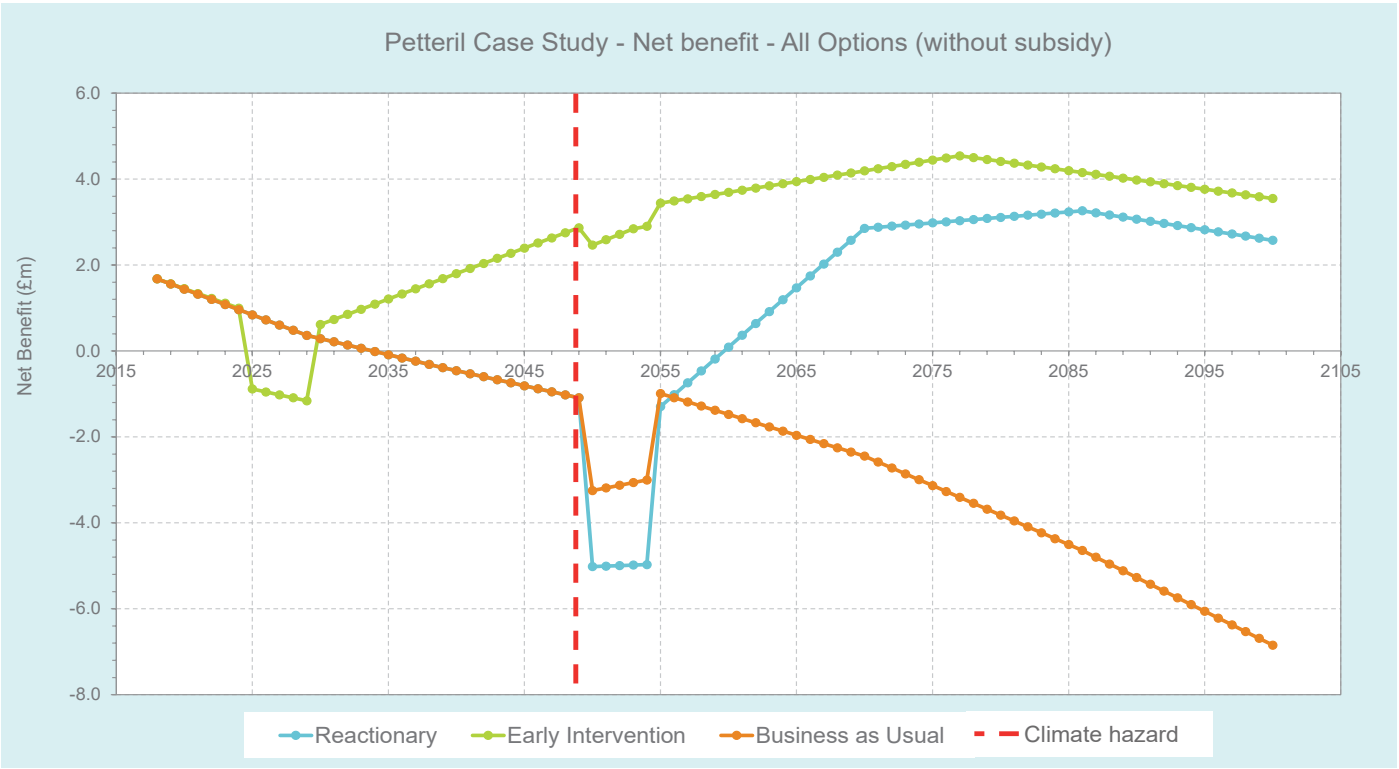


Figure 5. Net benefits arising from interventions in land use.

the three scenarios – business as usual, early intervention (anticipatory), and reactionary (to the climate hazard, see Figure 2). Figure 5 presents the net benefit for these three scenarios, valued from specific ecosystem services such as carbon sequestration, agricultural productivity, timber sales, recreation, land-use change, and other environmental benefits including biodiversity. Whilst these valuations were not comprehensive, they yield trends and an indication of net benefits. Note that the drastic change in net benefit at year 2050 is a consequence of the climate hazard threshold being reached. The predictions demonstrate clearly that the costs of land-use change occur earlier in the anticipatory scenario (years 2025-2030) yielding benefits earlier, whilst the business as usual and reactionary scenarios are subject to significant costs when the climate hazard threshold is reached in 2050. The net benefits from a business as usual scenario decline after the climate hazard because the land can no longer provide the same benefits. The costs of changing land use to something that provides more net benefit and better climate resilience was higher in the reactionary scenario.

Application to the case studies

In all case studies, it was demonstrated that anticipatory adaptive decisions can lead to greater benefits and more sustainable land use over time. Delaying adaptive actions reduces the land's ability to insulate against the impact from reaching a given climate threshold. Where land uses are projected to become increasingly unviable in the future because of climate change, land-use change to build resilience before hazard threshold events occur limits the inevitable increase in costs and provides greater net benefits than relying on repeated low-regret measures to try to maintain the current land-use activity (Figure 5).

Norfolk and Suffolk Broads

The majority of the 3,200 km^2 of land is used for arable and livestock farming (approximately 85%), therefore a climate hazard threshold derived from coastal and inland flooding significantly increases the costs of agricultural production. This is due to factors such as waterlogged soils exceeding agricultural field capacities, saline incursions into freshwater and farmland habitat, and increased soil runoff and erosion. However, in the anticipatory scenario, costs were shown to reduce through a switch to more flood-resilient land uses such as a move from arable (cereal crops) to pastoral (semi-improved grassland) and saltmarsh. Despite an initial short-term rise in costs under this scenario when compared to the business as usual scenario, taking early and effective action to change land use reduces total costs by £490 million over the 80-year reference period and reduces the risk of escalating costs over the long-term.

Petteril catchment, Cumbria

The 160 km^2 of land in the Petteril catchment is mainly used for agriculture as pastoral and arable land (approximately 90%). The hazard threshold identified in the workshop and modelled was three seasons in five years of winter/spring waterlogging of fields and/or fluvial flooding of agricultural land that causes the crops and grassland to be submerged for more than 14 days. To pre-empt (anticipate) this climate hazard, stakeholders suggested changing crop types to sunflowers, grain maize, soya and horticultural products and converting farmed land to agro-forestry and woodland. In addition, advances in the availability and use of drought resistant varieties of cereals, grasses and maize, and investment in additional on-farm water capture and management assets would increase resilience. When summed over the 2018 to 2100 reference period, the present value of the net benefit over and above the business as usual scenario was £41 million in the anticipatory scenario as opposed to £17 million in the reactionary scenario. The land-use changes increased the potential for carbon removal, increased production of timber and would provide benefits to water quality and biodiversity.

Moor House and Upper Teesdale

This case study focused on a peatland habitat subject to damaging grazing and peat extraction activities across approximately 60% of the total catchment of 88 km^2. It demonstrated how the risks from climate change could effectively be irreversible and endanger the supply of essential ecosystem services from the natural environment. Furthermore, the modelling results indicate that the longer unsustainable land-use activities are continued, the higher the potential level of degradation to the natural assets that support it. Based on a hazard threshold of persistent low winter rainfall followed by spring and summer drought (consistent with the UKCP09 high emission scenario for 2080 and stakeholders' views), the findings suggest that, although unlikely, a complete cessation of damaging activities on the peatland habitat is needed, as part of a combination of interventions to restore damaged peat assets. This would prevent further loss of the peatland and would also support the delivery of ecosystem services including carbon sequestration, clean water, flood risk reduction, and other environmental benefits over the 80-year period. When compared to the business as usual scenario where peat extraction and grazing continue, the total net benefit of carbon sequestration provided by the land at Moor House and Upper Teesdale was £167 million higher in the anticipatory scenario, and £131 million higher in the reactionary scenario. The combination of low winter rainfall followed by spring and summer drought with a wildfire was also considered, but an economic valuation was not completed. However, it is important to note this likely damaging scenario on the current climate change trajectory.

Somerset Levels and Moors

Agricultural land use covers 90% of the 2,500 km^2 area included in the case study, so food production is a major ecosystem service. In addition, significant areas of farmland, together with the woodlands and heaths, provide important biodiversity services: Natural England Priority Habitats cover nearly a quarter of the case study area. The large area of peat on the Levels and Moors also provides a significant store of carbon. The climate hazard thresholds considered in the workshops were i) warmer and drier summer seasons followed by a drought putting agricultural productivity at great risk, ii) warmer and wetter winter seasons, and iii) three seasons in five years of waterlogging of fields and crops. Adaptation to i) would involve changes to different crops and additional water control management measures to retain soil moisture level in the levels. In the case of flooded and wet conditions, the adaptive scenario included a switch to lowland wet grasslands and an increase in the area of improved grasslands at the expense of cereals. It also allowed for a 10% increase in woodland. The results from modelling an anticipatory approach demonstrated a marginal increase in net benefits from ecosystem services for the majority of the appraisal period.

Applying the adaptive approach to policy making – focus on agriculture

The Climate Change Committee 2018 report describes how a future UK land strategy which not only delivers climate goals but also balances other pressures (e.g. increased biodiversity, clean and plentiful water, good water quality) will require significant changes in land use (Climate Change Committee 2018). Incremental changes will not deliver climate goals, but bold decisions can ensure land continues to supply essential goods and services and that land management plays a bigger role in meeting climate objectives.

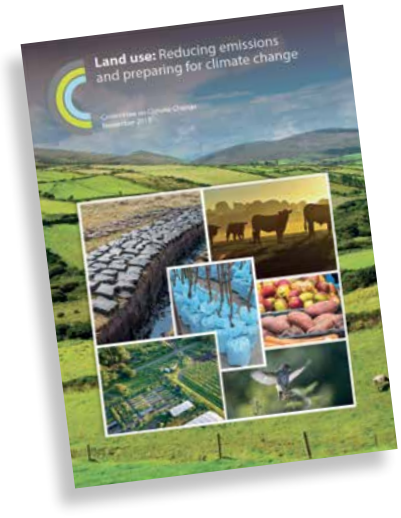


Figure 6. Climate Change Committee Land Use report.

Three themes were developed in the report around managing potential trade-offs between climate change mitigation, adaptation and sustainability, and three areas of synergy were identified:

- *Some land-use change can confer net benefits across climate change mitigation, adaptation and wider environmental goals.*
- *Successful mitigation and adaptation requires early, anticipatory action to maximise the net benefits.*
- *An integrated, strategic approach is needed now to enable the transformational changes required.*

The report recommends that:

1. *New land-use policy should promote transformational land uses and reward landowners for public goods that deliver climate mitigation and adaptation objectives. New policies should also reflect better the value of the goods and services that land provides.*
2. *Support should be provided to help land managers transition to alternative land uses.*

This call comes at perhaps one of the most critical times for UK agriculture and for the British landscape since the end of the Second World War.

Agriculture across the UK is now facing a major transition period as revolutionary as the post-war transition, which involved incentivised intensification from 1950 to the late 1970s. From the mid-1970s the legacy of the post-war policy evolved, with the primary objective of food self-sufficiency and productive efficiency. This evolution was usually a reactionary policy response often involving new and much wider regulations. The changes were often a reaction to previous policies, such as the withdrawal of grants for hedgerow removal. They were also a response to specific practices and events, such as the salmonella and BSE crises. As new policies and regulations emerged, numerous government bodies arose in parallel to regulate farming; there are now five in Defra alone. In addition, the withdrawal of the UK from the EU has presented the opportunity to completely and independently rethink agriculture and to reset the UK's agricultural policy framework.

The transition involves major new policies. For example, in England there is a draft Environment Bill, an Agricultural Bill which affects existing Basic Payments and introduces Environmental Land Management schemes (ELMs), and – on the near horizon – a single Regulatory Body for agriculture combining regulation and the reintroduction of advisory support to farmers. These policy changes will provide for a simpler system of regulating farm activities, continued improvements in productive efficiency and for farming to deliver greater public goods. There is the opportunity to future-proof agriculture against climate change, to deliver food security, and for farm businesses to become more viable, but the transition will involve the need to mitigate and adapt to climate change.

This transition is being planned for irrespective of the UK's exit from the EU. It needs to be a success. As Nan Fairbrother wrote in 1970 in her seminal book *New Lives, New Landscapes*: 'farmland without farmers degenerates as swiftly as gardens without gardeners' (Fairbrother 1970). Her reference here was both literal, a reference to the effects of the Great Agricultural Depression of the late Victorian period, and also symbolic, correctly identifying that farming and farmers need to have a purpose. Our research for this project

and for government organisations has found that the public is beginning to understand this and they want farmers to deliver a healthy living for themselves and for everyone in the UK.

Climate adaptation – next steps for UK land use

Two challenges exist in developing appropriate policies in the UK that support climate adaptation. Firstly, there is a risk that '*one policy fits all*', national-type solutions emerge, where policies don't respond to the regional climate change projections or cultural traditions. The second challenge centres on the scale and independence of land management across the UK. The first challenge we believe could be managed with regional and sub regional prioritised policies, informed by adaptive pathway analysis. For example, a single regulator for agriculture who acts regionally and provides local advisory services to farms could offer the opportunity to provide regionally specific advice on projected climate hazards and adaptive responses.

The second challenge is arguable more complex. It relates to the fact that decisions on the management of our landscapes are taken daily by thousands of individual owners and managers 'on the ground'. In 2017, approximately 70% of England's land was managed through farming and 10% through forestry, employing just 2% of the national workforce. In England alone, there are over 100,000 commercial farm holdings. Farms range from intensive pig and poultry units to extensive upland grazing, and from highly intensive market garden cropping to extensive cereal production. The farming industry in the UK is diverse; in fact '*many farms do not regard themselves as businesses*' (Defra 2018). This diversity adds layers of complexity for policy makers. However, the climatic and weather context for every farm enterprise is already undergoing change, affecting growing seasons, pests and diseases and water resources, and introducing new perils. This is understood by the farming community. Again, the solution to the complexity is likely to lie with a single regulator that also provides farm-specific advice. Following the Second World War, when it was essential to galvanise British agriculture, one of the main features of the transition then was the establishment of an 'on the farm' advisory service, ADAS. The transition now being planned for could re-establish advisory services and the opportunity to deliver the transformational land-use changes the Committee on Climate Change has called for.

Conclusion

The work described in this article on adaptive anticipatory decision making provides a systematic approach to land-use change planning which allows for implementation in a robust and evidence-based way. The approach and analysis can act as a base for future work by policy makers, regulators and practitioners to understand the long-term viability of current land use. However, in order to support this, further research is still needed into the risks to current land uses from climate change.

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Ash Dieback Disease in Ireland: Implications in the Context of Climate Change

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Keywords: ash dieback disease, biodiversity, climate change abatement, ecosystem function, *Hymenoscyphus fraxineus*, Invasive Alien Species

The impacts of ash dieback on ecosystem function and biodiversity loss are discussed in this article. Ash dieback is just one of an increasing number of invasive alien tree diseases which threaten the feasibility of large-scale tree planting programmes to mitigate climate change and a national strategy is urgently needed. While this is being prepared, action can be taken to prevent the spread of alien tree diseases at an individual and community level, and various approaches are suggested.

Introduction

Climate change is no longer regarded as a possibility at some time in the future but as a reality that may destroy millions of livelihoods within the next few years (Bendell 2018). In Ireland, the Government has proposed planting trees as a climate change abatement policy measure (Department of Agriculture, Food and the Marine 2014); the global benefits of this approach were described by Bastin *et al.* (2019) and Woroniecki (2019). However, the threat of disease is a major obstacle to the use of trees for mitigating climate change.

Most people have heard the terms Invasive Alien Species (IAS) and Invasive Non-Native Species (INNS), which refer to plants such as Japanese knotweed *Fallopia japonica* and giant hogweed *Heracleum mantegazzianum*, and animals including

Figure 1. Ash dieback. Photo credit ashridgetrees.co.uk.

American mink *Neovison vison* and grey squirrel *Sciurus carolinensis*. These species have been introduced to a country from overseas, colonise rapidly, and often lead to serious economic and environmental damage. Indeed, Invasive Alien Species are regarded as the largest cause of global biodiversity loss next to climate change (IUCN 2018). Insect and microbial Invasive Alien Species are less well known because they are less obvious initially but they can explode into a major problem (Beales *et al*. 2016).

Impacts of ash dieback in Ireland

Ash dieback is a fungal disease of European ash *Fraxinus excelsior*. It is caused by a fungus, originally known as *Chalara fraxinea* and now called *Hymenoscyphus fraxineus*, that is thought to have originated in east Russia and China where it lives harmlessly on Manchurian ash *Fraxinus mandschurica* without causing disease. It found its way to Europe, probably via live plant and timber imports, and was first identified in plantations of European ash in Poland in 2009. From there it switched from harmless endophyte to deadly pathogen and, by 2012, ash dieback disease had spread to 25 European countries, including Ireland, an unprecedented rate of spread for any organism. It arrived in County Leitrim on a commercial batch of ash saplings imported from continental Europe in 2012. Six years later, in 2018, Forestry Minister Andrew Doyle concluded that control was no longer feasible because of the extent of disease spread. The same situation has occurred in the UK: a recent survey confirmed infections across 80% of Wales, 68% of England, 32% of Northern Ireland, and 20% of Scotland (Hill *et al*. 2019).

The loss of our ash trees is a tragedy on many levels. European ash has grown in Ireland since before the last Ice Age**,** which means that it has evolved here over thousands of years, making countless connections with other organisms and creating a niche environment for other species to flourish. Danish mythology describes the ash as the 'Queen of the Forest' with her branches reaching to the sky and her roots traversing the earth. Indeed, mature ash is one of our most magnificent native trees, reaching 40 m in height, distinctive by its graceful foliage, its characteristic white bark with black diamonds and its soft open canopy. It is also one of our most common trees, representing more than 35% of hedgerow species in some counties such as County Clare.

Along with its beauty and presence, European ash fills an unique and vital ecological role in our natural and farmed ecosystems. It produces a readily degradable leaf litter which balances the pH of soil. The leaf litter is high in nitrogen, phosphorus, potassium and sulphur which generate rapid nutrient flows that support a rich biodiversity. Its leaf buds are late to break**,** which allows high light penetration in early spring, and this shapes ash woodland's distinctive ground flora of wild garlic *Allium ursinum*, bluebell *Hyacinthoides non-scripta*, wood sorrel *Oxalis acetosella*, and male fern *Dryopteris felix-mas*.

In addition to the ground flora, ash trees represent a hotspot for other kinds of biodiversity. Mitchell *et al*. (2014, 2016) identified 955 species of birds, small mammals, mosses, fungi, lichens and invertebrates that are *associated* with ash, i.e. they rely on ash for part or all of their lifecycles. Of these, over half (536 species) are lichens and some of these are *obligate***,** which means that they are entirely dependent on their ash host to survive. In 2018, the British Lichen Society described how the light dappled shade beneath ash canopies combined with the high pH of ash bark make it an ideal environment for lichens so there is growing concern that ash dieback has or will lead to multiple lichen extinctions (British Lichen Society 2018)

Alternative tree species to ash

Loss of biodiversity is one aspect of ash dieback disease. Loss of ecosystem function is another, particularly leaf litter decomposition and nutrient cycling. Mitchell *et al*. (2014, 2016) and Broome and Mitchell (2017) conducted systematic studies to examine which tree species can best replace the biodiversity and ecosystem value of ash. Their findings showed that some tree species, such as oak (*Quercus robur* and *Q. petraea*) and beech *Fagus sylvatica*, can provide alternative hosts for a high number of ash-associated species, but they do not replicate ash's superb ecosystem function. Other tree species, such as alder *Alnus glutinosa* and small-leaved lime *Tilia cordata* have rapid leaf litter decomposition rates but do not support many ash-associated species. Alder emerged as the one species that can best support both functions, providing a home for 89% of ash-associated species and serving a similar ecosystem function to ash.

However, woodland management becomes very complex in the face of climate change, alien tree diseases and biodiversity loss. Which tree species can we plant to best maintain the biodiversity and ecosystem function of ash woodlands and hedgerows? Which species will be able to adapt to climate change? What about other invasive alien tree diseases: will our selected ash-alternative species succumb to the next microbial invasion? Sessile and pendunculate oaks, supporters of the greatest number of ash-associated species, are already succumbing to a brutal invasive alien disease caused by the *Phytophthora ramorum* fungus, which belongs to the same genus as potato blight (Duff *et al.* 2016). Broadmeadow and Ray (2014) have prepared a useful tool to aid tree species choice to help adapt woodland to a changing climate. A similar tool is needed to help identify tree species that can replace those that succumb to fatal diseases so that we do not lose vital ecosystem function and biodiversity.

Response to disease: what can we do?

Is there anything that could have been done to stop ash dieback disease from its disastrous course? Given current international trade policies and national land management practices, the answer may well be no. How do we prepare? What do we focus on: mitigation to prevent further spread of ash dieback, planting with alternative tree species to maintain ecosystem function and biodiversity, or tree breeding for a future species that can withstand disease pressure? What is undeniably critical is an approach that builds resilience in our environment so that ash and other tree species can withstand the onslaught of disease and stresses.

Perhaps we are too late for the majestic ash, but can we stop other tree diseases? Sudden oak death, caused by the fungus *Phytophthora ramorum*, is already established in at least 14 locations in six counties in Ireland.

Figure 2. Infected trees show extensive dieback of leaves, twigs and branches.

Four other *Phytophthora* species have been reported which attack larch *Larix decidua*, beech, alder, willow (*Salix* spp.) and firs (*Abies* spp.). Dothistroma needle blight (*Dothistroma septosporum* and *D. pini*) was first detected on Scots pine *Pinus sylvestris* at two locations in Ireland in 2016 (https://www.agriculture.gov.ie/forestservice/treediseases/dothistromaneedleblight/). The green spruce aphid *Elatobium abietinum*, present in Ireland since 1914, is now rapidly multiplying because of climate change. The large pine weevil *Hylobius abietus*, which attacks Douglas fir *Pseudotsuga menziesii* and young Sitka spruce *Picea sitchensis* is already well established. Four other insect pathogens, including the dreaded oak processionary moth *Thaumetopoea processionea*, whose hairs can cause irritation and dermatitis, are established in the UK and hovering at Ireland's doors. If no action is taken, we may one day wake to a landscape of dead trees.

However, there is no such thing as "*can't do*". It has been possible to control even the deadliest infectious human diseases, such as TB, smallpox, leprosy, and HIV, by adopting a systematic approach based on high standards of hygiene, the development of new medicines, and building resilience within the population. Ireland has already demonstrated its capacity to deliver coordinated and well-planned actions against disease. In 2001, an outbreak of foot-and-mouth led to wide-scale spread across the UK, including a farm in South Armagh close to the Irish border, followed by further outbreaks over the following months. This led to cross-border cooperation to prevent the spread into Ireland. An analysis in 2002 by the Centre for Cross Border Studies (Clarke 2002) concluded that the skilled, proactive actions taken by the two agriculture ministers north and south of the border, along with other state agencies, successfully contained the spread and stopped what could have been the catastrophic consequences of a wide-scale outbreak.

Stopping the spread of foot and mouth disease into Ireland is a fine example of what can be achieved. It is up to the Government to take action at national level to prevent the importation of infective materials, to introduce measures that prevent spread, to raise awareness and education, and to provide incentives to landowners to monitor tree health and to act promptly and appropriately when disease is found.

On an individual and community level, there is also much that can be done and there are a growing number of internet resources and research publications which provide guidance and tools. Some of the main recommendations are given below.

Hygiene

Our most important action is to introduce hygiene ('biosecurity') into all our activities. Just as we use decontaminating hand washes on a regular basis in hospitals and when travelling, so we should adopt automatic and routine hygiene outdoors in order to break the pathways that pathogens use to spread. Tree diseases are transported within and between countries and regions via different routes, but primarily via the horticultural trade. Wood packaging material (e.g. pallets) can easily harbour insect diseases such as the oak processionary moth. The main pathways at local and regional levels are dirty equipment (e.g. chainsaws, boots, vehicles), infected soil and leaf litter, brush (e.g. from hedge cutting), and natural pathways such as wind and water.

Figure 3. Lesion on ash tree trunk caused by ash dieback.

Practical action to prevent the introduction and spread of tree pests and diseases

In 2018, the UK Government produced a useful biosecurity toolkit: Think Kit, Think Transport, Think Trees (https://www.gov.uk/guidance/prevent-the-introduction-and-spread-of-tree-pests-and-diseases). The most relevant general guidance is as follows:

Think Kit

- Make sure all equipment, including boots and clothing, are free from soil and organic materials before entering or leaving a site
- Routinely disinfect equipment such as pruning saws and chainsaws

Think Transport

- Remove any build-up of soil and organic materials on vehicles and machinery, including wheels and footwells, before leaving an area or site
- Clean your vehicle regularly

Think Trees, plants and materials

- Develop relationships with nurseries you can trust so they can help you responsibly source plant and tree stock from pest- and disease-free areas
- Regularly monitor the trees and plants in your gardens and communities and report any suspect symptoms to the National Parks and Wildlife Service (www.npws.ie) and the Forest Service (https://www.agriculture.gov.ie/forestservice/forestservicegeneralinformation/contact).

Other biosecurity considerations include:

- Be careful about transporting soil: it may be infested with microbial or insect tree diseases and invasive alien plants such as Japanese knotweed and giant hogweed. If you purchase soil, ensure that it is certified as clean.
- Ash logs can be transported as they are regarded by the Irish Government as unlikely to carry the disease (https://www.agriculture.gov.ie/forestservice/treediseases/ashdiebackchalara). However, brush is highly likely to be infected. If you cut hedges, burn brush on site or transport it in a sealed trailer to prevent pieces from falling off.
- Recent research suggests that *H. fraxineus* may not be the agent that kills, but it weakens ash trees to the point that secondary invaders such as the deadly honey fungus root pathogen can get a hold. This means that high standards of woodland and tree management could help to build sufficient resilience to slow the disease down until a cure is found.

Breaking the link in the ash dieback lifecycle

Many fungi have complex, little understood lifecycles and *H. fraxineus*, the causal agent of ash dieback, is no exception. When we consider control measures against a fungus, the starting point is to identify those phases in the lifecycle when it is at its most infectious, and then to identify if there are weak links in the lifecycle when it is at its most vulnerable. Fungal and bacterial diseases require what is known as 'inoculum potential' in order to get established as a disease. Inoculum potential is the spore load, which is the volume of spores that is required in order to overcome the tree's defence mechanisms. It is probable that the spores produced on fallen ash leaves in autumn develop in sufficient numbers to create this inoculum potential: think of the sheer volume of leaves that fall from a single mature ash tree. Therefore, it is possible that the removal of fresh leaf litter could keep the spore load sufficiently low to limit the capacity of the fungus to cause disease. Clearly, raking-up and burning leaves from a mature ash on a daily basis is an arduous task, yet those trees which have been managed in this way are still healthy in an otherwise disease-ridden location. This may be a worthwhile approach for individual ash trees in gardens and amenity areas and for high value specimens.

There is some evidence that silica builds up the cellular strength of a tree's water and nutrient transporting channels. Seaweed contains high levels of silica and also represents a highly alkaline environment which fungi cannot tolerate. So, for those living near the sea, applying a thick layer of fresh seaweed around the base of the tree and from there to the outer edge of the canopy may be beneficial (but not against the trunk). It is unproven, but would be an interesting citizen science project if a few hundred people tried it on a few thousand ash trees.

Pruning

Marciulyniene *et al*. (2017) examined if pruning could halt the spread of ash dieback within individual trees. Their research showed that within 5 cm of a lesion, *H. fraxineus* was found in 80 % of every investigated branch, but at 10 cm from the wound this dropped to below 50 %. They concluded that the infection could be cut out of a tree by pruning at least 30 cm from each lesion. In theory, the approach can work but, in practice, it may be impossible and the wounds created by pruning may provide a gateway for other infections.

Fungicide treatment

Dal Maso *et al*. (2014) tested six fungicides for their potential to control ash dieback. Their systematic research showed that copper sulphate and potassium phosphite were ineffective, but treatment with thiabendazole and allicin applied by low impact methods, such as trunk injection, resulted in significant slowing of the disease. However, this approach is not feasible for large-scale operations.

Conclusions

The benefits of planting trees as a climate change abatement measure are widely reported in the literature, but rarely is there a mention of invasive alien tree diseases and the impact these are having on planting programmes. Over a period of seven years, ash dieback disease has swept across Ireland and may kill 95–99% of our European ash population. As our ash trees die, it is not only Ireland's traditional source of hurley sticks that will be lost; the health of our ecosystems will decline, as will our biodiversity and our economy.

Can we stop the disease? Probably not: recent research in the UK indicates that *H. fraxineus* is becoming more virulent and spreading more rapidly, not less. Is there anything we can do to limit the rate of spread? Yes, take the precautions listed above and pay particular attention to hygiene. Appropriate land management for disease control combined with planting with alternative tree species is likely to be the most effective mitigation.

There are 12 other serious alien tree diseases that have arrived in Ireland, but unlike ash dieback, the consequences of these are not yet evident. The Department of Agriculture, Food and the Marine have recently completed a consultation, to which CIEEM contributed (https://cieem.net/resource/plant-health-bio-security-strategy-2020-2025-ireland-response/), which will lead to a national plant health and biosecurity strategy 2020-2025. This will help to build resilience in the environment and stop diseases at point of source. But, until the strategy is implemented, we must take action at individual, community, and organisation level to raise awareness and introduce biosecurity and hygiene into all our outdoor activities.

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Agriculture and Environmental Policy – Brexit and Beyond

Will Manley CEcol FCIEEM

Keywords: agriculture, agri-environment, Common Agricultural Policy, Environmental Land Management

This article summarises key and current points within the context of agriculture and environmental policy developments post-Brexit. It focuses on the development of the Environmental Land Management scheme (ELMs) and the Agriculture Bill in England, within a broader remit of relevant policy documents and with commentary on key and related issues. A final section comments on perspectives relating to impacts on the environment.

Introduction

In the cycles of reforms of the Common Agricultural Policy (CAP) that occur at predetermined intervals of five to seven years, there is always a spike of activity from farming and environmental organisations, the relevant government departments and agencies, as well as researchers and consultants. There are

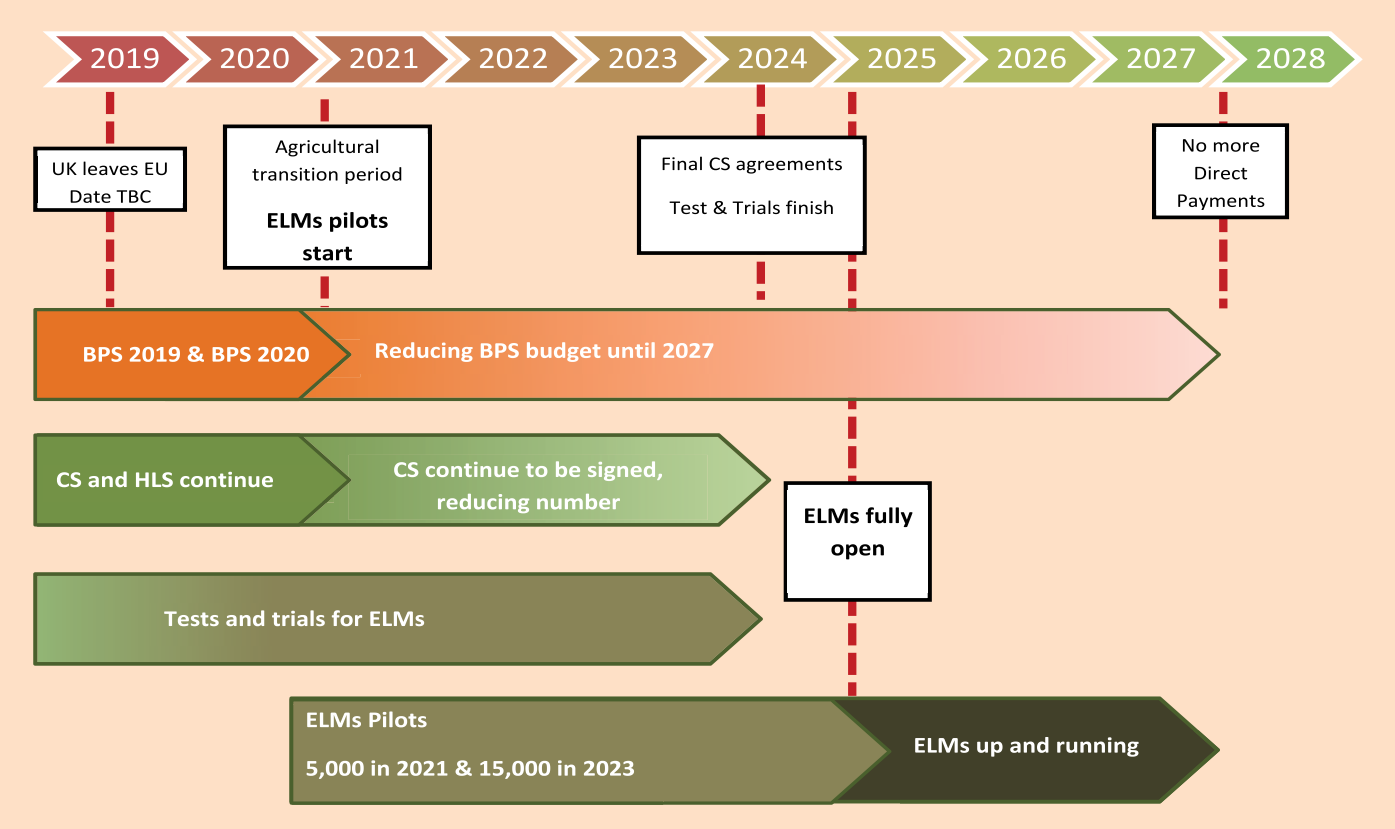

Figure 1. Outline of proposed timeline of transition of support payments and development of Environmental Land Management schemes (ELMs). CS, Countryside Stewardship; BPS, Basic Payment Scheme; HLS, Higher Level Stewardship. Adapted from NFU Briefing 8/1/19; ELM Update: January 2019.

ambitious proposals and counter proposals and lobbying, but all within the EU CAP framework. The same reform process is occurring within the EU now, but of course this time the UK is developing policies and legal frameworks separate to the CAP. Notwithstanding the added political uncertainties, and the exceptionally active period of integrated policy development, there are similarities to the previous reform processes with the hopes and ambitions of developing better schemes that deliver better outcomes. Within the framework of agriculture and environmental policy developments post-Brexit, a focus is given to existing and planned actions around the Environmental Land Management scheme (ELMs) and the Agriculture Bill, within the broader remit of the relevant Department of Environment, Food and Rural Affairs (Defra) policy documents. The focus is in relation to the Defra framework and the situation in England, with a more limited reference to the devolved governments.

There is a significant content of unknowns but the aim here is to give a broader understanding of where we are at present and the direction where we could/should be going. This includes the final section of the article that addresses a perspective relating to impacts on the environment.

Environmental Land Management Scheme (ELMs)

Defra began with a blank sheet of paper when developing the new ELMs. It started out as a description of a proposed system. The terminology was used within the 25 Year Environment Plan (Defra 2018a) when describing the design and delivery of a new *environmental land management system* as the key vehicle to deliver the environmental ambitions of this policy document. It was also used in the Defra consultation paper *Health and Harmony: The Future of Food, Farming and the Environment in a Green Brexit* (Defra 2018b). Indeed, and mirrored in the responses from environmental organisations as well as many farming and land management interests, the CIEEM response to this significant consultation welcomed the proposals of a replacement of agricultural support payments for …*a new environmental land management system* [that] *will be the cornerstone of our agricultural policy.*

In response to the Defra consultation, and in subsequent permutations describing systems and contracts, the Environmental Land Management scheme became formalised as a new scheme. In England, alongside the planned and progressive reduction in support payments, the new Environmental Land Management scheme (ELMs) will be developed to be in operation by 2024/5. The intervening period is being used for tests and trials to develop the scheme, with the first pilot running in 2021, but the details of the ELMs remain unknown at this stage. The timeline of transition of support payments and development of ELMs is presented in outline in Figure 1.

The timeline also indicates the pragmatic arrangement whereby existing Higher Level Stewardship (HLS) participating farmers coming to the end of their 10-year management agreements have been allowed to extend agreements rather than have the disincentive to apply to the new Countryside Stewardship scheme for a

short period ahead of the launch of the ELMs in 2024/5. Countryside Stewardship participating farmers continue, with new applicants still able to sign up ahead of the ELMs launch (see Figure 1).

To develop the new ELMs, Defra has sought ideas to test and trial new innovations, approaches and mechanisms. Tests are defined as being shorter with a focus on specific elements, involving more limited funding. Trials are designed to provide proof of concept on new ideas, and to assess practicality and value for money of new or innovative delivery mechanisms. Responses have been received from a range of stakeholder organisations and groups including, for example, National Parks, Conservation Boards, Areas of Outstanding Natural Beauty, and Farming and Wildlife Advisory Groups. The Facilitation Fund Groups are also being seen by Defra as a ready-made set-up with which to test and trial ideas. These groups are clusters of adjoining farms, farmers and landowners working together at a landscape scale supported by Countryside Stewardship funding.

The results and responses from these tests and trials will inform a rolling pilot programme timetabled to begin in 2021 which will, in turn, inform and confirm the national programme launching in 2024/5. The extent and time given to developing a final programme is in contrast to the more limited land-based testing of previous national agri-environment schemes including, for example, the Entry Level Stewardship scheme, (the lower part of Environmental Stewardship launched in 2005) that was subject to a pilot to test the practicability of the scheme design on a range of farm types, and to then revise and improve it before its national launch. Elements of scheme design, and participation factors including payments will also be given a focus in the tests and trials programme, but it will remain challenging, within the limited timescales of testing, to assess the environmental outcomes and additionality gained by specific funding options.

Funding and priority issues of ELMs

The framework for funding the prescribed management options that underpin agri-environment schemes is significantly dominated by income foregone payments and its direct link to farm enterprise profitability. The freedom to fund specific environmental management outcomes within schemes is constrained regardless of EU membership. Should farm incomes fall, other approaches may become preferred in order to sustain or increase participation in agri-environment schemes or the equivalent. Over time, other payment methodologies have been explored and, concurrently with ELMs testing, there is an on-going study commissioned by Defra to explore new payment methodologies with the potential aim of moving away from income forgone to one with natural capital at its heart.

There is also another concern related to funding mechanisms, namely that there is potential for biodiversity to become less prioritised if it is effectively in competition with the delivery of other and wider public goods, such as flood regulation and climate change priorities. This was less of an issue under the conventionally funded and prioritised agri-environment schemes but may become more of a conflicting issue in a new system of defined payments linked to natural capital and / or ecosystem services.

Agriculture Bill

Introduced at Westminster in September 2018 by Michael Gove, the then Secretary of State at Defra, the Agriculture Bill is an 'enabling' bill that provides the legal framework for the UK to disengage from the measures within the Common Agricultural Policy. Of particular note is the confirmation and timeline involved with the winding down and cessation of agricultural support payments (Basic Payment Scheme, BPS) for farmers and landowners, and the introduction of a new system based on public money for public goods (see Figure 1). The Bill does not apply to Scotland, and there are different and separate local policies operating through devolution in Wales and Northern Ireland, therefore in effect this Bill is essentially directed at England. There will no longer be a Common Agricultural Policy in the UK, and it is possible that a lighter green wash might be applied to existing CAP-supported systems operating within Scotland, Wales and Northern Ireland. The Bill was under threat from the parliamentary timetable, but at the time of writing it has now progressed to Committee Stage.

The testing and trialling of specific areas of ELMs continues, with over 100 proposals received by the Defra Tests and Trials Advisory Group. Priority is being given to either test a new or innovative approach or develop a platform that can be used to test critical elements or building blocks of the new system. It can be envisaged that much of what is being learnt and developed will not be wasted even if Brexit were not to happen. Under such a scenario however, the major changes in turning around the machinery of the CAP agricultural support payments would be stopped and the opportunity to significantly shake up the system and switch to increased resources of public money for public goods would be severely limited. The opportunity that Brexit presents to reset the agriculture and land use sectors is recognised across the spectrum of academic writers and journalists. Without significant change, there is limited chance of enhancing the natural environment through the objectives set within the 25 Year Environment Plan (Helm 2016); even journalist George Monbiot, not a natural Brexit supporter, wrote enthusiastically about leaving the EU CAP (Monbiot 2018). It is also noteworthy that CIEEM members were surveyed on support for Brexit ahead of the referendum, and were overwhelmingly in support of Remain. But it is likely that addressing the frustration and real concerns on the EU CAP that many might share with the likes of Helm and Monbiot, would be jeopardised if the UK remains in the EU.

Impacts on the environment

In proposed changes to EU policies and schemes, and attempts to estimate likely impacts on the farmed environment, an established approach is to assess probable farm business impacts and to assess farmer actions and reactions to changes, and to new funding and business opportunities. This has been a substantial area of my research work undertaken for Defra and other agencies, working in collaboration with associates in the fields of farm and business management, to assess likely impacts of policy scenarios on the farmed environment (e.g. Silcock *et al*. 2003; Gaskell *et al*. 2010). Farmer

decision-making is likely to be a focus of inquiry alongside the tests and trials, and development of pilots ahead of the confirmation of the final schemes.

Arguably the most significant factor will be the overall budgets available to fund ELMs and equivalents in the devolved countries, and how that funding is shared out. There has been a consistent criticism from some farmers and their representative organisations that some agri-environment schemes are limited in their accessibility to all farmers. This is an inevitable consequence of more effective targeting of the schemes to deliver better environmental outcomes within the limitations of a finite budget. The balance between ease of application and effective numbers of participating farmers was a recognised problem in the new Countryside Stewardship scheme, but the overall aim to prioritise and target resources, and to promote landscape-scale conservation, for example, is the rational approach. There will be a need within ELMs to continue to improve targeting and priorities, and this will be a significant issue in its effective use and funding. In parallel to the introduction of ELMs will be the potential of increased criticism from farmers who will be accommodating the loss of the universal support payments with their associated but very limited environmental conditions. Participation of those farms with important landscape-scale location and features will be key, but the tension that exists in a voluntary scheme between payment levels and meaningful and simple management to deliver additional and measurable environmental outcomes is likely to remain. The testing and pilots are of vital importance in disaggregating the key participant drivers and barriers, as well as developing the required management options and payments.

Providing a more positive note, and reliant upon a recent large-scale farmer survey in England that reported in June of this year (Wildlife and Countryside Link 2019), the results showed that half of all farmers agreed with the principle of 'public money for public goods'. The report also showed that two thirds of farmers believed regulation to be essential to protect standards, although it did not unpick any differences and distinctions that might apply for instance between animal welfare and wildlife protection.

Conclusion

The details of Brexit are uncertain and delayed, but the framework for major reform of agriculture policy and the signals for development of environmental measures are clearer and time-defined. However, inevitably, there are unknown elements at this stage particularly surrounding the crucial environmental linchpin of the ELMs. The specific details of the ELMs including the required management conditions, payments, environmental outcomes, and advisory support are not established. These are all elements of the tests and trials programme and provide continuing opportunities for stakeholders to influence and develop better environmental outcomes. Without the ELMs details the likely impact on farm businesses and farmer participation rates is limited, and hence any assessment of the overall impact on the environment is also limited.

It is likely that the ELMs will continue to improve its targeting and priorities, and to lean further into landscape-scale conservation with further promotion of linkages and co-operation with farmer groups. In parallel to how and where resources are targeted, there will also need to be more honest and candid conversations with the farming and landowning sectors. These conversations will highlight that many farms and landholdings do not, and cannot, provide high levels of environmental benefit and provide relatively poor value for money (VFM) in agri-environment participation. There are some cautious grounds for a more constructive approach and participation in ELMs but, remaining pragmatic, it will require a mindset change not only within the farming and land-owning sectors, but also within the environmental advisory sectors.

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About the Author

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Agricultural Change – Lessons From the Past as Pointers for the Future. A Personal View.

Steve Pullan CEcol CEnv FCIEEM

Keywords: agricultural history, agri-environment, Brexit, CIEEM, land-use change

The impact of agriculture on the environment is well documented. Its changing face over the last couple of centuries has produced a plethora of publications and arguments over the impacts of producing food and its consequences for biodiversity and the landscape. This article reviews some of the historical information and highlights past changes in land use as a way of trying to predict the possible changes that might result from the UK leaving the European Union and the consequences for land use change and nature conservation in the future.

Introduction

Most people think that their view of the countryside and the elements within it are timeless and have not changed. However, paintings, old photographs and historical documents clearly give a different picture. From a nature conservation perspective, there are many seminal publications like Norman Moore's *The Bird of Time* (Moore 1987), recording the decline of heathland in the south of England, and Lowe *et al*. who recorded the conflict between agriculture and conservation in locations like the Somerset Levels and Halvergate Marshes (Lowe *et al*. 1986). Both publications showed that significant change has occurred in the countryside and that the nature conservation interest has declined markedly in some areas. In relation to agricultural practices, Stoate (1994a,b) documented changes on a specific farm over the last century and Pullan (2011) described how the amount of arable and grass has fluctuated over time. Both authors highlight the impact of government policy on land use, but Stoate also emphasised how farming technology can have a major impact on nature conservation interest. Clearly, both the technology of producing food and government policy influence the way that the land-owning and farming community impact on the environment and biodiversity.

Land use, technology and biodiversity loss

By analysing agricultural land use in Northumberland, England, over the last 150 years, Pullan (2011) showed that the ratio of arable to grassland farming was related to the various agricultural policies since the Napoleonic wars (Figure 1: see the effect of the World Wars in the 1930s and 1940s for example). When agriculture was supported either through direct market mechanisms, or via tariffs and taxes, arable increased at the expense of grassland. However, a whole range of other, more subtle changes in technology and fashions were operating within these broad changes, which, added together, altered the way that agriculture impacted on the environment and nature conservation.

Technology also changed dramatically over the same period, notably the replacement of horse power and manual effort with machines, tractors and chemicals (Stoate 1994a,b). These changes have had major impacts on nature conservation and the landscape.

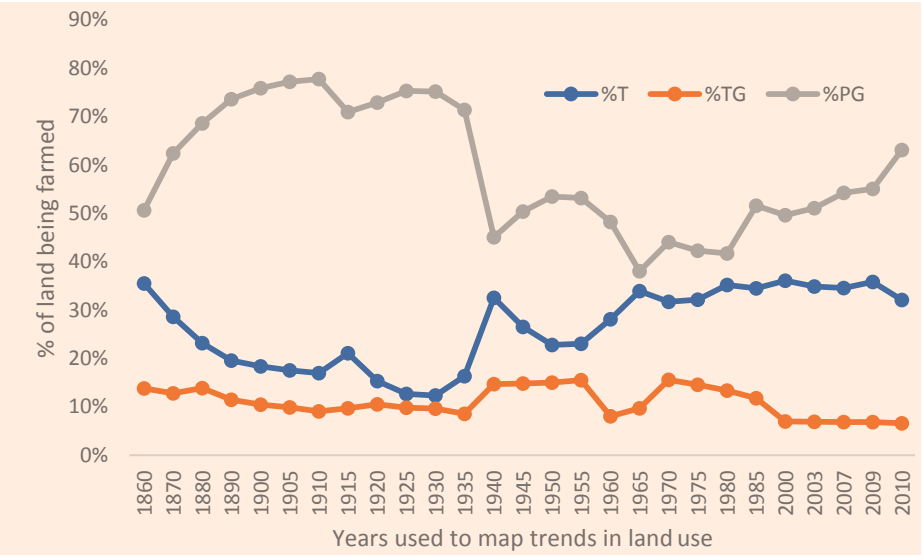

Figure 1. The percentage of tilled land (%T), temporary grass (%TG) and permanent grass (%PG) in Northumberland from 1860-2010. These figures exclude rough grazing and heather moorland. Adapted from Pullan (2011).

A classic example is the decline of the grey partridge *Perdix perdix* within the farmed landscape. The grey partridge is a bird primarily of the arable system and its decline is associated with intensification of agricultural productivity since the Second World War, specifically the increase in mechanisation, fertilisation and the use of chemicals to increase productivity (Potts 1986). Increased use of herbicides reduced the numbers of weeds in the arable crop, which in turn reduced the number of invertebrates that provide food for grey partridge chicks. In addition, Potts (1986) showed that the corncockle *Agrostemma lithago* has disappeared as a weed in arable crops and suggests that the introduction of mechanical seed cleaning in the 1920s removed this herb from the arable system, together with the insects that were associated with it. Clearly, as technology has improved and agricultural has become more intensive, biodiversity and the landscape have been altered. While agriculture may respond in a strategic way to the policy signals sent by government, major change is also driven by new technology (Pullan 2011, Stoate 1995a,b).

History of agri-environment schemes in England

In 1969, for the first time, agriculturalists and conservationists came together to consider the same piece of land from their different perspectives. During a conference held by the RSPB, they considered the production of food but also the impact on the environment. The agricultural delegates considered a number of scenarios for how best to change a mixed farm into a range of different, specialised farming units to improve its profitability. Derek Barber from the Countryside Commission then evaluated the impacts of the different farming scenarios on nature conservation and the biodiversity found on the farm. The conference and subsequent report (RSPB 1970) precipitated a new approach to farming and conservation, giving birth to advisory services like the Farming and Wildlife Advisory Groups (FWAG).

In 1985, the pioneering Broads Grazing Marsh Conservation Scheme was developed by the Broads Authority, Ministry of Agriculture, Fisheries and Food and the Countryside Commission. In the face of drainage and destruction of wildlife habitat on Halvergate Marshes, the scheme used financial incentives to persuade farmers to adopt more environmentally friendly methods. This initiative led to the creation of the UK's first Environmentally Sensitive Area (ESA) in 1987 and the subsequent roll-out of ESAs nationally.

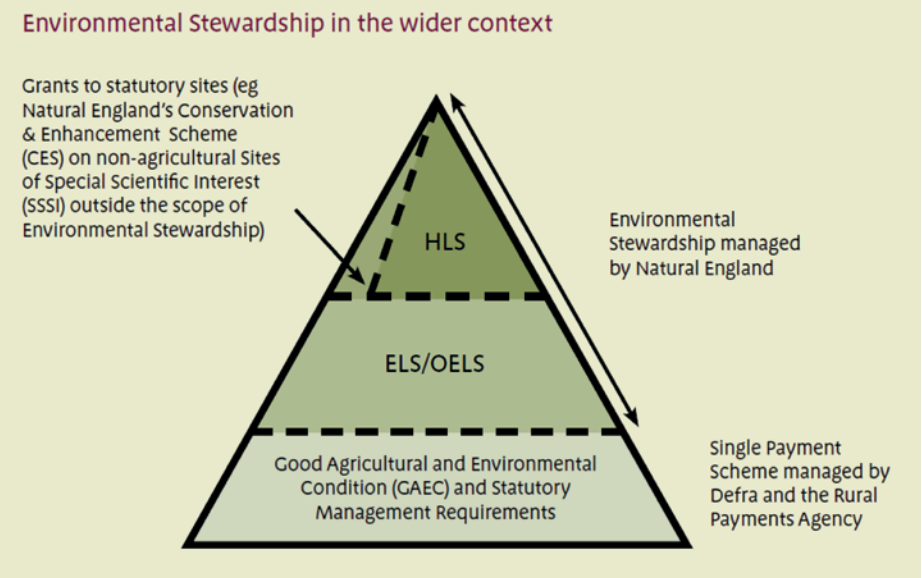

Figure 2. The elements of environmental stewardship, launched by Natural England (NE) in 2005. The diagram shows the funding triangle for support to farmers and land managers with a broad, single payment at a low level at the base and a more restricted Higher Level Scheme attracting higher payments at the peak. The amount of funding received by individual farmers and land managers increases as they move up through the schemes from bottom to top. HLS, Higher Level Stewardship; ELS, Entry Level Stewardship; OELS, Organic Entry Level Stewardship. Taken from Higher Level Stewardship: Environmental Stewardship Handbook, third edition (NE227) (Natural England 2010).

Alongside these developments, the European Union realised that their support for agriculture was producing mountains of wheat and lakes of milk and wine. Following a major review of the Common Agricultural Policy in the early 1980s, they decided to influence production directly to reduce the amount of surplus food. In 1988, they came up with set-aside and production quotas whereby farmers had to leave a proportion of their land out of intensive production. This became compulsory in 1992 for large arable farmers (Pullan 2011). In the UK, this led to whole-farm Countryside Stewardship, which was to become the backbone of agri-environment schemes until the foot-and-mouth outbreak in 2001.

As a consequence of foot-and-mouth, the UK Government set up its own review of farming and food production methods, which resulted in the Curry report (Curry 2002). This report made a number of recommendations and also emphasised key policy areas which are still pertinent today, including:

1. *The operation of a new broad and shallow stewardship tier should be piloted across a range of sectors as soon as possible. Farming industry representatives and other land managers should be involved from the start in the design and implementation of the new scheme. The Government will need to consult widely on the resulting revision of the existing England Rural Development Programme*
2. *We urge the Government to ensure in the forthcoming trade round that payments to create a market for environmental goods are not struck down by rules. We believe that they will be a key tool in rural development policy*
3. *Government should take an active role, working with the industry, in reviewing the full range of industry bodies, to make sure that they are modern and in tune with the industry's new ethos.*

The Curry review led to an environmental stewardship scheme with two elements: the broad and shallow, and the deep and narrow (Figure 2). The idea was that those

farmers who managed their land to protect the environment, and continued to do so, were awarded a broad payment across the whole of their holding which supported their conservation activities – the Single Farm Payment. The deep and narrow part of the scheme, later to be called Higher Tier, took aspects of the earlier Countryside Stewardship scheme by including habitat restoration, support for important Biodiversity Action Plan habitats/species and Sites of Special Scientific Interest. Similar schemes operated in Scotland and in Wales. The aim was to deliver a package of measures to the farming community with the objective of 70% of all agricultural land being managed under some form of agri-environment scheme; at its height in 2012 this target had been reached. However, despite this, it is apparent that biodiversity continues to decline in the wider countryside when looking at all long-term datasets.

What might happen as a result of Brexit?

So, what of the future and the impact of leaving the European Union? If Government decides to move the country back towards a strong free-trade policy without support monies to the farming community, then history is likely to repeat itself. For example, in Northumberland the area under grassland is likely to increase once again and the area under arable will decrease (Pullan 2011). However, Government policy indicates that they wish to continue with support for agriculture to provide public goods, in line with the Curry review (Curry 2002). What these public goods are and how they will be supported is under discussion and this will be assimilated into the new Agriculture Bill currently before Parliament.

There are new aspects of agricultural support that Defra seems keen to explore. One of these is the idea of payment for environmental productivity. In my personal view, this can be translated into 'the more species of plant, insect, bryophytes or birds that the farmer can show to have increased on his land, the greater the level of payment he will receive'. An example of how this might be achieved is given in Pullan *et al*. (2018) in relation to the impact of grazing by Schedule 1 geese as part of an agri-environment scheme. The authors demonstrate that the farmer could count goose dung to determine the level of payment, which reflects the level of goose impact on his farmland.

Another option would be to allow independent environmental advisers to be both the advisor and assessor on an annual basis. The advisor would map the range of habitats and important public goods on the farm and then carry out a yearly audit to judge the delivery of the goods, on a similar basis to a financial accounting audit. This report and audit would then provide the basis for the payment the farmer received for protecting or enhancing environmental goods. Clearly, there are many implications that need to be considered carefully before taking on such a role as the new 'guardians of the countryside'.

Implications for CIEEM and its members – final thoughts

CIEEM may have a role here, especially in relation to the Institute's desire to set standards within the industry. At present, Defra believes that there is limited, if no environmental advice available to the agricultural industry and that it therefore has to stimulate the market. However, some members of the Institute would dispute this fact. One of my concerns is that there is a considerable amount of questionable advice from other professions who believe they are the right people to act as advisors to the farming community, because that's what they've always done. The Institute is trying to make the case that professional ecology should only be undertaken by competent ecologists. One purpose of the Institute seeking a Royal Charter was to protect the profession. In my personal view, the changes to agricultural support that are occurring at present provide the Institute with the ideal opportunity to strongly make the case that Chartered Institute members are the best, most appropriate and most competent people to undertake biodiversity auditing on a regular basis going forward. In addition, agri-environment policy is still very much in flux and this is an opportunity for the Institute to fundamentally shape the way that government policy can be developed to protect and enhance the environment post-Brexit.

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About the Author

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Restoring Urban Rivers for a Better Future: the River Calder Methodology

Carys Hutton MCIEEM
JBA Consulting

Alec Boyd
Yorkshire Wildlife Trust

Keywords: biodiversity, flood resilience, multiple benefits, river restoration, urban catchment, water quality

Management of rivers in urban catchments is particularly challenging. With increased demand for housing, high density development and urban sprawl, the pressures facing our urban rivers are likely to worsen in the future. To add to this pressure, there remains uncertainty about the future of funding for river restoration schemes in urban catchments. Therefore, practitioners must consider alternative interventions which can be delivered at low cost and low risk.

The issues identified in the Calder are not unique to this catchment but are common in other urban catchments. Pressures include physical modifications such as straightening, culverting, weirs, and bank reinforcement, as well as modern-day issues such as invasive non-native species (INNS), urban debris, and urban development. The method used in this study provides a model for the future management of other urban rivers.

Introduction

The pressures on our urban rivers are likely to worsen in future, especially with a growing population and an increasing demand for housing. The management of urban rivers must therefore consider multiple approaches to achieving environmental, cultural and economic benefits. However, with uncertainties around funding, it is imperative that low-cost interventions are explored.

Urban areas provide numerous constraints to the management and re-naturalisation of rivers. Often, restoration of rivers in urban catchments is to remediate for heavy engineering approaches of the past, such as realignment, culverting and reinforcement. The approach undertaken here is to develop a method that can easily be replicated across other catchments and can also be delivered at a low cost compared to more heavily engineered solutions. It is primarily targeted towards conservation NGOs and voluntary groups, but it can be adopted by other river restoration practitioners as well.

In 2017, Yorkshire Wildlife Trust commissioned a study of the Calder catchment, West Yorkshire, to identify the key issues affecting the watercourses and propose a range of suitable soft interventions that could be delivered at low cost to address, or help alleviate, these issues. The study now underpins The Middle Calder and Tributaries Project, which commenced in 2019 and runs until 2022 and is being delivered by Yorkshire Wildlife Trust. This project is part of the Calder Greening Scheme of works, which is led by Calderdale Council in partnership with the Environment Agency (EA) and Yorkshire Wildlife Trust and is funded by the European Regional Development Fund (ERDF).

The Project aims to identify and implement a number of location-specific, soft interventions that will deliver multiple benefits for the catchment's people, wildlife and economy. The primary ecological outcomes will be:

- Improved ecological connectivity of the watercourse with its associated riparian habitats.
- Reinstated natural geomorphological processes, resulting in habitat improvements for fish, invertebrates and macrophytes.
- A positive contribution toward achieving Water Framework Directive (WFD) targets for ecological elements within the Middle Calder waterbodies.

The Middle Calder

The River Calder flows through the key economic centres of Hebden Bridge, Mytholmroyd, Sowerby Bridge, Halifax, Elland, and Brighouse in Calderdale, West Yorkshire. Many of the urban conurbations within the catchment have grown considerably over the last century, impacting flood resilience, water quality, and biodiversity of the aquatic and riparian environment.

Calderdale suffered significant flooding in December 2015, affecting approximately 2,000 homes and costing businesses £47 million (Calderdale Council 2016). There is a legacy of river engineering in the River Calder catchment from the development of the cotton, wool, and carpet industry in the 19th century. Physical modifications include straightening, bank reinforcement, weirs, and culverts. Additional pressures include the presence of invasive Himalayan balsam *Impatiens glandulifera* and Japanese knotweed *Fallopia japonica,* poaching of riverbanks from walkers and dogs, and the accumulation of urban debris in the channel.

Methodology

The watercourse was divided into arbitrary reaches of between approximately 1 and 3 km to help with the planning of surveys. A walkover survey of each reach was conducted in November 2017 by ecologists working in pairs, each led by an ecologist in JBA's Catchment and River Restoration Team. The walkover data provides a high-level and standardised assessment of the river catchment, which was then used to help secure the funding for the Mid Calder and Tributaries project. The data also forms the baseline against which changes can be measured.

The methodology for the walkover surveys was built upon the Catchment Walkover for River Basin Management guidance produced by the Environment Agency (2013) but adjusted to incorporate an additional step for identifying appropriate soft interventions. The method is designed to be a high-level and standardised approach to recording a range of pressures within a river catchment (Figure 1). After identifying land use, these pressures are categorised as Tier 1 issue categories (Figure 2) and then sub-categorised from a list of 68 Tier 2 issues, for example Tier 1: Hydromorphological condition; Tier 2: Man-made barrier – culverts.

A severity scoring system is then used to rate the impacts from Grade 1 to Grade 4 depending on the scale of impact the issue is likely to have on the watercourse (Figure 3). The 'impact' can be visual (e.g. sewage debris, algal growth, ferrous deposits from mine water), or physical (e.g. destruction of fish habitat, presence of man-made structures, barriers to fish migration) or related to the distribution of invasive non-native species.

The recommended interventions were formulated by the lead surveyors based on their experience and knowledge, taking into account the limitations and specific conditions along the river. The techniques proposed are not new; there are numerous studies demonstrating the effectiveness of different soft interventions in increasing biodiversity and naturalising river processes, and good guidance is available, e.g. the Manual of River Restoration Techniques produced by the River Restoration Centre (2013).

Indicative costs for the proposed interventions were calculated using prices from online suppliers and local contractors. Costs were calculated for three delivery scenarios based on different combinations of interventions, and concept designs were produced for each.

The information was presented in a user-friendly document designed as a manual of techniques that Yorkshire Wildlife Trust could use to tailor the future management of the River Calder and its tributaries to the funds and resources available. The interventions can be scaled up or down according to resource availability, and certain areas or interventions can be prioritised.

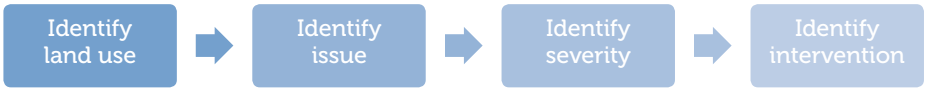


Figure 1. Methodology for river walkover, based on *Catchment Walkover for River Basin Management* guidance produced by the Environment Agency (2013).

Tier 1 issue categories

Farm infrastructure

Farm activity

Arable land

Livestock field

Forestry plantation

Urban and point source issues (including surface water drainage pipes)

Hydromorphological condition

INNS

Other issues (e.g. run-off, fly-tipping)

Figure 2. Tier 1 categories in the *Catchment Walkover for River Basin Management* guidance (Environment Agency 2013). Those most relevant to this study are marked in bold.

Severity score

Grade 1: Major impacts over 1 km of a watercourse

Grade 2: Significant impacts over 100 m of a watercourse

Grade 3: Localised and limited impacts over less than 100 m of a watercourse

Grade 4: Potential for regular and persistent transport of pollutants indicating a high risk of impact, but none observed at the time of inspection

Figure 3. Severity scoring system in the *Catchment Walkover for River Basin Management* guidance (Environment Agency 2013).

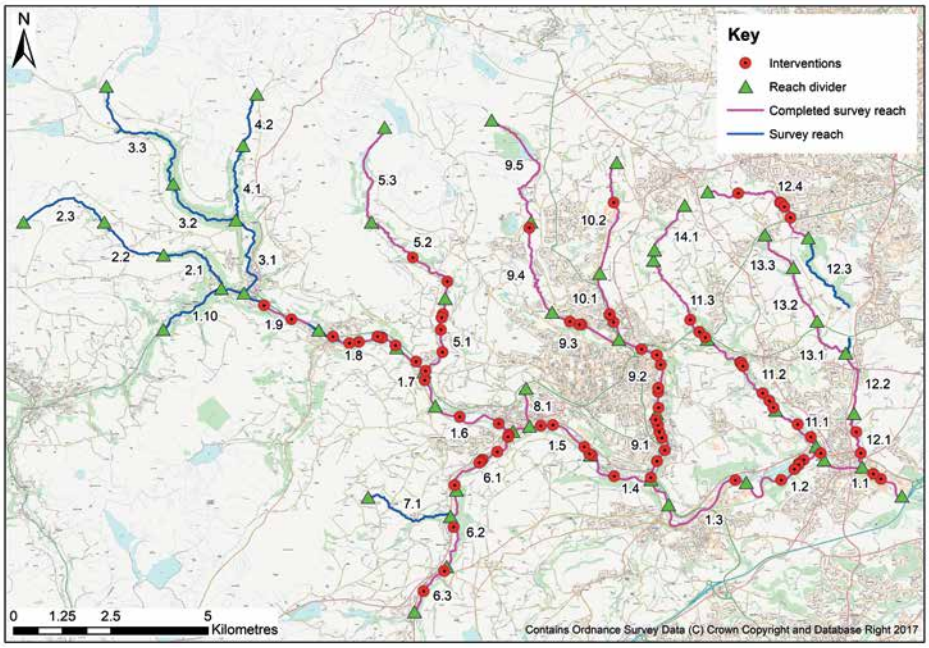


Figure 4. A map of the watercourses surveyed, reach dividers, and location of proposed interventions within the Calder catchment.

Outputs and management approach

Soft interventions were recommended for 59 locations within the catchment (Figure 4). Examples of issues identified along the River

Table 1. Example land uses and issues along the River Calder and its tributaries, the corresponding proposed interventions and their likely benefits, and indicative cost.

Land use	Issue	Proposed intervention	Likely benefit	Indicative cost*
Left bank: Sub-urban / urban development Right bank: Sub-urban / urban development	**Hydromorphological condition** Straightened and over-widened channel with reinforced banks inhibiting natural hydromorphological function.	Create a sinuous, low flow channel by installing berms on alternate sides of the channel. These would be made from brash faggots and planted with a native wetland plant mix appropriate to the site.	The intervention will diversify the flow regime, allow macrophytes to become established, and provide greater habitat complexity. This will benefit aquatic ecology, particularly by providing more suitable habitat for invertebrates and fish. The intervention will also improve the aesthetic value of the river for the local public.	100m @ £36/m
Left bank: Parkland Right bank: Sub-urban / urban development	**Hydromorphological condition** Bank erosion caused by over-use by people and dogs.	Use a combination of terrestrial and marginal planting (appropriate native species), and create designated access areas. Inform the public of the purpose of the work.	Planting will help to stabilise the banks and reduce sediments entering the watercourse. It will also create a more attractive amenity whilst still enabling people to access the riverside.	60m^2 @ £25/m^2
Left bank: Broadleaf / mixed woodland Right bank: Scrub	**INNS** Himalayan balsam and Japanese knotweed. Absence of native vegetation and banks vulnerable to erosion.	Strategic INNS control prioritising upstream stands of INNS and severely infected areas. Re-plant banksides with native species to stabilise soils. Reduce footfall in infected areas where possible, e.g. limit access by redirecting members of the public.	After INNS control, bank stability will be improved through re-colonisation by native vegetation. Removal of INNS will enable a greater diversity of plants to establish which could improve habitat structure.	Himalayan balsam = 120m^2. Japanese knotweed = 300m^2. Volunteers hand pull Himalayan balsam = £0/m^2. Stem injection of Japanese knotweed = £1/m^2 + kit. Planting = £25/m^2)
Left bank: Broadleaf / mixed woodland Right bank: Sub-urban / urban development	**Other issues** Urban debris and fly-tipping	Remove urban debris and fly-tipping from the channel and banksides. Engage local businesses and communities to encourage responsible disposal of waste.	Un-natural debris will be removed from the river channel helping to reduce flood risk and improve the aesthetics of the river.	24m^2 @ £0 – £200 (skip hire)

*Excludes staff-associated costs and VAT.

Calder and its tributaries are listed in Table 1, along with the proposed interventions.

The information was presented in the manual as a series of tables, with one table per surveyed reach (Tables 2, 3). Each table included a map of the reach and location of the interventions, at least one photograph of the reach, a description of the existing condition of the reach, and a list of proposed interventions (at each location) and the likely benefits.

Implementation

The approach used in this study has been successful and several of the interventions are now being delivered. A significant litter clean-up has been completed in reach 10.2, removing all the fly-tipping from the river (ref. Table 2). Plans are also underway for riparian planting along the riverside where heavy use by people and dogs has resulted in bare ground (Figure 5). The proposed intervention at this location is to install coir rolls and pallets along the water's edge (Figure 6), and plug plant the bank with a native species mix tolerant of being regularly inundated by water. To further relieve the pressure on the bankside, planning is underway for a designated access point constructed from railway sleepers to help concentrate activity to one location, therefore protecting the wider riverside.

The implementation of intervention measures at 59 locations along the River Calder catchments is expected to result in multiple benefits for the local economy, people and wildlife:

- increase health and wellbeing through more opportunities to access attractive outdoor spaces and engage with local rivers
- establish sustainable and resilient wildlife habitats and improve biodiversity

Figure 5. Bare ground at riverside due to heavy use by people and dogs, with coir rolls ready for installation. Photo credit Yorkshire Wildlife Trust.

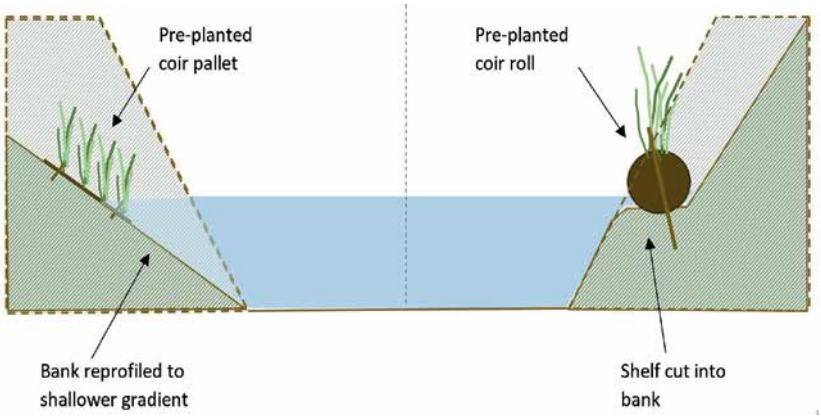
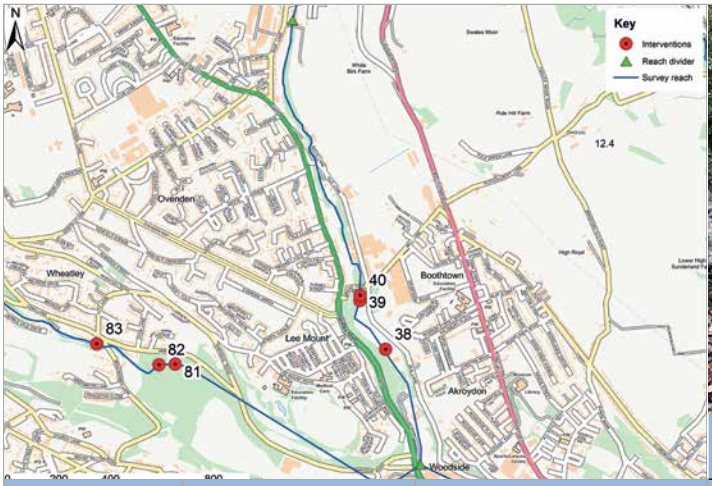


Figure 6. Concept design for the use of pre-established coir pallets (left) and coir rolls (right) to introduce marginal plants and stabilise banks. Photo credit JBA Consulting.

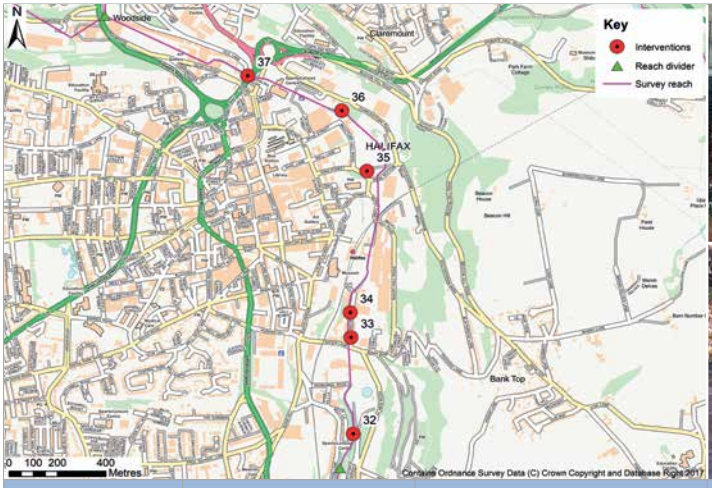
Table 2. Map, location details and photograph of reach 10.2 with a description of the existing condition, proposed interventions and summary of likely benefits.



Fly-tipping (40)

Reach 10.2	Existing condition	Suggested intervention	Likely benefit
Start: SE0872025934 End: SE0822327662	The reach is largely occupied by residential housing, with agriculture in the northeast. Issues include: Culverting Fly-tipping Poor hydromorphology (straightened and over-widened)	**38:** Investigate de-culverting **39:** Install large wood Install flow deflectors **40:** Remove fly-tipping	**De-culverting** De-culverting can have significant benefits for aquatic fauna and flora by daylighting the river, helping to restore natural processes, and connectivity of riparian habitat. It also helps connect the river to the floodplain and could help reduce flood risk. **Large wood** Installation of large wood diversifies the flow velocities across the channel and enhances natural erosional and depositional processes. Large wood provides refuge for juvenile fish, and habitat for aquatic invertebrates. **Flow deflectors** Installation of flow deflectors will help to narrow the channel by encouraging depositional processes and establishment of berms. These can be left to vegetate naturally, or can be planted. **Remove fly-tipping** Removal of urban debris and fly-tipping will help reduce flood risk, reduce pollution and improve the attractiveness of the river.

Table 3. Map, location details and photographs of reach 9.2 with a description of the existing condition, proposed interventions, and summary of likely benefits.



Straightened channel, walled (33)

Canalised watercourse (34)

Reach 9.2	Existing condition	Suggested intervention	Likely benefit
Start: SE0969124004 End: SE0872025934	The reach is heavily industrialised and high walls reinforce the watercourse along much of its length. The watercourse is culverted in some areas. Issues include: Culverting Poor hydromorphology, (straightened, over-widened, reinforced banks)	**32 and 33:** Install berms Marginal planting (coir rolls) **34:** Remove artificial shelf and replace with a natural vegetated, scalloped shelf **35:** Wetland creation Investigate de-culverting **36:** Install berms Install large wood Marginal planting (coir rolls) **37:** Marginal planting (coir pallets) following scrub control	**Berms** Installation of berms on alternate sides of the river can help to narrow the watercourse and enable more natural river processes. Berms provide substrate for macrophytes to colonise. These help stabilise sediments and provide habitat for riparian wildlife. Vegetated berms will give the river a more attractive appearance. **Marginal planting** Introduction of native marginal plants will improve riparian habitat connectivity and provide habitat for wildlife, for example invertebrates, small mammals and birds. Planting will also improve the aesthetics of the river. **Wetland creation** Creation of wetland habitat adjacent to watercourses helps to improve the connectivity of habitat, support wildlife, improve water quality, and it can provide an amenity for people to use and enjoy. **De-culverting** De-culverting can have significant benefits for aquatic fauna and flora by daylighting the river, helping to restore natural processes and connectivity of riparian habitat. It also helps connect the river to the floodplain and could help reduce flood risk. **Large wood** Installation of large wood diversifies the flow velocities across the channel and enhances natural erosional and depositional processes. Large wood provides refuge for juvenile fish and habitat for aquatic invertebrates.

- create new and enhanced rural and urban green spaces
- create new habitats, including new wet woodlands, grasslands and aquatic habitats at multiple riverside sites to improve air and water quality and aid flood attenuation.

Discussion

The Mid Calder and Tributaries project has produced a database of predominant land uses, identified restoration issues and graded them by severity, and proposed interventions throughout the catchment. Some 'ground-truthing' has been undertaken by Yorkshire Wildlife Trust in order to help prioritise the interventions and determine site-specific factors such as ease of access, landownership, and health and safety constraints. Securing the permits and consent required to deliver the in-channel work has taken

a disproportionate amount of time in scenarios where only one or two small interventions are planned.

The interventions proposed range from those that can be delivered at almost no cost and require a low level of expertise, for example, hand-pulling Himalayan balsam, to those requiring further investigation and expertise, and involving greater cost, such as de-culverting. Most interventions will be delivered by Yorkshire Wildlife trust staff and volunteers.
The scale of interventions proposed is deliberately wide-ranging to accommodate changes in funding, priorities and objectives so that it will remain useful and relevant in future.

A key consideration at the outset was to provide outputs that were user-friendly whilst also informing what interventions should be delivered where, and including sufficient detail to support a funding bid. It was important that the interventions could be scaled up or down according to the availability of funding and resourcing as this was unknown at the time, and remains uncertain beyond the lifespan of the ERDF funding.

The protocol described here is a relatively fast, cost-effective, and standardised method of highlighting key issues along a watercourse, and will be suitable for other urban catchments. The results can help to underpin future catchment restoration by providing an evidence base for funding applications and a manual of potential solutions. The use of soft interventions is recommended because they are low cost compared to engineered options, and can have significant benefits not just to riparian and aquatic wildlife but to the people who live and work around the river. Whilst the walkover survey can be done without extensive prior experience, interventions should only be proposed by those with a sound understanding of the site-specific geomorphological processes.

It is recommended that interventions are not used in isolation but are delivered as a suite of restoration management actions in a holistic, catchment-wide, and collaborative way. This can be achieved by working with stakeholders including statutory bodies, private and third sector organisations, and communities to secure funding, establish what and where the priorities are within the catchment, and deliver the interventions using a joined-up and coordinated approach.

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EUROPEAN UNION
European Regional Development Fund

Notes

The Mid Calder and Tributaries project is being delivered by Yorkshire Wildlife Trust (YWT) as part of the Calder Greening project. The Calder Greening Scheme is led by Calderdale Metropolitan District Council in partnership with the Environment Agency and YWT. It covers a range of initiatives designed to establish resilient green infrastructure along the Calder Valley corridor.

The Mid Calder and Tributaries project is a three-year project looking to rehabilitate land on and near the River Calder and its tributaries in the Middle Calder catchment, whilst providing multiple benefits for people, the economy and wildlife. JBA Consulting was commissioned by YWT to undertake a study to identify the pressures having a negative impact on the river and to recommended specific interventions to help alleviate these pressures. The work was funded by the Environment Agency. The findings of the study underpin the Mid Calder and Tributaries project, and the study was a key element in securing the funding for the project. The Mid Calder and Tributaries project officer was appointed in July 2019. So far, a significant litter clean-up has been delivered on one of the becks, and plans are underway for installing coir pallets along a shallow sloping bank that is heavily poached by people and dogs.

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Trouble with Knotweed

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A couple of years ago I wrote an article for an online ecology magazine about Japanese knotweed. This followed the boom in property litigation that now surrounds this invasive non-native weed. The article provided a potted history of how knotweed had become a litigious issue, from apparently innocuous beginnings in the Wildlife and Countryside Act 1981, where it is stated that it is a criminal offence to allow knotweed to spread into the wild. I warned that ecologists, as paid professionals carrying out their surveys, could be the target of civil claims where costs had been incurred due a failure of an ecologist to spot the presence of Japanese knotweed.

Figure 1. Japanese knotweed shoot.

Not long after the above article was published, I was appointed to act on a case where a CIEEM member was under such a spotlight for allegedly having failed to identify, and report to their client, a number of knotweed stands on a proposed development site they had been employed to survey.

This case, and my previous article, raise two important questions for ecologists:

- Are ecologists sufficiently aware of what Japanese knotweed, its hybrids and closely related species look like, particularly in winter when canes die back and in spring when new shoots appear (previous use of herbicides can also significantly affect its morphology)?
- Are ecologists doing enough to manage their client's expectations about the work they are appointed to undertake and are they sufficiently protecting themselves from potential legal action?

Can ecologists identify Japanese knotweed?

With regards to the first question, ecologists in the past could have been forgiven for not knowing what knotweed looks like. I have flower keys from the 1980s and 1990s that don't even include images of knotweed and only mention it in passing – it's not a native or even, arguably, a naturalised plant after all. However, its current high profile and associated legal issues make it essential that ecologists are familiar with knotweed and the morphology of its annual growth cycle.

To briefly illustrate how the issue of knotweed has historically not been one that has particularly grabbed the attention of ecologists, I describe below my experience of the birth of the knotweed and property risk problem.

When the knotweed control industry really took off in the early 2000s, it was essentially a result of the contaminated land regime. Legislation in the late 1990s required the ground contamination status of land to be determined and the contaminated land remediated, if necessary.

There was subsequently a feeding frenzy as contaminated land consultants rushed to sell their services to local authorities and developers, on who the principal assessment and remediation actions were focused by the legislation. However, Japanese knotweed was quickly identified as essentially being a ground contaminant, as the law required waste containing knotweed propagules to be declared and appropriately disposed of; much like chemically contaminated waste soils had to be. Knotweed's status as a *bona fide* contaminant was then assured when it was successfully argued that it met the requirements of land remediation tax relief by being something in the ground that could damage built structures (when the definition in the guidance was really aimed at chemical contaminants that caused effects like so-called 'concrete cancer'). As such, knotweed became an essential issue for the construction industry, particularly when and where development occurred on brown-field sites; such sites often being contaminated from poorly controlled historic uses and which, coincidentally, are the ideal locations for knotweed to flourish.

The problem was that contaminated land specialists had very little interest in, or understanding of, plants. Knotweed was therefore often missed on engineers' site surveys and investigations. Their excuses were pretty good ones, as living things were not their bag. So they blamed the ecologists...

At that time, ecologists were much more interested in saving valuable habitat and protecting vulnerable species. Knotweed was not really on their radars.

It was this gap between engineers following the contaminated land regime, and ecologists looking for biological things to save and enhance, that was the impetus for the rapid rise of the Japanese knotweed contractor. Using some, fairly flimsy at that time, guidance from the Environment Agency, contractors from muck-shifting and waste haulage backgrounds leapt onto the bandwagon and began digging holes 7m in radius and 3m deep around often small stands of knotweed plants. These 'contaminated' soils were then chucked in landfills at inflated costs, with the bonus of tax relief due the land being remediated of nasty contamination that could, potentially, affect buildings.

So knotweed became a significant issue that was not adequately being assessed by ground engineers or ecologists. The new breed of knotweed contractors were mainly being used on a reactive basis, to deal with the issue of knotweed after it had been identified. Historically, therefore, knotweed surveys have not been a routine part of the due diligence or environmental impact assessment processes associated with proposed development.

It is in this landscape that some ecologists are apparently failing to keep up. Whether you agree with the issues or not, knotweed is a very real property risk, with an active and growing litigation market affecting everyone in the property transaction and development planning processes. Insurance companies are recognised as often being much more likely to pay up when costs are found against them, and it is for this reason that the professional indemnity insurance that most ecologists benefit from is making them a soft target for litigation.

Which brings me on to the second point.

Are ecologists doing enough?

Specifically, are ecologists doing enough to manage their client's expectations, and are they doing enough to protect themselves from potential litigation?

It is essential, in this climate of knotweed litigation, that ecologists make their instructing clients aware of what they will, and what they will not, be doing for them. In the case I was recently involved in, the developer seemed quite comfortable that his case was solid in claiming that the ecologist had failed to spot knotweed on a development site, resulting in a significant sum being added to the project budget to effectively deal with it (i.e. by excavation of the knotweed rhizomes and disposal of them to landfill).

As I discussed in my previous article, the Preliminary Ecological Assessment (PEA) is particularly fraught with difficulties in this regard. Unless they are clearly told otherwise, there is ample risk for clients to believe that by appointing an ecologist to undertake a PEA they are absolving themselves of any comeback from ecological surprises that the PEA might not reveal.

Ecologists might think it sufficient that the name PEA says it all. It is a ***preliminary*** assessment, after all, not an exhaustive, catch-all analysis of the ecological constraints and opportunities at a site. CIEEM's guidance recommends that the limitations of a PEA are made clear in the ecologist's report. However, having reviewed many PEA reports from many other ecologists, the variation in the level of risk management on this issue is quite shocking. I have seen statements that indicate that there were no limitations to the survey, and similarly glib comments hidden away as footnotes on figures along the lines of *"the survey was limited by the conditions on site at the time"*. Is this enough? Well, it is currently being tested in the courts, so clear guidance might be forced upon us by case law – probably at the expense of an ecological consultancy firm or two…

It is then no wonder that some clients might be unsure about what a PEA is and exactly what questions they are paying an ecologist to answer.

From my experience and from my discussions with CIEEM, this is something that members really ought to be doing better. It is one thing to add some caveats to a report in the limitations section, but it is arguably much better for everyone involved if the PEA's limitations are set out and made clear at the start of the appointment.

Ecologists need also to be aware that if they fail to adequately manage their clients' expectations, they could have an argument on their hands with their professional indemnity insurance provider, as to whether or not this failure was an act of negligence that might bring them outside their cover. Due to the potentially large sums involved in the remediation of knotweed-contaminated land, the consequences of this could be the end of more ecological consultancy firms.

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Plants in Practice

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Plants are critical to professional ecology (not to mention to life on Earth), but we believe that the importance of plants (including lower plants) is not sufficiently reflected in professional practice; not in the policy and guidance that underpin our practice, not in the botanical skills of ecologists and not in the resources given to training staff. We believe that the lack of guidance together with often low levels of competence in plant and habitat identification could, and do, lead to the under-valuing of and loss or damage to important plant populations and habitats.

There is a plethora of guidance for ecologists undertaking survey and assessment of the various animals that dominate the professional ecology world, and junior ecologists have lots of experienced colleagues to turn to for chiropteran and other protected species wisdom. Yet where do you look for examples of botanical good practice? Guidance is even lacking on such basic requirements as how to survey plants in a development or other consultancy

context, and for too long we have been pretending that Phase 1 Habitat survey is up to the job and that the National Vegetation Classification (NVC) is the last word in botanical survey and assessment in ecological consultancy. For many ecologists, a protected species licence is a major career goal, but surely the aspiring professional should also be able to demonstrate competence in plant identification and habitat survey? Quite simply, professional practice in relation to plants and habitats is incoherent, often inadequate, and in need of standardisation.

We believe the development of new guidance should be led by the people who care about our wild plants, our natural vegetation and habitats. The Botanical Society of Britain and Ireland (BSBI) and Plantlife are therefore setting out on a collaboration with CIEEM to produce guidance for professional ecologists on botanical and habitat survey and assessment. Of course, we do not know everything, and we want to use the collective experience and expertise of CIEEM members to make this guidance as relevant to professional practice as possible.

The timing is right for this. The UK Habitat Classification and its rigorous field methodology is beginning to be used by professionals, and this new classification is the basis for Natural England's recent update to the Biodiversity Metric. Moreover, with Net Gain climbing the agenda, there should be an increasing demand for professionals who understand vegetation and habitats. Finally, the BSBI's Field Identification Skills Certificate (FISC)[1] is becoming an industry standard for assessing botanical competence, and many consultant ecologists are using the online course Identiplant[2] to improve their botanical field skills.

We want to build on these developments. This will not be a simple task – especially as we strive to consider all plant groups – but we believe it to be urgent. We envisage that the combined expertise of BSBI, Plantlife, academics, and ecological professionals will be able to develop effective guidelines and best practice training tools to nurture a new generation of suitably qualified field botanists. This will contribute to the critical task of maintaining and enhancing UK plant biodiversity, which is the responsibility of all of us.

The first stage of producing new guidance will be to define its scope. We will need help from the CIEEM membership to do this – please contact David (email below) if you have thoughts on topics you would like to see covered. If you would like to be actively involved as a volunteer in committee discussions or as an author, then we would also like to hear from you.

Notes

1 https://bsbi.org/field-skills

2 identiplant.co.uk

Botanical Society of Britain and Ireland

The BSBI is for everyone who cares about the wild plants of Britain and Ireland. Since 1836, the BSBI has been promoting the study, understanding and enjoyment of British and Irish botany. Find out more about at bsbi.org.

Plantlife

Plantlife is a British conservation charity working nationally and internationally to save threatened plants and fungi. Plantlife owns nearly 4,500 acres of nature reserve across England, Scotland and Wales, and has 11,000 members and supporters. Find out more at plantlife.org.uk/.

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Health and Safety for Field Ecologists: A Flexible and Cost-effective Approach

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Keywords: ecology field survey, Health and Safety, working near water, working at height

Ecology surveyors carry out many routine activities in the field that are inherently risky, including working in or near water and using ladders. This article describes a flexible and cost-effective approach to Health and Safety (H&S) training and recording competency for ecologists for such activities.

Arcadis ecologists became aware in 2017 of a Health & Safety (H&S) share (Downey 2016) relating to an incident at Volvo, where the company was fined £900,000 for a serious injury to a staff member as a result of a fall from a ladder. The person had not been trained in how to check ladders before use and the ladder was damaged. The incident resonated strongly with the ecology team, as ecologists regularly have to use ladders to install and inspect equipment – such as bat and dormice boxes.

Through a group discussion with the Arcadis Safety, Health, Environment and Quality team, and with other staff who were involved in field surveys, a gap was identified in training and competency evaluation for surveyors using ladders, as well as working in or near water. The knowledge gaps identified were "Non-specialist working at height" and "Non-specialist working on or near water". Tasks included: using a ladder to put up and check structures in trees or on posts (such as air quality monitors and bat or dormice boxes); internal building inspections; working close to trenches; survey work along the edges of water bodies (for example River Corridor and River Habitat Surveys, Environment Agency water course surveys, canal surveys, sediment sampling, and/or water vole surveys); carrying out or overseeing flood management or mitigation works; and surveying in water bodies (e.g. water quality and hydrological functioning surveys, great crested newt surveys, and fish rescues). What was not included was work that required specialist qualifications or equipment, such as tree climbing or rope harness work or off-shore boat-based work.

Figure 1. Throw line training at Arcadis Cardiff office.

The options for training and competency evaluation were reviewed, guided by staff who were H&S and/or accredited trainers in these topics, and it was agreed that the most sustainable and cost-effective option would be for Arcadis to provide in-house training that was compliant with government and regulatory guidance (see Box 1). The challenge was how to deliver the training in such a way that it could be accessible at a time which suited the field workers (who are often out of the office for weeks at a time), how to assess their competency and how to provide an audit trail of the training. The approach described here is considered to address employer's and employee's H&S responsibilities (see Box 2), as a cost-effective alternative to sending all surveyors on externally-provided H&S training courses; as an example, half-day ladder training courses cost upwards of £75 per person.

Box 1. H&S Legislation and Guidance

Name	Aim	Location
The Health and Safety at Work Act 1974	The primary legislation covering occupational health and safety in the UK, which aims to ensure practical compliance, and help organisations understand and implement an 'organisational intent' to support health and safety.	http://www.hse.gov.uk/legislation/hswa.htm
The Management of Health and Safety at Work Regulations 1999	Introduced to reinforce the Health and Safety at Work Act 1974. They place duties on employers and employees including those who are clients, designers, principal contractors or other contractors.	http://www.legislation.gov.uk/uksi/1999/3242/contents/made
Provision and Use of Work Equipment Regulations 1998 (or 1999 in Northern Ireland).	These regulations deal with the work equipment and machinery used every day in workplaces, and aim to keep people safe wherever equipment and machinery is used at work.	http://www.hse.gov.uk/work-equipment-machinery/puwer.htm https://www.hseni.gov.uk/articles/equipment-work
The Work at Height Regulations (2005)	Requires all work at height to be properly planned and appropriately supervised.	http://www.legislation.gov.uk/uksi/2005/735/contents/made
The Health and Safety Executive	The HSE provides information on H&S at work and is responsible for enforcing the Health and Safety at Work Act.	https://www.hse.gov.uk/
HSE Guidance: Safe Use of Ladders and Step Ladders	Provides simple, sensible precautions to keep people safe when using ladders and stepladders in the workplace.	http://www.hse.gov.uk/pubns/indg455.pdf
HSE Guidance: Working at Height: a brief guide	Describes what employers/ employees need to do to protect workforce from falls from height.	http://www.hse.gov.uk/pubns/indg401.pdf
HSE: Code of Guidance for Working and Operating Over or Near Water Within the UK	This provides information in respect of H&S during work for event activities on, over or near inland and inshore waters.	http://health-and-safety-for.co.uk/working-near-on-or-over-water
HSE: Working near Water	Guidance on working near water.	http://www.hse.gov.uk/pubns/watindx.htm

A three-stage training and assessment process was designed as follows:

1. Development of two pre-recorded PowerPoint training modules to be viewed by all ecologists: 'Non-specialist working at height' and 'Non-specialist working on or near water'.
2. Development of a practical training course.
3. Recording of all H&S training given in an ecology competency matrix, and regular refresher training.

Each training module lasted approximately 30 minutes and included: types of work covered; relevant legislation; simple guidance on survey procedures; typical hazards and risk assessment; and use of PPE/equipment. The H&S training modules spelled out employer and employee responsibilities (see Box 2); showed how the tasks described should be planned and documented in advance; reinforced the Arcadis "Stop Work Authority" if staff considered the work to be unsafe; provided training on key field tasks; and stressed individual accountability to check and report faulty equipment, as well as report any incidents/near misses. The modules took approximately three months to develop, review, record and upload to Arcadis' Learning Academy where staff could access them.

Several experienced field ecologists were given training by a qualified H&S trainer on aspects of practical H&S training, as well as how to deliver this training themselves. These 'trained trainers' could then cascade the practical training to all other surveyors. This practical training allowed surveyors

Box 2. Employer's and Employee's Responsibilities

Employer's responsibility to ensure:	Employee's responsibility to:
• All work [at height or in/near water] is properly planned and organized.	• Follow planned procedures, having been briefed on the task and having read and signed the appropriate risk assessment.
• A risk assessment is produced and followed.	• Report any safety hazards.
• Potential emergency situations and rescues are planned for.	• Use PPE/equipment supplied properly, following any training and instructions given to you.
• Those involved are trained and competent, and briefed on the task.	• Carry out checks of PPE/equipment prior to use, not to use faulty PPE/equipment and report any faults.
• PPE/equipment is available and appropriate inspection protocols are in place before use.	

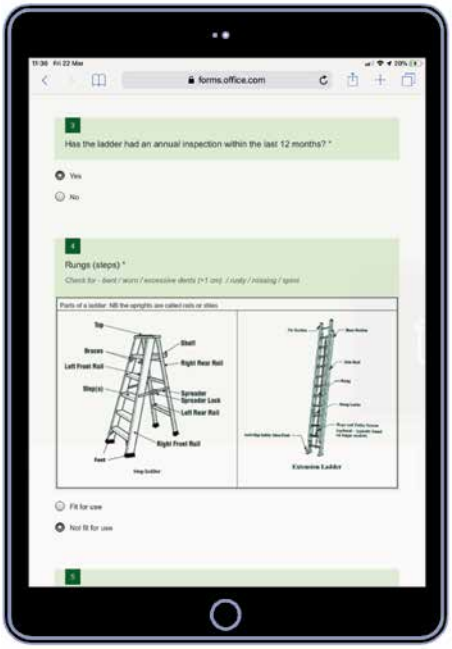

Figure 2. Pre-use ladder check form on a tablet.

to practice such techniques and build up their confidence (such as using throw lines before they may be required to do so in an emergency, see Figure 1); to learn how to check equipment/PPE prior to its use; and to be formally assessed by the trainer that they were competent.

Our ecology competency matrix (closely related to CIEEM's competency recording protocols) provides our Information Management System for recording staff competency. Staff recorded that they had viewed the PowerPoint presentations. Trainers assessed the practical H&S skills in a training session, and recorded ('pass' or 'fail') that individual surveyors were competent to use and check PPE/equipment safely and suitably. Additionally, Arcadis developed pre-use equipment/PPE check/inspection forms, accessible via mobile apps, for recording that the relevant checks had been carried out (Figure 2).

The flexibility of this training and competency approach, means it can be carried out as and when required, tailored to our specific needs, and without the need for external training courses, which may be costly and difficult to organise for large numbers of staff (Arcadis employs approximately 65 ecologists). This approach satisfies HSE guidance, which states that employers must make sure work is properly planned, supervised and carried out by 'competent people'. The HSE definitions is that a competent person should have 'sufficient skills, knowledge and experience to perform the task, and our training approach provides an auditable trail to that effect.

References

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Acknowledgements

The author is grateful to all the Arcadis staff who were involved with the development and delivery of this training procedure, including: Dave Avery (Senior Health & Safety Practitioner – Highways); Katy Baker (Head of Capability in the ESI team at time); and Paola Reason (Safety, Health, Environment and Quality lead for ESI).

About the Author

Will is a Principal Consultant, with 15 years of experience in professional consultancy, specialising in the ecology and conservation of great crested newts, reptiles and mammals (particularly bats and badgers), with experience in producing RAMS, and is a trained auditor.

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Air Quality Mitigation – Towards Nitrogen-Neutral Development

Andrew Baker FCIEEM
Baker Consultants

Over the past few years the issue of air quality has been put squarely at the top of the ecological agenda. The ecological effects of poor air quality and in particular the deleterious impacts of increased nitrogen deposition have been thoroughly documented in the peer review literature for decades. The Community of Air Pollution Effects Researchers (CAPER) brings together scientists working on air pollution impacts on the natural environment. CAPER was established in 1974!

It is however only in recent years that air quality has become a serious constraint to development. Inevitably this has been led by the application of the Habitats Directive generating case law which has become so celebrated that they are now known by their shorthand of 'Wealden' or the 'Dutch' case. These *cause célèbre* landmark cases are far from being abstract or theoretical legal arguments but have had real world consequences for those advancing land use policies or consenting activities that could give rise to additional pollution on protected sites. In the Netherlands, the Dutch Ministry of Agriculture attempted to introduce a 'Programmatic Approach to Nitrogen' management in areas around Natura 2000 sites. Prior to the introduction of the programmatic approach, no new agricultural activities that had the potential to produce sources of nitrogen had been allowed for a period of eight years. The approach ultimately failed and was shelved following the European court cases, however many lessons were learned. In the UK, the 'Wealden' case continues to cause serious issues for the development of local plan policies. For example, the potential air quality issues arising from new development around Epping Forest have been a major stumbling block for the development of the Local Plan and consequently even small residential developments have been turned down.

The concepts of Critical Loads and Levels are now widely understood by professional ecologists, however consequences of exceedance of critical load when it comes to applying the Habitats Directive are perhaps less well understood. Critical Loads are defined as *"a quantitative estimate of exposure to one or more pollutants below which significant harmful effects on specified sensitive elements of the environment do not occur according to present knowledge"* (www.apis.ac.uk). Given that the Habitats Directive requires that significant harmful effects (adverse effects upon integrity) must be ruled out it is therefore a logical conclusion that if Critical Loads are exceeded then the integrity of a site is therefore threatened. In the UK this view is still controversial, in the Netherlands it is an accepted truth reiterated in the 'Dutch' case when Advocate General Kokott stated in her opinion in the case (C-293/17 and C294/17) at paragraph 62: "*In this regard, it seems difficult, if not impossible, to accept values that are higher than the critical loads.*"

Indeed, in the subsequent paragraph she went on to consider cumulative impacts of nitrogen on sensitive habitats and stated at paragraph 63: *"Furthermore, it would also appear to be necessary to consider to what extent the individual protected habitats have been exposed to an overload of nitrogen deposition for a considerable time. … It might therefore be necessary, until the removal of existing nitrogen reserves, to permit even less additional nitrogen deposition than envisaged in the critical loads."* In this paragraph she not only got to the heart of the issues but also demonstrated her thorough understanding of the ecological issue she was addressing.

The outlook for air quality is, however, far from bleak. Mitigation measures are the subject of intense research, whether

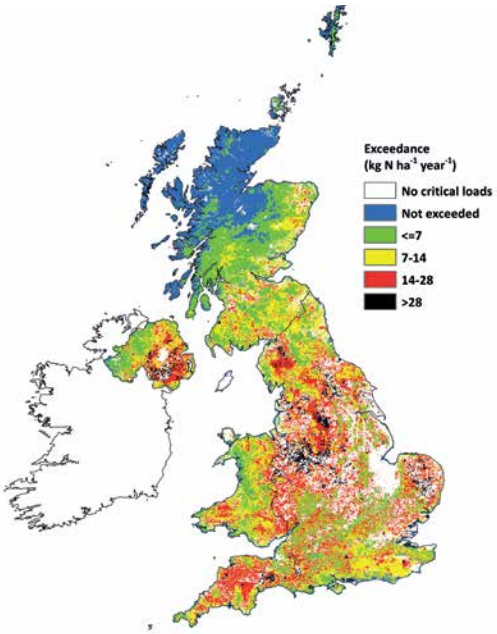

Figure 1. The Average Accumulated Exceedance (AAE) of nutrient nitrogen critical loads, for all habitats combined, and based on UK 5x5 km deposition data averaged for 2012-14. Reproduced with kind permission of the Centre for Ecology and Hydrology.

it be site management to tackle historical nitrogen loadings or technological measures to prevent the release of pollutants at source.

CIEEM has been very active in examining the implications of the developing case law for our members. Following the very successful joint IAQM-CIEEM conference in January 2019, CIEEM has decided to make air quality the subject of the 2020 Spring Conference in Sheffield (see page 69). The keynote speaker is Dick Bal of the Dutch Ministry of Agriculture who will explore the lessons learned from the 'Dutch' case. The conference will aim to explore mitigation measures and will draw upon the latest research in this area.

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Restoration Science Relevant for Action

James Hicks MCIEEM
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The challenge to restore our ecosystems right now is more important than ever. Current demands for restoration initiatives across the planet, combined with shifting human and environmental baselines, has exposed complex questions that straddle the divide between theory and practice. To address these questions, the Royal Society brought together academics, practitioners and policy-makers from across the world for a two-day event on 23-24 September 2019 to try and synthesise current understanding and develop a research agenda to address knowledge gaps.

The event was split into three themed speaker sessions, with the final afternoon focussing on exploring shared research priorities, building towards a special British Ecological Society e-journal of collaborative papers on the various priorities identified during the event, to be published 9-12 months from the event.

The first series of talks explored the theme of restoration ecology's complex spatial and temporal dynamics and how changes in these will affect the success of restoring degraded ecosystems in the future. In a world with changing environmental, social, economic and political baselines, we need to adapt our current tools to deliver effective restoration projects. A cohesive approach to incorporate concepts such as rewilding, green infrastructure and species translocations, was deemed important to ensure successful restoration. It was also clear from the talks that a better understanding of the composition of ecosystems, and the functions and service provisions of the ecosystem components, will help ecologists predict the success of different restoration tools and ensure the right tool is used.

The second series of talks focused on how shifting human baselines affect the success of restoration projects. The human population is increasing at an unprecedented rate; this shifting human baseline is having an increasing demand on the landscape, often to the detriment of biodiversity. Ecologists and environmental managers are often guilty of overlooking the importance of considering the social sciences when designing restoration projects. We are good at considering the robustness of ecological theories behind restoration projects, but we often fail to tap into the knowledge of local people who know the land much better than we do. Several speakers presented indisputable evidence that successful restoration projects were only achieved when local people were engaged and benefitting from the restoration. We need to look more at 'win-win' restoration projects to benefit biodiversity and people alike; people are crucial in restoration and our efforts are in peril if we discount this role when devising our strategies.

The final series of talks explored the importance of shifting environmental baselines. The environment around the world is changing all the time and we need to reconcile these dynamics in future restoration projects. Nature is wonderfully but frustratingly disorganised, meaning we can't always accurately predict future conditions. To keep up with this, we need to change our conceptual model of restoration and realise everything interacts with everything else. We need to integrate resource management, favour heterogeneity and connectivity across landscapes, work with multiple scales (not just at the species level!), build and maintain adaptive capacity with humans (as human communities need to adapt and respond too) and work within an envelope of plausible future scenarios for the outcome of restoration projects.

Following the series of thought-provoking talks, there was an interactive group discussion on a critical agenda for future research and policy implementation. We had some powerful and rightfully emotional responses from experts (academics, practitioners and policy-makers) whilst developing a new restoration research framework. It was decided that there is a clear need for more research in many areas, and the devised restoration research framework comprises topics such as: landscape perspectives (scales), links between ecosystem composition and the functions/services they provide, different methods of restoration, and better ways to more accurately predict restoration trajectories based on shifting environmental and human baselines.

A key theme that arose throughout the event was the indisputable need for more socio-ecological research in restoration science. If restoration projects do not provide 'win-wins' for people and biodiversity alike, they simply will not succeed. It was also clear that there needs to be more collaboration between academics, practitioners and policy-makers. It was agreed that a joint policy paper on current research understanding, discussing what works and what doesn't work, would really benefit restoration science going forward.

We have a real opportunity now to restore the ecosystems we have damaged and it's not too late. As ecologists and environmental managers, we need to continue to drive restoration science forward, engage better with people and understand shifting environmental and human baselines in order to deliver effective, successful and sustainable restoration projects.

About the Author

James is a Senior Ecologist at Atkins and sits on the committee for the CIEEM Ecological Restoration and Habitat Creation Special Interest Group. James has been involved with numerous ecological restoration projects associated with major infrastructure projects.

International Focus

Surveying for Golden Jackal

Iain Lednor
RSK

The golden jackal *Canis aureus* is an adaptable candid that can inhabit a wide range of habitats and is found widely from Southeast Asia to Central Europe. It also occurs throughout the Indian subcontinent, the Middle East and south eastern Europe. This opportunistic species will move into human-dominated habitats to scavenge at night, retreating to cover during the day. The absence of larger carnivore species such as the wolf *Canis lupus* favours the species, and the absence of the wolf is seen as a potential reason for its recovery throughout areas of Europe.

In Europe, the golden jackal typically occurs in densities of around one family group per square kilometre, with a recorded range of 0.1-5 family groups per square kilometre. The population size for Europe has been roughly estimated at 70,000 golden jackals. Although listed as of Least Concern on the IUCN Red List of Threatened Species, this species is of conservation concern in some European countries, for example it is listed as Vulnerable on the Albanian Red List.

As recently as 2011, both the Eurasian and African golden jackal species were thought to be the same species, but genetic investigations have found them to be distinct from one another with the African species being more closely related to the grey wolf. It has been subsequently renamed the African wolf *Canis lupaster*.

Figure 1. Jackal caught on camera trap.

With jackals being cryptic species, the use of camera traps can be a key non-invasive tool in identifying habitat use. They can be installed in pre-identified habitats of likely occurrence (i.e. watering holes, habitat trails) and whilst the use of camera traps is limited in terms of its statistical usability and estimating the population of a target species, they are very useful in proving the presence or absence of a species.

Transects within a study area can be used to identify tracks and other signs of mammal species. Suitable habitat can be surveyed to identify field signs such as scat and footprints. Tracking surveys to identify footprints are best undertaken in snowy conditions but muddy and sandy substrate can also be favourable, especially following rain, which makes footprints more noticeable and identification easier. Understanding how jackals move through the landscape by following forest roads, natural travel corridors and natural trails can maximise success of finding field signs.

Vocalisation surveys provide an efficient tool for monitoring social and territorial canid species. Canids respond to human imitation of howls or acoustic broadcasts of actual howls, which is the basis of the acoustic survey method. Recorded yip-howls are broadcast using a megaphone from pre-determined calling stations. Each broadcasted howl lasts for 30 seconds followed by a 5-minute pause and this cycle is repeated five times giving approximately 30 minutes at each location. Surveys are undertaken during the night when jackals are active. The first broadcasted howl is set to a low volume to avoid scaring the jackals or other canid species, and each subsequent broadcast is increased in volume. If jackals respond, the direction of the responding howling group is recorded, and the distance is estimated from the volume. It is possible to estimate numbers of individuals in the group from the number of howls heard, allowing population dynamics of the area to be determined.

Figure 2. Tracks of two jackals moving side by side.

If you would like to contribute to this page please contact Corin Simmonds (CSimmonds@rsk.co.uk).

The EcIA Checklist: Driving up Standards of Ecological Reporting

Mike Dean CEcol FCIEEM and **Mike Oxford CEcol FCIEEM**

The quality of ecology reports, particularly Ecological Impact Assessment (EcIA) reports submitted with planning applications for development projects, has been identified as a concern by both CIEEM and the Association of Local Government Ecologists (ALGE). The poor quality of an ecological report can be a causal factor in delay to the determination of planning applications and also in many of the complaints made against CIEEM members.

In recent years CIEEM has taken a number of steps to try to raise the standards of ecological reports:

- It has published updated *Guidelines for Ecological Report* Writing (https://cieem.net/resource/guidelines-for-ecological-report-writing/);
- It has published a *Guide to Ecological Surveys and Their Purpose* (https://cieem.net/resource/guide-to-ecological-surveys-and-their-purpose/);
- Courses on *Ecological Report Writing and Report Writing for EcIA* have been added to CIEEM's Continuing Professional Development programme; and
- Since 2016, CIEEM has been working collaboratively with ALGE on an initiative aimed at improving the quality of EcIA reports specifically – the EcIA Checklist and Declaration.

The intention of the EcIA Checklist and Declaration is that it will be completed by the ecologist acting on behalf of the person submitting a planning application (the applicant), who would also be the lead author of, or person responsible for 'signing off', the EcIA report submitted with the application. This would form part of the documentation to be submitted with any application where ecological information is required.

The Checklist (see graphic) provides criteria to be considered by a Local Planning Authority (LPA) when reviewing an EcIA report. This would be completed initially by the ecologist acting on behalf of the applicant – it would be their responsibility to confirm that the criteria have been met, and to 'signpost' the LPA to the relevant section(s) of their report for each of the criteria. The LPA can then use the submitted Checklist to identify any specific areas of concern within the report.

The Declaration (not provided here) effectively requires the ecologist to take responsibility for the content of the report and the completion of the Checklist. It would also be signed by the applicant, or their agent, to confirm that they have read the EcIA report and understand the commitments made in relation to impact avoidance, mitigation, compensation and enhancement.

CIEEM and ALGE believe that the EcIA Checklist and Declaration has the potential to significantly raise standards of reporting. However, to realise its full potential it needs to be adopted by individual LPAs as a requirement. Several LPAs in South East England will be trialling the use of the EcIA Checklist and Declaration in early 2020 for a period of up to six months, after which its effectiveness and practicality will be reviewed. This may lead to it becoming a permanent requirement, and may encourage its use in other regions.

The Checklist may also help to resolve the ongoing debate about whether it is acceptable to submit a Preliminary Ecological Appraisal Report (PEAR) with a planning application, instead of an EcIA report. The answer to this question is provided in paragraph 3.15 of CIEEM's *Guidelines for PEA* (https://cieem.net/resource/guidance-on-preliminary-ecological-appraisal-gpea/) – although an EcIA report should still be provided ideally, a PEAR could be written in such a way that it performs the function of an EcIA report. A further test, therefore, in addition to those listed in the CIEEM guidelines, will be whether the Checklist can be completed on the basis of the PEAR, with a justifiable answer of 'yes' to all criteria, and with appropriate sections of the PEAR referenced to demonstrate it is adequate and contains all necessary information to enable the LPA to determine the application.

While the proposed approach will require ecological consultants to do a little more 'paperwork', we consider the benefits will be worth it. For those already producing good reports, it should be a very simple exercise to complete the Checklist and should therefore not be onerous, particularly if it were incorporated into a consultancy's Quality Assurance procedures. Indeed, the use of the Checklist criteria by ecologists when checking/reviewing an EcIA report is recommended by CIEEM in any case. This is why CIEEM's Professional Standards Committee (PSC) has decided to publish the Checklist (but not the Declaration at this stage) on the CIEEM website even though it is not currently a requirement, and before the trial in South East England has been completed. If members adopt it voluntarily there should be an improvement in the quality of ecological reports. In the future, the Checklist will also allow CIEEM to judge the quality of EcIA reports objectively and fairly against an established benchmark when assessing complaints made against members.

Ecological Impact Assessment (EcIA) Checklist

	EcIA Criteria (to ensure decisions are based on adequate information in accordance with Clauses 6.2 and 8.1 of BS42020:2013)	Yes No n/a	Paragraph reference number(s)
Pre-app/ scope	1. Where pre-application advice has been received from the Local Planning Authority and/or an NGO and/ or statutory body (e.g. NE DAS, NRW DAS)[i], it has been fully accounted for in the EcIA		
	2. The scope, structure and content of the EcIA is in accordance with published good practice[ii, iii and iv]		
Surveys, Sites, Species and Habitats	3. Adequate[v] and up-to-date[vi]: a. Desk study has been undertaken[vii] b. Phase 1 habitat survey (or equivalent) has been undertaken[vii] c. Phase 2 ecology surveys have been undertaken (where necessary)[viii]		
	4. All statutory and non-statutory sites likely to be significantly affected are clearly and correctly identified		
	5. All protected or priority species and priority habitats[ix] likely to be significantly affected are clearly and correctly identified, and adequate surveys have been undertaken to inform the baseline		
	6. Any invasive non-native plant species present are clearly and correctly identified		
	7. Where a separate PEA Report states that Phase 2 ecology surveys are required, these have been undertaken in full and results submitted with the application (or lack of such surveys is justified)		
Impacts and Effects	8. The assessment is based on clearly defined development proposals along with relevant drawings/plans (and any plans used are the same version number as those submitted with the application) or 9. The residual ecological effects are considered to be not significant at any geographical scale irrespective of the detailed development proposals, and the assessment is based on a worst-case-scenario		
	10. The report describes and assesses all likely significant ecological effects (including cumulative effects) clearly stating the geographical scale of significance (where relevant)		
Mitigation, Compensation and Enhancement	11. The mitigation hierarchy has been clearly followed[x]		
	12. The report: a. Clearly identifies the proposed mitigation and compensation measures, and explains how these will adequately address all likely significant adverse effects b. Includes, where necessary, proposals for post-construction monitoring c. Recommends how proposed measures may be secured through planning conditions/obligations and/ or necessary licences		
	13. A summary table of proposed mitigation and compensation measures has been provided		
	14. The need for any mitigation licences required in relation to protected species is clearly identified		
	15. Proposals to deliver ecological enhancement/Biodiversity Net Gain have been provided		
Competence/Good Practice	16. Limitations[xi] of the ecological work have been correctly identified and the implications explained		
	17. All relevant key timing issues (e.g. site vegetation clearance or roof removal) that may constrain or adversely affect the proposed timing of development have been identified		
	18. All ecological work and surveys accord with published good practice methods and guidelines OR deviation from such guidelines is made clear and fully justified, and the implications for subsequent conclusions and recommendations made explicit in the report[xii]		
	19. All ecologists and surveyors hold appropriate species licences (where relevant) and/or have all necessary competencies to carry out the work undertaken		
Conclusions	20. The report clearly identifies where the proposed development complies with relevant legislation and policy, highlighting any possible non-compliance issues, and highlighting circumstances where a conclusion cannot be drawn as it requires an assessment of non-ecological issues (such as socio-economic ones)		
	21. The report provides a clear summary of losses and gains for biodiversity, and a justified conclusion of an overall net gain for biodiversity		
	22. Justifiable conclusions[xiii] based on sound professional judgement[xiv] have been drawn as to the significance of effects on any designated site, protected or priority habitat/species or other ecological feature, and a justified scale of significance has been stated		

Footnotes for the Checklist are available on the document in the online CIEEM Resource Hub.

The Checklist can be found on the CIEEM website (https://cieem.net/resource/ecological-impact-assessment-ecia-checklist/). PSC would value feedback from CIEEM members on the content of the Checklist and the general approach proposed. Please send any feedback to enquiries@cieem.net. Any updates following the trial in South East England will be published on the CIEEM website.

Ethical Dilemmas

Welcome to this new *In Practice* series of problems and conundrums that can face members during their professional practice. The purpose of the feature is to encourage you to reflect on and explore scenarios that you may face during the course of your work and to consider the appropriate ways to respond to ensure compliance with the *Code of Professional Conduct*.

In each issue we will set out the ethical dilemma here in *In Practice*. We will also start a discussion thread on CIEEM's LinkedIn page to enable you to share your thoughts and views (but please remember that there is often no wholly right nor wholly wrong answer). In the next issue of *In Practice* we will share some thoughts on the dilemma from the Professional Standards Committee (PSC) as well as moving on to a new scenario.

PSC would welcome your ideas for future dilemmas as well as feedback on whether this feature is of interest/helpful. Send your thoughts to enquiries@cieem.net.

So, here goes…

You are a CIEEM member who is a consultant ecologist. You are contracted by a new client in June to undertake a Preliminary Ecological Appraisal (PEA) of a potential development site. The client intends to submit a planning application before the end of the year. This site is not easily visible from the public highway.

You undertake a data search with the Local Records Centre which provides records of great crested newts (GCNs) in four ponds located between 150 and 250m from the site (dated 3-5 years ago). A review of Ordnance Survey maps, recent aerial photos, and a County-wide Phase 1 habitat survey (provided with the data search results) show that the site is unmanaged grassland and scattered scrub, likely to provide suitable terrestrial habitat for GCNs. There is an off-site pond visible on the Ordnance Survey maps located 50m from the site, although there are no GCN records for that specific pond. There are no barriers to the movement of newts between the site, the pond within 50m and the other ponds within 250m for which there are GCN records.

When you visit the site in August you find that much of it has been very recently cleared by an excavator, with all vegetation removed and stockpiled in one corner of the site. Tree roots have been grubbed out, the turf has been stripped off, and the ground is now largely bare and has been repeatedly tracked over. The site no longer provides habitat likely to be used by GCN, as it currently exists. You had requested access permission to the adjacent land where the pond 50m from the site is located, but this was refused.

1. What do you do?
2. What might the implications be for you depending on your course of action?
3. Would your actions differ if there were desk study records of GCN in the pond within 50m of the site?

Add your thoughts to the CIEEM LinkedIn group discussion at: www.linkedin.com/groups/4306428/

Complaints Update

Breaches of the *Code of Professional Conduct*

At a hearing on 22 August 2019, Mr Richard Millington ACIEEM was found to be in breach of clause 4 of the *Code of Professional Conduct* having failed to meet the required standard in ecological survey and reporting. Mr Millington was given a reprimand with advice and a training requirement.

At a hearing on 15 October 2019, Mr Andrew Gardner CEnv MCIEEM was found to be in breach of clauses 1, 3, 4 and 5 of the *Code of Professional Conduct*. These breaches arose as a result of a poor standard of ecological advice and assessment, inadequate report writing and a failure to manage stakeholder relationships professionally. Mr Gardner was issued with a reprimand with sanctions.

Sharing Knowledge: Atkins Competency Framework

Jules Price MCIEEM
Atkins

Keywords: competency, sharing knowledge, competency criteria

Background

In 2016, we published an article (Vincent, 2016) discussing the benefits of aligning our competency framework with that of CIEEM. Within Atkins (member of the SNC-Lavalin group), we have developed set criteria to assess the ecological competencies of its staff for various types of survey, mitigation and reporting. There are many good reasons for this: it allows people to map their competencies for career development and progression purposes; it provides consistency of approach between the different ecological specialists in-house; it helps us identify any gaps in our service provision; and assessing competencies is an essential part of the chartership process. However, one of the most important purposes is that it ensures the quality assurance of the surveys that we undertake. Aligning our terminology with the CIEEM framework and linking our criteria to CIEEM's competencies for species surveys guidance promotes consistency across the profession.

Over the last five years, we have seen a significant increase in the number of major projects in which we are involved at any one time. In addition, as we are all aware, there are ever greater challenges around project timetables. When these two issues are put into the mix with the seasonality of ecological surveys and ensuring that our surveys are robust and in line with guidance, this puts increasing pressure on our ecologists. We have, therefore, increased our supply chain significantly over the last few years and now have a number of trusted sub-consultancies with whom we work on a regular basis. At one stage during one of our recent projects, there were over 300 ecologists working on the scheme undertaking the full range of survey, data analysis and assurance, mapping and report writing. Whilst this allows us a greater degree of resource flexibility, this also demands its own process for quality assurance.

Sharing knowledge

With the above factors in mind, we are now working with our sub-consultants to ensure consistency of approach between the consultancies that are part of our supply chain so that all staff working on Atkins projects are assessed using the same criteria with which we assess our own staff. Anyone leading a survey on an Atkins project, whether in-house staff or sub-consultants, will need to be able to demonstrate that they are at least 'capable' in accordance with the criteria. Our own staff have completed evidence forms that have been checked and approved by senior staff. In the first instance for sub-consultants, we are asking that the CVs provided in any case are tailored to include evidence of relevant competencies.

In autumn, the next step will be that sub-consultants who undertake work for us, at 'capable' level (or above), will complete a more detailed evidence form for that competency. This will provide us with a quality assurance audit trail and the confidence that all staff are competent enough to ensure that we can technically deliver on all our projects.

We have now made our criteria publicly available on our website:

https://www.atkinsglobal.com/~/media/Files/A/Atkins-Corporate/group/services-documents/ecology_competencies_criteria_and_process_2019.pdf

This document describes how we developed the criteria and sets out the criteria for each competency level for each survey type. We currently have criteria for nine survey types (badger, bats, birds, dormouse, great crested newt, otter, water vole, habitats and extended Phase 1 habitat survey). We are in the process of developing and piloting criteria for a further five survey types (reptiles, white-clawed crayfish, red squirrel, pine marten and wildcat). We are also producing criteria for the role of Ecological Clerk of Works and for Habitats Regulations Assessment. The document will be updated with these criteria when we are satisfied that they are appropriate.

We hope that by sharing this information we are promoting the consistency of high standards across our industry, without each company having to re-invent a rather time-consuming wheel.

Reference

Vincent, K. (2016). The Benefits of Aligning the Atkins and CIEEM Competency Frameworks. *In Practice – Bulletin of the Chartered Institute of Ecology and Environmental Management*, **92**: 51-52.

Acknowledgement

Thanks to Kate Vincent for comments on this article and to Kate and members of our Competency Network for the sterling work they have done in establishing and progressing compliance with the framework.

About the Author

Dr Jules Price is an Associate Director at Atkins and is head of technical ecology services. She has 30 years of experience in ecology, mostly in the private sector, and advises on all aspects of ecological impact assessment and mitigation.

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Competency Framework Self-Assessment Tool Now Online

Stuart Parks
Head of Membership and Marketing, CIEEM

Hopefully, many of you will have made use of CIEEM's Competency Framework at some point, whether as a tool to support the planning of your professional development, as a line manager or sponsor, or as an applicant for higher grades of CIEEM membership and chartership. In September's *In Practice* (Issue 105, p42) we provided some updates on changes made to the Framework after a period of review. To support the use of this revised Framework, this month we will launch an online self-assessment tool which we hope will enable you to make even more use of this valuable resource.

A Quick Recap

Competencies are the skills, knowledge and behaviours that are required to perform certain activities well and which are critical to success in specific professional roles. A Competency Framework is a structure that sets out and defines the different competence levels for each individual competency and establishes a clear link with professional performance. It is a standard against which you can measure yourself. As a professional, you are competent if you:

- Know what to do
- Know how to do it
- Know when to do it
- Know why you do it
- Can do it consistently well
- Know when to seek help and advice

The purpose of CIEEM's Competency Framework is to:

- support members in identifying their current and required levels of competence and to plan their continuing professional development (CPD) in order to achieve these new levels;
- enable the identification of competence-based professional role profiles;
- support CIEEM's careers advice and careers guidance;
- specify the levels of competence expected of our members at different professional grades and thereby provide for a competence-based assessment of membership and Chartered Ecologist eligibility; and
- promote high standards of professional practice.

The Self-Assessment Tool

The self-assessment tool has been designed and built to offer as much flexibility as possible to the user. You can choose to assess yourself against a single competency, a suite of competencies that fall under an overarching theme, or the entire Framework of 40 competencies. You can also decide your 'starting' level of competence to speed up the process. By entering the same login details each time you use the tool you can revisit your previous assessment outcomes or choose to self-assess against entirely different competencies.

The tool will take you through a series of questions that have simple 'yes/no' responses. The questions have been constructed to focus on what a competency 'looks like' in practice, allowing users to quickly get to grips with the requirements of each competency at each level of competence. Although the tool only requires a 'yes/no' response, in order to answer the questions with confidence you will often need to think about specific examples of when you actually carried out this activity. So if you are thinking of using the tool to assist you in the upgrade or application processes for membership or chartership, it would be a good idea to make a note of these projects so that you can draw upon them later in your written evidence or at interview. And, of course, having specific examples of your competence will always be useful when discussing your professional development, planning your career progression or identifying ways to broaden your experience.

Do remember though that the tool's output is just a guide. Answering 'yes' to a sufficient number of questions does not in itself demonstrate your competence, but the tool can give you an indication or confirmation that you are likely to be working at a particular level in specific areas and that you should be able to evidence this if required (for example to apply for Chartered Ecologist status).

Further information

You can find the self-assessment tool on the CIEEM website. The latest version of the Competency Framework is in the website's Resources Hub (www.cieem.net/resources-hub/), or find it by using the global search at the top of any page on the CIEEM website.

Closure of the Graduate Membership Grade: What Happens Next?

Stuart Parks
Head of Membership and Marketing, CIEEM

As reported in *In Practice* 101 (Sept 2018), as part of an overall review of CIEEM's membership structure, the Governing Board approved a proposal to close applications to the Graduate membership grade at the end of 2018. Since then, our newly introduced Qualifying grade, created to support those at the earliest stages of their career in the sector, has been very positively received with well over 200 successful applications in the first year. Over the same period, we have also seen the number of applications from members upgrading their subscription from Graduate to Associate level, and beyond, almost double.

When these changes were introduced, it was also agreed that existing Graduate members could retain that status and its associated post-nominal for a period of up to 24 months, within which time, in the opinion of the Membership Admissions Committee and the Governing Board, it should be possible for members to increase their competence sufficiently to be able to upgrade their membership. We are now halfway through that 24-month period, so if you are a current Graduate member, or if you employ a Graduate member in your team and need them to retain their membership, please read on.

All existing Graduate members admitted before 2019 should by now have received a communication from the Membership team outlining the options available to them and confirming the need to act by the end of December 2020. If you have not yet received any communication, you need to get in touch with the Membership team as soon as possible.

As explained in that communication, current Graduate members have a choice between two routes to maintain their membership:

1. Apply to upgrade membership to at least Associate level
2. Apply to transfer membership to the Qualifying grade

What you need to do:

a. If you feel able to evidence at least Capable level competence, now is a good time to submit an upgrade application as our volunteer assessors usually have the most capacity at this time of year. As an incentive to act, if we receive your application before 31 January 2020 there will be no administration fee to pay.

b. If you think you are not quite able to evidence a higher level of competence, try to plan your work to gain the experience you feel is missing in the next few months: the sooner we receive your upgrade application the better.

c. If the nature of your work is such that you do not feel you will be able to demonstrate a higher level of competence within the next 12 months, you will need to apply to switch to Qualifying membership. Please be aware that this grade is very specifically designed for those working at Basic level competence or below and if your work history and experience suggests that you have surpassed this your application to this grade is likely to be refused.

How we can help:

In order to assist members needing to upgrade their membership we have produced several resources that can be found on the 'Applying for membership' webpage (cieem.net/applying-for-membership), including:

- A short video about the Competency Framework, how to use it and the best ways to evidence your competence.
- Copies of some recent *In Practice* articles providing 'Top tips' from application assessors and answers to some frequently asked questions.
- A guidance document for applicants and a short video about the application process.

Please also remember that the Competency Framework was revised in September 2019, so you need to be sure that you are making use of the most recent version – again available on the website (cieem.net/competency-framework). Also on the website is the recently launched competency self-assessment tool (see page 55) that allows you to gain a good idea of your overall level of competence and identify your strongest areas to select for your application.

Most importantly, do not rush your application. Although we need to receive it sooner rather than later, take the time to pick your strongest areas of competence, evidence them with well-chosen examples, and do yourself justice.

As always, the Membership team is available to answer any questions you have about the process on 01962 868626 and at membership@cieem.net.

Registered Practices Update

Sally Hayns CEcol MCIEEM
Chief Executive Officer, CIEEM

We now have over 70 Registered Practices and we are delighted that so many companies are signing up to the scheme. We do appreciate that it has not been popular with everyone and there have been misunderstandings about the scheme including, for example, why we had to change our approach from a Professional Directory (a Directory that indirectly promoted non-members as well as members) to an exclusively Members Directory. We have listened to feedback and made changes (or are making changes) where we can in order to make it more useful to you.

The Registered Practices scheme is exclusively about companies and organisations wishing to show leadership in promoting high professional standards and be proactively advertised to an external client base. It is not suitable for all members and their businesses, especially those who do not need/want to be promoted to an external audience or those that prefer to be sub-contracted (for whom the Sub-Contractors Directory is freely available).

For those that can see the advantages, it is important that you give us feedback on our promotional activity on your behalf. For example, from January we will be linking the Registered Practices Directory to the 'Find a Professional' area on the Planning Portal for England and Wales and we hope clients will come to you directly from there, but we do need to know from you whether that is being effective (because it's not cheap!). Similarly, our articles and advertising in magazines and industry press for architects, planners and housebuilders across the UK and Ireland should direct people to the Registered Practices Directory and hence to you. But we do need to know if it is working.

The next few months will be crucial as the survey season starts to come around again so the sooner we have your feedback the easier it will be to respond. Also, if you have your own ideas on where and how we should be promoting you, please do get in touch via registeredpractices@cieem.net. If you are planning to join the Registered Practices Scheme please note that there will be a short delay whilst your application is checked and processed before you can be advertised.

Promoting the Directory

For many Registered Practices, the principal benefit of joining the scheme is to be promoted to potential new clients via the Registered Practices Directory. We are very committed to investing in marketing the Directory.

To date we have:

- Contacted local planning authorities in mainland UK to make them aware of the Directory and its purpose.
- Promoted the Directory to all ALGE members.
- Notified the statutory nature conservation bodies.
- Promoted the Directory at the British Association of Landscape Industries (BALI) conference.
- Written an article for the Housebuilders Federation magazine referencing the Directory.
- Written an article, alongside an advert, for The Planner, the official publication of The Royal Town Planning Institute (RTPI), again referencing the Directory.
- Promoted the Directory via the Planning Advisory Service.
- Referenced the Directory in an RTPI 'thought piece' blog.
- Referenced the Directory in pieces for RTPI Northern Ireland and Wales.
- Met with the Royal Incorporation of Architects in Scotland (RIAS) to discuss potential future collaboration with them and their members.
- Promoted the Directory at The Bat Conservation Trust's National Bat Conference.
- Promoted the Directory during a speaking slot and exhibition stand at the Westminster Social Policy Forum seminar: Next steps for house building in England – planning, investment and innovation.

Over the coming months we will:

- Contacting local planning authorities, ALGE members and statutory nature conservation bodies again (and periodically) across the UK and Ireland.
- Placing a link to the Directory onto the Planning Portal (England and Wales) for a trial six-month period.
- Placing targeted pay per click Google ads pushing the Directory based on specific key words.
- Writing further articles for RTPI magazines.
- Promoting the Directory during a speaking slot at REGEN, an exhibition, conference and networking event for the UK regeneration industry, attended by thousands.
- Sending a solus newsletter to REGEN's 15,000 email subscribers.

Training, Education and Careers Development Update

Sally Hayns CEcol MCIEEM
Chief Executive Officer, CIEEM

The Training, Education and Careers Development Committee (TECDC) comprises 15 members drawn from across the relevant employment sectors including academia, consultancy, NGO, industry and statutory nature conservation body. The Committee's role is to oversee CIEEM's provision of training and continuing professional development support for members as well as developing materials and activities to promote careers and reach out to potential new ecologists and environmental managers.

TECDC's work is far-ranging. The Committee members undertake the annual CPD audit of members records, ensuring that obligations are being met but also providing constructive feedback to individuals as appropriate. They have oversight of the breadth of the professional development programme, helping to identify gaps and review proposals for new training courses, as well as making recommendations on delegate fees and trainer remuneration.

Conferences and webinars are another area of responsibility. TECDC reviews the feedback from every CIEEM conference and makes recommendations to the Governing Board regarding future topics. Similarly, the performance of the webinar programme is reviewed and opportunities for new webinars are discussed.

Last year the Committee approved a new Careers Strategy and now has the responsibility of supporting its delivery. This includes recruiting Careers Champions and providing a new toolkit of careers to help you, our members, promote ecological and environmental management careers in schools. Other careers work includes working with the British Ecological Society on the Summer Schools and Students conferences, providing resources and literature for careers advisers and supporting the development of new bursaries.

Other areas of current or recent work that TECDC is leading on/supporting include:

- The development of a new mentoring platform for members.
- The design of a new CPD recording tool.
- New Level 6 and Level 7 apprenticeships.
- Work placement search board.
- Degree accreditation scheme and alignment with the Competency Framework.
- Competency Framework self-assessment tool.
- Accredited Ecological Clerk of Works scheme development.
- Early career training packages.

So, as you can see it is a busy Standing Committee covering a wide range of activities that support your professional development and growth as an ecologist or environmental manager.

Action 2030: CIEEM Response to the Climate Emergency and Biodiversity Crisis

John Box CEcol CEnv FCIEEM and Amber Connett GradCIEEM

Introduction

We have until 2030 to avoid the worst of global heating. That requires action now.

Global temperatures are currently 1°C hotter than pre-industrial levels. The Paris Agreement strengthened the global response to this threat by aiming to keep the global temperature rise to well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5°C. Research has shown that we have only 11 years for global heating to be kept to a maximum of 1.5°C. Even a further 0.5°C of heating will significantly worsen the risks of drought, floods, extreme heat and poverty for hundreds of millions of people. The recent UN Intergovernmental Panel on Climate Change report (2018) says urgent and unprecedented changes are needed to limit the increase to only 1.5°C but these changes are affordable and feasible. Limiting the increase in global temperatures to 1.5°C could prevent corals from being completely eradicated and ease pressure on the Arctic. This requires halving global emissions of greenhouse gases by 2030 and ending emissions by 2050.

Change is Happening Now

In response to the statutory Committee on Climate Change report released in May, the Climate Change Act 2008 was amended in June to commit the UK government by law to achieve 'net zero' greenhouse gas emissions by 2050. This would require tens of billions of pounds of investment every year which is about 1-2% of our GDP. Not acting would be far more costly. The report from the Committee on Climate Change states that a net zero target is not credible unless policy is ramped up significantly.

The UK Government has the legislative means and the money to tackle this huge challenge over the next 11 years. But does it have the will for such a huge transformation of how we all live? The House of Commons declared an environment and climate emergency in May, but this does not legally compel the Government to act. Local Authorities have also been declaring climate emergencies. We know political will can be transformative and such actions encourage and motivate us all.

The improving economics and increasing capacity of solar, wind and tidal power demonstrate the way forward. CO_2 removal through forest planting and habitat restoration will be needed. There are new jobs in these new industries with technological research driving down unit costs. The future of the planet lies with these young industries.

The Biodiversity Crisis

Globally there is an unprecedented decline in natural life. The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) reports that there are over one million species at risk of extinction without 'transformative changes'. The rate of species extinctions is accelerating, with grave impacts on people around the world now likely. The five direct drivers of change in nature with the largest relative global impacts in descending order are: changes in land and sea use; direct exploitation of organisms; climate change; pollution; and invasive species. We are eroding the very foundations of our economies, livelihoods, food security, health and quality of life.

The UK Government stated formally earlier this year that the forthcoming Environment Bill for England will mandate 'Biodiversity Net Gain' meaning that the delivery of much-needed infrastructure and housing is not at the expense of vital biodiversity. While this principle has not yet been included in policy in Scotland, Scottish businesses are already implementing this on a voluntary basis. In Ireland, there is both Government and practitioner interest in taking the approach forward. Wales are also taking forward this principle through the requirement under Section 6 of the Environment (Wales) Act 2016, that public authorities must seek to maintain and enhance biodiversity. Biodiversity Net Gain cannot be used where irreplaceable habitats are involved, such as ancient woods and veteran trees, limestone pavements, fens and bogs.

Figure 1. Climate change is forcing puffins to travel further out to sea to find prey species like sand eel.

The climate emergency and biodiversity crisis are inextricably linked and cannot be addressed in isolation. We need sound advice about adaptation for the increasing effects of the rapidly changing climate for both people and nature. Nature-based solutions must play a key role in mitigating against and adapting to climate change. Resilient ecological networks across landscapes are needed with habitats joined up by green and blue corridors to allow species to colonise new areas. We all need contact with natural environments every day for physical and mental health and well-being. John Lawton's *Making Space for Nature* has the mantra of 'More, Bigger, Better, Joined Up'. England is the focus, but the principles apply to different contexts and geographies.

What Can We Do?

Ecologists and environmental managers are at the forefront of the fight against biodiversity loss and climate change adaptation. We must lead the way in restoring degraded habitats and landscapes, ensuring developments and other land, freshwater and marine use practices deliver biodiversity net gain and sharing best practice and evidence, both within the profession and with decision-makers.

CIEEM is committed to leading the way for our profession in taking urgent action to address the climate emergency and biodiversity crisis, already having declared a climate emergency and biodiversity crisis and published a briefing on the latest facts and figures surrounding these issues (both documents can be found at the Resources Hub: www.cieem.net/resources-hub). We are working to set more challenging targets for our organisational impact on climate and biodiversity as we work towards our own net zero emissions and net gains for biodiversity targets; and supporting our members to do the same.

CIEEM already offsets all staff travel. More recently we have also started to offset all delegate travel to CIEEM conferences.

To achieve our mission, we are committed to:

- Achieving net zero emissions by 2030 for CIEEM operational activities.
- Setting up a focus group to devise ways in which we, as a profession, can avoid or reduce our operational impacts on the climate and biodiversity when we undertake our roles, and subsequently to provide and promote guidance, training and other support for practitioners. The new group, called Action 2030, will have its first meeting in December 2019.
- Reviewing the operational impacts of CIEEM's offices, activities and procurement, and continuing to monitor and report on its implementation. We have already renewed our Environmental Policy for 2019 (view at: www.cieem.net/what-we-do) and will review it biennially.
- Continuing to review the latest research on the climate emergency and biodiversity crisis and updating our summary briefing paper biennially to inform members.
- Continuing the work led by our Policy Team, Strategic Policy Panel and Country Policy Groups to influence policy and secure timely commitments to ambitious, robust targets and action on both the climate emergency and biodiversity crisis.
- Continuing to work in collaboration with other like-minded organisations to share best practice, speak with a common message and to increase the effectiveness and urgency of our climate emergency and biodiversity crisis action agenda.
- Providing regular updates on action we are taking to meet our own targets and influence policy surrounding the climate emergency and biodiversity crisis through updates in *In Practice* and e-newsletters.

About the Authors

John is an experienced ecologist and environmental manager who has worked in both the public and private sectors. He is a CIEEM Fellow and was President from 2012-2015. He is a member of the UK Urban Ecology Forum which is linked to the UN Human Settlements Programme (UN Habitat) promoting socially and environmentally sustainable towns and cities.

Amber is CIEEM's Policy and Communications Officer. She is working with the Action 2030 group to deliver CIEEM's actions on the climate emergency and biodiversity crisis.

Contact Amber at:
AmberConnett@cieem.net

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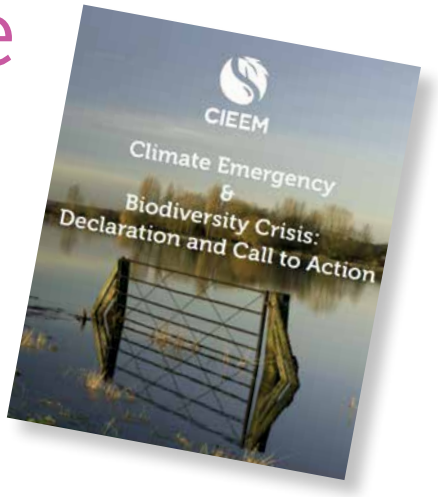
Policy Activities Update

Amber Connett GradCIEEM
Policy and Communications Officer, CIEEM

The last few months have been uncertain in terms of environmental policy in the UK. Since September, Parliament has been prorogued twice, the Prime Minister reached a new deal with the EU and the long-awaited Environment Bill has been published (see Box 1).

UK and England

As part of our action on the climate emergency and biodiversity crisis laid out in our declaration (available at: www.cieem.net/climate-emergency-and-biodiversity-crisis-declaration), we have launched a climate change and biodiversity crisis working group of CIEEM members called



Box 1. What you need to know about the new Environment Bill

Following on from the launch of the Environment Bill by Environment Secretary Theresa Villiers in October, we have had a chance to further digest the Bill itself. Alongside the Bill, Government has also published a policy statement.

We were very pleased to hear the Secretary of State say at the launch that the climate emergency and biodiversity crisis are inextricably linked and that we need to pursue nature-based solutions. She also acknowledged that efforts must be across all of Government, not just Defra, and that the need for a step change is unarguable.

Setting Targets

We are pleased to see the Bill taking a long-term (more than 15 years) view with requirements on Ministers to set targets with review periods. CIEEM believes we can be more ambitious however, including more targets and for the short-term as well.

Principles

Five principles (environmental protection integrated into policy-making, preventative action, precautionary, environmental damage rectified at source, and polluter pays) are included on the face of the Bill. However, it conspicuously excludes the non-regression principle and has some notable exemptions including defence and taxation.

Environmental Watchdog

The new Office for Environmental Protection will have climate change included in its remit, as CIEEM has championed. However, the watchdog needs to be much further removed from Government to make it truly independent.

Duties on Public Bodies

The Bill strengthens the duty on public bodies to not just protect but also enhance biodiversity, and that local authorities must have regard to relevant local nature recovery strategies.

Secretary Villiers in her speech said that Government will provide data, guidance, and support for authorities in producing these strategies but did not elaborate on what this would look like.

The Bill empowers local authorities, which will require funding and expertise. Appropriately competent biodiversity professionals must be at the heart of delivering the ambition and duties set out in the Bill.

In questions after her speech, Secretary Villiers acknowledged that resources and funding will be needed, saying that the Bill will create new income streams for the environment but did not suggest any new Government funding.

Biodiversity Net Gain

The Bill makes the BNG approach mandatory to ensure that new developments enhance biodiversity and help deliver thriving natural spaces for communities. The Bill sets the requirement for gains at 10% but which may be amended by the Secretary of State. The Bill states that the biodiversity gain achieved will be the projected value of the onsite habitat at the time that the development is completed.

The Bill obliges the Secretary of State to produce and publish a biodiversity metric and a biodiversity gains site register. Irreplaceable habitats are excluded from the provisions, but are yet to be defined.

The Bill allows three routes to securing biodiversity gains: enhancement of the biodiversity of land to which the planning permission relates; the allocation of registered offsite biodiversity gain; and the purchase of biodiversity credits. The Secretary of State may use payments from biodiversity credits only for carrying out works to enhance biodiversity, buying land to carry out works to enhance biodiversity, or related administration.

Biodiversity gains will need to be maintained for at least 30 years after the development is completed.

Exemptions are not explicitly mentioned on the face of the Bill, but are listed in the published impact assessment, which states that the Government will not introduce broad exemptions beyond those already proposed for permitted development and householder applications such as extensions. Instead, Government will introduce narrow and targeted exemptions for the most constrained types of development, and consider process easements for minor developments. It continues, saying that BNG will not include nationally significant infrastructure nor marine development within the scope of the mandatory requirement.

Jason Reeves MCIEEM
Head of Policy and Communications, CIEEM

Note: Although the Environment Bill has fallen, we expect it to be reintroduced to the new Parliament in due course.

Action 2030 (www.cieem.net/action-2030). The group will be chaired by John Box CEcol CEnv FCIEEM. More details on this work can be found on page 58.

Our Strategic Policy Panel (SPP) met on 3 October and agreed a number of items, including: a process for measuring the impact of our policy engagement (which will initially be monitored as part of a rolling programme of surveillance rather than being target driven), policy focus topics for the upcoming year and our actions regarding the forthcoming general election. The agreed focus topics are strategic land management (which includes net gain), the marine environment, and the climate emergency and biodiversity crisis.

We recently wrote to Environment Minister Rebecca Pow MP requesting a meeting to discuss how CIEEM can contribute to the delivery of the 25 Year Environment Plan, Natural England's strategies and ambitions, and the new Environment Bill. At the time of writing, Ms Pow has requested a meeting in November.

Jason Reeves (CIEEM Head of Policy and Communications) attended the launch of the Environment Bill on 15 October and is leading on our response to the Bill. The Bill launch included a speech by Secretary of State for the Environment Theresa Villiers MP (see https://cieem.net/what-you-need-to-know-about-the-new-environment-bill/).

Sally Hayns (CIEEM CEO) attended a workshop run by Defra on Biodiversity Net Gain and planning in October. Areas for discussion included policy and delivering net gain in the planning system and planning authority access to training, ecological expertise and systems.

Scotland

Our Scotland Policy Group met on 24 September and agreed to develop a series of key messages to underpin our policy work in Scotland. This was also their last meeting with Kathy Dale (CIEEM Vice President Scotland until November 2019) as Chair. We would like to thank Kathy for all of her hard work leading the group, which has made fantastic ground on policy engagement over the last few years.

Annie Robinson (CIEEM Scotland Project Officer) recently met with the Scottish Policy Officer at the British Ecological Society to share information and updates on policy developments. She also met with Scottish Environment LINK to further explore CIEEM-LINK collaboration, information exchange and policy developments.

Annie, Kathy, Sally and Jason met with Sally Thomas (Director of People and Nature) and Des Thompson (Principal Adviser on Science and Biodiversity) at Scottish Natural Heritage in October. This is part of regular liaison meetings that we have now established to share information and engage in SNH strategy developments.

Wales

The Wales Policy Group met in October in a joint meeting with the SPP. During the meeting the group discussed taking forward work on flood mitigation using nature-based solutions and fed into the SPP's discussions on focus topics and Brexit issues.

Diana Clark (CIEEM Wales Project Officer) has drafted our response to the Revised Proposals for Supporting Welsh farmers after Brexit consultation by Welsh Government. The response is available in CIEEM's online Resources Hub..

Former CIEEM Wales Vice President Mike Willis is the new Chair of the Wales Policy Group.

Ireland

Elizabeth O'Reilly (CIEEM Ireland Project Officer) has recently written to the Department for Agriculture, Food and Marine, requesting that we be invited to take part in the Common Agricultural Policy Post 2020 Consultative Committee Meetings chaired by Minister Michael Creed. At the time of writing we are awaiting response.

The Ireland Policy Group met on 6 November to continue their horizon-scanning activities and discuss Brexit developments. They are continuing to take forward work on a pollinators advice note, and are exploring Biodiversity Net Gain in Ireland.

We are pleased to announce Nick Marchant MCIEEM as the new Chair of the Ireland Policy Group.

Consultations

We have recently responded to the following consultations:

- Management measures for widely spread Invasive Alien Species (IAS) in England and Wales
- Plant Health & Bio-security Strategy 2020-2025 (Irish Government)
- Forestry and Wood Processing Sector Plan (SEPA)
- Revised proposals for supporting Welsh farmers after Brexit (Welsh Government)
- Draft National Development Framework (Welsh Government)
- EFRA Committee inquiry on the Environment Bill

Future Priorities

Our priorities for the next few months will include getting a full programme of events underway for the All-Party Parliamentary Group for Nature (APPG for Nature), facilitating the work of our new Action 2030 group on the climate emergency and biodiversity crisis, and exploring options to contribute to wider discussions on new post-2020 biodiversity frameworks and strategies.

Contact Amber at:
AmberConnett@cieem.net

CIEEM is grateful to the following organisations for investing in our policy engagement activities:

ARCADIS Design & Consultancy for natural and built assets
biocensus Experts in Ecology
BSG ecology
EPR
pba peterbrett

Figure 1. Crayfish training. Photo credit Paul Bradley Associates.

Raising Standards Through Training: Results of the Training Survey

Siân Kear
Professional Development Officer, CIEEM

Earlier in 2019 we asked CIEEM members to participate in our Training Survey in order to allow us to take a more strategic approach to the development of our Professional Development Programme (PDP). The aim is to create a 'core' programme of training which ensures adequate topic and geographic coverage throughout the UK and Ireland, in order to best serve our members.

The survey closed for responses on 7 May 2019 and we received 508 responses in total, with good representation from all geographic sections. A big thank you to all those that participated, your contributions are much appreciated!

Since May we have been reviewing the results in detail at both a national and regional level.

The first tranche of tenders opened on 1 November and will close on 6 December 2019. The second tranche will open on 15 November and close on 16 December 2019.

The tender brief and tender proforma documents can be downloaded from our website (cieem.net/invitation-to-tender/).

If you have any questions regarding the tenders, please contact Siân Kear, Professional Development Officer (siankear@cieem.net).

We have also reviewed the results of the survey by Member Network in order to identify gaps in provision. For example, areas that have a population of Eurasian beavers but currently do not have any training offered on the topic.

In order to address these gaps, we will be undertaking a 'Call for Trainers' early in 2020. We will specify the training courses that we want to deliver, along with general learning outcomes and the locations that we would like them to be delivered.

We hope that this will enable us to either find expert trainers locally or those who are willing to travel. We will publish this information on our website and invite anyone who is interested to get in touch.

We were already aware of a couple of training courses that we feel are essential for us to offer to our members, but which we do not currently have trainers for. However, the survey also identified other topics that are a priority for you. With the assistance of our Training, Education and Careers Development Committee (TECDC) we have prioritised the courses and will be commissioning contracts for the development and delivery of these new or revised courses.

We hope to find trainers who are able to travel and deliver the courses throughout the UK and Ireland. However, if this is not the case, we will put together a team of trainers to provide good geographic coverage to deliver the same course (subject to any country-specific content). This will not only ensure greater consistency in the content delivered but is also a good resilience measure in helping us to ensure that we can deliver essential courses into the future.

The first courses that are being advertised for tender for the development and delivery are as follows:

- Habitat Survey and Mapping – tender deadline 6th December 2019
- Positive Planning for Biodiversity – tender deadline 6th December 2019
- Preliminary Ecological Appraisal – tender deadline 6th December 2019
- Identification and Management of Non-native Invasive Plant Species – tender deadline 16th December 2019
- Introduction to Habitat Condition Assessment – tender deadline 16th December 2019
- Nature Conservation Legislation in the UK – tender deadline 16th December 2019
- Professional Ethics, Responsibilities and Decision-Making for Ecologists and Environmental Managers – tender deadline 16th December 2019

Contact Siân at:
siankear@cieem.net

Student Hub:

Stress, Structure, Sanity and the Importance of a Little Self-Care

A recent NUS survey found that 87% of students experienced stress, 77% anxiety and 48% feelings of panic. We know – bleak, but researchers have also looked into what makes a successful, happy student and the thing that came out on top: **future orientation** (i.e. an idea of where you want to end up and some notion of how you intend to get there). And that's where we can help.

But first, we called on the best resource around, our Student members, to find out their top tips on how to keep it together in the face of deadlines, debt and depression. And these aren't just any students; these are the ones that you look at and think, how has your head not exploded with everything you're juggling? These are the ones with three jobs, their own business and a whole suite of extra curriculars that they're somehow excelling at on top of everything else. You know the ones. These guys have got it down and they're here to help.

If you need help with the 'future orientation' part of things, why not attend a local Geographic Section event to meet other members or sign up to our new mentoring platform that will match you with a mentor who can provide guidance, support and a wealth of experience? No one got where they are all on their own; they all had a bit of a boost from someone in their network, which is exactly what we want to do for you. If you need help, then ask for it, from a CIEEM member who's been in your shoes and come out the other side. In the meantime, download a mindfulness app, make a date to catch up with friends, get some fresh air, exercise, and remember: you have got this.

Andrew Barrett

Andrew is currently in Sweden (one of the most expensive countries in Europe), studying for his Masters, works two part time jobs and is also in the process of starting his own business. Phew!

1. Work the mind *and* the body.

My way of earning money, running around a bar and cycling for deliveries, gives me set times (my shifts) away from my laptop, where I can burn off all the calories I gained eating biscuits while writing. It helps the finance side of things *and* my sanity.

2. Plan your diary meticulously.

I put everything in my diary, even the hour block I gave myself to write these tips! Of course, the plan needs to be flexible and things do move, or take longer/shorter than anticipated, but it means I know when I have an event to look forward to, how many hours work I put in and how much play time I have as a result. It helps me feel balanced.

3. Surround yourself with understanding friends.

I am surrounded by people and we all have work to do, deadlines and financial strains. On my course there are people who understand my work, within the university I have friends to be social with and in my church, I have quieter friends to have dinner with. Then, at the end of the day, I can go back to my room and have time for me. I try to look at myself through my friends' eyes to get some objectivity, which helps me see things more positively, especially when I'm being hard on myself.

Peter Walker

Peter is in his third year at the University of Southampton and is Student Representative for CIEEM's South East Committee, where he helps organise events to increase student involvement and awareness.

1. Keep track of deadlines.

One of the biggest causes of preventable stress is not keeping an eye on deadlines for assignments. By actively keeping track of these, you can better organise your time and prioritise certain tasks over others, preventing the stress from creeping up on you.

2. Give yourself regular breaks.

Give yourself time away from the books, especially in periods of high stress. Even if you have multiple deadlines and assignments due in, try to take even just five minutes off to go for a quick walk or make yourself a drink. By giving yourself breaks, you allow yourself to de-stress and focus more on the task at hand. Once you return, you may even find you work more effectively for having taken a break.

3. Try Mindfulness.

Unfortunately, periods of stress are inevitable. The key is to create coping strategies to deal with it. Mindfulness has been shown to improve both mental health and academic achievement and, if you need some guidance, check out the apps 'Headspace' or 'Calm', that provide directed meditation exercises.

If you *do* need some extra help, please don't suffer in silence. There are loads of organisations you can contact who can offer help and support. A good place to start is with www.mind.org.uk.

British Ecological Society

Inspiring the Next Generation

Students from less traditional backgrounds get an unrivalled opportunity to experience ecology in the field on the British Ecological Society summer school. Just don't expect a relaxing time.

Early morning birdwatching, days spent out in the field and the lab followed by evenings discussing all they've found with experts and mentors – it's no wonder the 16-18 year-old students come back exhausted from the British Ecological Society (BES) summer school.

The week-long residential course takes students from low income and ethnic minority backgrounds and provides them with an incredible opportunity to find out what ecology is, and its relevance to many of the challenges facing the world.

Never Heard the Word 'Ecology'

This July, around 30 students from schools around the country descended on a field studies centre in Malham tarn in the Yorkshire Dales.

"We want to take students from less traditional backgrounds and expose them to the relevance of ecology in our world and the breadth of opportunities open to them," explains Karen Devine, who led the summer school and is Head of External Affairs at the BES. *"The majority come never having heard the word 'ecology', never mind considered taking a course in ecology at university."*

Mornings and afternoons often start with a session that's purely on the science, then there's an example of how that science is used. For example, a researcher led the group through an area of freshwater ecology. Then Environment Agency staff and other CIEEM members did a hands-on task about mapping flooding locations locally and students made decisions on where to build houses and where to allocate flood defences.

Learning from Experts, Support from Mentors

The students get to work with experts who really know their stuff, talk to mentors (university students helping out on the course) and hear about a whole range of careers available in ecology. It gives a really rounded picture of ecology all the while being immersed in the nature around.

One student said, *"It's amazing to meet so many committed scientists who have exposed me to experiences I would never have had the opportunity to do."* Phoebe Whitehead is a regular: *"I just love it."* She's been on summer schools as an A-level student and an undergraduate, before coming to Malham this year as a mentor. She explains that the role of a mentor is *"to be there for students and help when needed."*

"Being a mentor is about being a friendly face," agrees Rohit Bangay, another student mentor. *"For me, the summer school exposes people to lots of different aspects of ecology,"* he explains, often in ways that students aren't exposed to in school.

Getting Involved

The BES summer schools have an important role in opening many students' eyes to ecology and the natural world. It's also a real opportunity to gain new experiences and mix with others from around the country and from different cultures. Many become committed to pursuing careers in our science. Ten years into the future this will help create a more diverse community of ecologists all set on tackling global challenges in biodiversity, urban infrastructure, food security and many more.

BES summer school.

We are always keen to hear from people wanting to support and be involved in our summer schools, particularly those from similar backgrounds as the students. It's important that the students meet ecologists and role models that they can identify with.

Contact Karen Devine at:
karen@britishecologicalsociety.org

Call for papers: Special Feature on citizen science

The BES journals have launched an open call for manuscripts for a Special Feature on citizen science. Ecological projects involving citizen scientists have rapidly increased in number and the consensus is that they can produce high-quality data. The aim of the Special Feature is to assess the contribution of citizen science to the advancement of ecological knowledge. Find out more on the journals site: https://besjournals.onlinelibrary.wiley.com/

The deadline for submission is Monday 27 January 2020.

Member Network News

With regional Section Committees across England and national Sections in Wales, Ireland and Scotland, as well as Special Interest Groups (SIGs) focussing on specific topics, we have something for everyone.

Each network is run by a committee of volunteers, providing opportunities to share knowledge, meet like-minded people and learn more about the science and practice of our profession.

There are currently about 170 Member Network volunteers doing amazing work all over the UK, Ireland and beyond. If you'd like to find out about what they get up to and how you can get involved, please visit www.cieem.net/member-networks.

SOUTH EAST ENGLAND

Oak Processionary Moth Workshop
05 June 2019, Ashtead Common

Sixteen people including woodland managers, ecological consultants and arborists attended this Oak Processionary Moth (OPM) Workshop, held at the City of London estate office on Ashtead Common. Millie Toft, the Forestry Commission's OPM Support Officer, gave an update on the biology, identification and history of this pest in the UK, as well as current management guidelines and likely future directions. This was followed by case studies from Zuza Featherstone, ranger for Ashtead Common, and Hamish White, Countryside Officer for Elmbridge Borough Council, highlighting the increasingly challenging and costly management of OPM on their sites, and their strategies for dealing with this.

Read more at https://cieem.net/south-east-members-learn-about-the-oak-processionary-moth/

YORKSHIRE AND HUMBER

Botany Day for Beginners and Improvers
30 June 2019, Kirkstall

In June, a group of keen botanists from the Yorkshire and Humber Section gathered at Kirkstall Valley Nature Reserve in Leeds to practice and share botanical identification skills.

Armed with plant identification books and hand lenses, we worked through a range of grasses, sedges, wildflowers and trees, recording 129 species in total. Some of these species are new records for the site, including species recently sown in the wildflower meadow – so it was exciting to see these becoming established!

Read more at https://cieem.net/yorkshire-and-humber-members-gather-for-day-of-botanical-identification/

MARINE AND COASTAL SIG AND SCOTTISH SECTION

The Life History of Cetaceans in Montrose Bay
19 September 2019, Angus

The CIEEM Scottish Section and Marine and Coastal SIG were honoured to work with the Tayside Biodiversity Partnership's Coastal & Marine Group organisers to provide this event as part of the wonderful 2019 Angus Coastal Festival. They were also very fortunate to be joined by Cllr Bill Duff – Angus Species Champion for the bottlenose dolphin.

Attendees had a glorious walk around coastal paths of Ferryden, a good vantage point from which 3 species of cetacean can regularly be seen, as well as being a good spot to watch seals coming in and out of their estuary haul-outs. Although they weren't lucky enough to get any cetaceans during their watches, they nevertheless had a good time talking about the life history of these animals, and getting some good hot-off-the-press updates on the monitoring which has been carried out over the summer by researchers at the Sea Mammal Research Unit (SMRU).

Read more at https://cieem.net/the-life-history-of-cetaceans-in-montrose-bay/

ECOLOGICAL RESTORATION AND HABITAT CREATION SIG

Floodplain Restoration at Elbury Farm
24 September 2019, Devon

Floodplain restoration was the subject of an excellent joint CIEEM and National Trust field workshop at Elbury Farm, Killerton Estate. After an overview of the farm from Phil Stuckey (National Trust Lead Ranger), there followed presentations on: managing a floodplain grazing marsh (Pete Otley, RSPB Site Manager); plant communities of mineral soil floodplain meadows and some restoration techniques (Simon Barker, National Trust Wildlife Adviser & Floodplain Meadows Partnership Ambassador); and water permissions and consents (Jess Bishop, Devon County Council Senior Flood and Coastal Risk Officer).

Delegates were challenged to come up with a brief management plan for the 25 ha restoration from predominantly species-poor floodplain grassland, to something far more biodiverse. It looks likely that the local NT team will go with a 'Knepp-style' approach, allowing hedges to billow out, scrub and ultimately woodland to develop, with perhaps pockets of fen-like vegetation.

Brown hairstreak butterfly might be one clear winner!

Read more at https://cieem.net/floodplain-restoration-at-elbury-farm/

SOUTH WEST ENGLAND

Hinkley Point C (HPC) Nuclear Power Station New Build – Ecological Mitigation
11 October 2019, Somerset

A group from the South West Member Network were taken over the secure threshold of Hinkley Point C, one of the UK's largest infrastructure projects, and gained rare insights into the site's ecological considerations and mitigation strategies. Attendees enjoyed observing implemented ecological mitigation features first-hand, including a retained and enhanced habitat corridor which still records barbastelles and horseshoe bats, connectivity through landscape planting and a bat gantry and retained woodland and grassland habitats beyond the site perimeter. Off-site mitigation associated with other HPC developments was explored, including a successful bat underpass and a new GCN pond. The attendees had a very enjoyable and interesting day which resulted in many questions and discussion about the success of the various initiatives. HPC provides a great case study for ecological mitigation at a large scale.

Read more at https://cieem.net/ecological-mitigation-at-hinkley-point-c-hpc-nuclear-power-station/

ELECTIONS 2019

Welcome to our new and re-elected committee members

The 2019 elections are now complete, with elections having taken place for the Governing Board, Advisory Forum and across our Member Networks. You can find the full results in in the Members' area at https://events.cieem.net/Portal/VolunteeringwithCIEEM/Elections.aspx.

All our committee members are volunteers and you can find out more about who they are and how you can get involved at https://events.cieem.net/Portal/Memberbenefits/Member_Networks.aspx.

Look out for upcoming events in your area and keep up to date with what's been going on at www.cieem.net/member-networks.

SOUTH WEST ENGLAND

Meeting Cornwall's Beavers
2 October 2019, Truro

During a week of stormy weather, a group of CIEEM members from the South West of England were lucky to have a dry day to visit the Cornwall Beaver Project. The project was set up to introduce beavers to an enclosure and monitor the impact that they would have on biodiversity and water management.

Following a brief indoor session watching some videos about the project, and an introduction to the project from Tom Shelley, Cornwall Wildlife Trust Conservation Manager, the group walked to the enclosure to see what impact they are having on the habitats. They chose vantage points, and waited for dusk to fall, with a hope of seeing a beaver or two! After a tense wait, they were treated to some views of the beavers carrying a felled branch across the pond, and then sitting on the far bank foraging. A brilliant end to the day!

Read more at https://cieem.net/meeting-cornwalls-beavers/

New Members

The decision on admission is usually taken by the Membership Admissions Committee or Registration Authority under delegated authority from the Governing Board but may be taken by the Governing Board itself.

CIEEM is pleased to welcome the following individuals as new and Chartered members:

ADMISSIONS

Chartered Ecologist (CEcol)
Cody Levine, Richard May

Full Members (MCIEEM)
David Bartlett, Dr Anthony Caravaggi, Rahul Chavan, Adrian Davies, Dr Brian Deegan, Jason Doe, Bridget England, Simon Fleming, Dr Danielle Fry, Katie Godfrey, Tom Grayling, Dr Alan Jemmett, Iain Mackenzie, Alexandra McDonald, Samuel Olney, Mike Phillips, Stephen Rudd, Richard Schofield, Daniel Seaward, Victoria Thomas, James Turner, Dr Laura Wood, Dr Lucy Wright

Upgrades to Full Membership (MCIEEM)
Christopher Arthur, Louise Bunn, Stephanie Clayton-Green, Bradley Fairclough, Luke Gibbons, Paula Graham, Jeffrey Grant, Matthew Hanson, Megan Lindeman, Craig Llewellyn, David Morris, Erik Paterson, Lynnette Pearce, Anna Simpson, Kitty Straghan, Jordan Wright

Associate Members (ACIEEM)
Tosha Allen, Joseph Allsopp, Rebekah Beaumont, Donna Black, James Charlton, Andrew Clark, Amy Copping, Lois Crisp, Danielle Eccleshall-Johnson, Simon Fawcett, Kate Haymes, Lauren Hornsby, Dr Rupert Houghton, Grace Kilbane, Jamie McCready, Elisa Neame, Catherine Pittman, Emma Renshaw Gema Rodriguez, Kesella Scott-Somme, Leanne Smith, James Williams, Mark Wilson, Mike Youdale

Upgrades to Associate Membership (ACIEEM)
Stuart Abernethy, Joanne Alderton, Lucy Bartlett, Jade Brennan, Joe Bullard, Anna Clark, Amelia Coleing, Katharine Garratt, Rosalind Gray, Carmen Green, Robin Jennings, Laura Kor, Dr Rebekah Mayhew, Francesca McDowell, Julie Merrett, Hannah Norman, Joanne O'Keeffe, Emily Park, Alex Perry, Matthew Rea, Jonathan Siberry, Jessica Stuart-Smith, Hugh Turner, Rebecca Turner, Lacey Urquhart, Douglas Williams, Thomas Wright

Graduate Members (Grad CIEEM)
Belinda Ayres, Jula Humphries, Rob Selwyn, Maddy Vierbuchen

Qualifying Members
Gemma Abela, Elena Aitova, Tristan Canterbury, Samuel Clement, George Cochrane-Davies, Lea Gracia Cohen Sanchez, Caitlin Coombs, Jack Curry, Sara Fissolo, Hannah Gillott, Gregory Gilmore, Laura Grice, Jake Healy, Scott Hendry, Victoria Iggo, Rachel Irwin, Amelia Keane, Amy Kennedy, Patrick Kitchener, Jade Lemm, Megan Lewis, Philippa Loam, Francis Marshall Ana Martinez Crucis, Lucy McKenzie, Maria Mcloughlin, Taylor Middlemiss, Rebecca Millar, David Miller Katie Mitchell, Amelia Ness, Callum Nixon, Kelly Norman, Susie Page, Coral Perfitt, Josh Pryke, Martin Rann, Mirza Rashid, Hayley Roberts, Georgia Roberts, Hannah Routly, Ashley Royston, Ben Satherley, George Simmonds, Emma Smith, Alice Sparkes, Claire Stephens, Fran Szymanska, Andrew Williamson, Kristina Wood

Upgrades to Qualifying Membership
Callum Bees, Grace Bishop, Victoria Chanin, Hannah Corrigan, Elizabeth Davis, Stephen Devereaux, Darren Ellis, Rebecca English, Samantha Faggetter, Helen Giddings, Hayley Glanville, Lucy Goddard, Scott Gudrich, Gareth James, Ceri Jones, Diana Luke, Rebecca Marsh, Kieran McGranaghan Rachel McNally, Alex Pelton, Alison Rogers, Tanya Rowlinson, William Silkstone, Eliott Spiller, Katherine Watson, Alexandra Zemanová

Student Members
Adeshina Ajeniyi, Axelle Amstutz, Paul Anderson, Joseph Aston, Sarah Atherton, Elsa Atkinson, Hannah Balacky, Ayoibukun Oluwa Bankole-Olusina, Amy Basford, Harriet Bennett, Nicholas Berry, Giulio Biondi, Fiona Bonellie, Therese Borseth, Adam Bows, Sinead Brady, Jake Brendish, Jennifer Kay Brisbane, John Bryers, Helen Burton, Lily-Ann Butterworth, Callum Cecil, Jess Christian, Thomas Clayton,Lauren Coffin, Helen Coleman, Declan Corral, Victoria Curley, Phillip Curtis, Josie Darkins, Deborah Davenport, Charlotte Day, Alice Deacon, Dorothy Dunne, Jessica Edwards, Jennifer Engwell, Sarah Evans, Sarah Farnborough, Milly Ferguson, Emma Foster, Frances Fowden, Jessica Francis, Harriet Gardiner, Kieran Gething, Jillian Gibson, Matthew Gilbert, Jacqueline Gill, Bianca Gittens, Jane Godfrey, Zoe Gothard, Isabelle Gough, Connor Grisdale, Elizabeth Hadland, Jonathan Heath, Bethany Hickling, Sophie Hocking, William Hodgetts, Victoria Hollins, Brittany Huggins, Leonora Hunt, Laurence Hyde Parker, Ashley Ide, Ellie Johnson, Alex Jones, Francesca Jordan, Ezra Joy, Caroline Kenney, Jamie King, Chris Kitching, Sarah Lonsdale, Sofia Lopera Marin, Jennifer Manley, Alan McCarthy, Max McCormick, Laura McHarry, Fiona Montgomery, Nisha Moreno-Hill, Daniel Mullen, Enrico Mullings, Sophie Nichol, Joan Nofrerias Mondejar, Ruth Peters-Grundy, Scott Probert, William Putnam, Ella Redmond, Hannah Richards, Sarah Richards, Rehana Roshan, Rebecca Sandey, Joanne Simpson, Vanessa Singh, Rhian Smith, Jessica Stone, Michael Taylor, Harriet Taylor, Steven Teale, Felicity Topping, Anna Treder, Rebecca Trigg, Elina Vainio, Nathan Van Cooten, Jasmin Vickers, Victoria Walters, Max Walters, Siobhan Ward, Chelsea Warner, Steve Wilkes, Jade Willers, Phoebe Williams

CIEEM

ASSESSING & MITIGATING AIR QUALITY IMPACTS ON BIODIVERSITY

4 MARCH - SHEFFIELD

Drawing on the latest research and approaches taken across the UK, Ireland and beyond, this conference will bring together ecologists and environmental managers, air quality professionals and planners to explore the basis for robust impact assessment strategies. It will go on to explore the effectiveness of transferable mitigation techniques to protect sensitive flora and fauna.

WWW.CIEEM.NET

Landscape Planning with Ecosystem Services: Theories and Methods for Application in Europe

Editors: von Haaren C., Lovett A., Albert C.

ISBN: 9789402416817

Price: £71.50-£89.99

Available from: www.springer.com

The services which natural resources provide for human wellbeing are increasingly threatened by unsustainable and competing land uses. This book argues that a solution to these issues in Europe can be found by merging the landscape planning tradition with ecosystem services concepts. Landscape planning has strengths in recognition of public benefits and implementation mechanisms, while the ecosystem services approach makes the connection between the status of natural assets and human well-being more explicit.

Grassland Plants of the British and Irish Lowlands

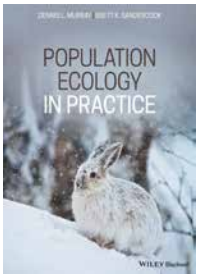
Authors: Stroh P.A., Walker K., Smith S., Jefferson R., Pinches C., Blackstock T., Peterken G.F.

ISBN: 9780901158611

Price: £34.99

Available from: www.nhbs.com

This publication begins with an overview of the history and types of lowland grassland and the reasons for change in Britain and Ireland. It follows with species accounts for plants currently considered to be of greatest conservation concern including Orchids, Lady's-mantles, Meadow Thistle and Pasqueflower. Information is given on identification, including similar-looking plants with which it may be confused, typical habitat, biogeography, a comprehensive ecology section, known and potential threats, and management requirements. Accounts are illustrated with a colour photo and an up-to-date distribution map.



Population Ecology in Practice

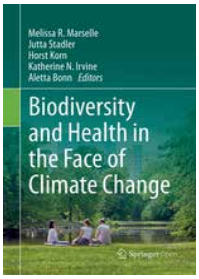
Editors: Murray D.L., Sandercock B.K.

ISBN: 9780470674147

Price: £44.99

Available from: www.nhbs.com

The book provides an overview of the key analytical approaches that are currently used in demographic, genetic, and spatial analyses in population ecology. It also covers new tools for designing robust field studies; estimation of abundance and demographic rates; matrix population models and analyses of population dynamics; and current approaches for genetic and spatial analysis. Each chapter is illustrated by empirical examples based on real datasets, with a companion website that offers online exercises and examples of computer code in the R statistical software platform.



Biodiversity and Health in the Face of Climate Change

Editors: Marselle M., Stadler J., Korn H., Irvine K., Bonn A.

ISBN: 9783030023188

Price: Open access

Available from: www.springer.com

This book identifies and discusses biodiversity's contribution to physical and mental health and wellbeing. Furthermore, the book identifies the implications of this relationship for nature conservation, public health, landscape architecture and urban planning – and considers the opportunities of nature-based solutions for climate change adaptation.

Wetlands Ecology and Management

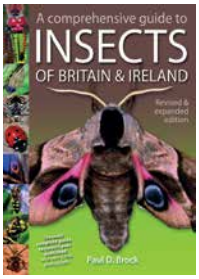
Authors: Siontorou C.G, Dimitriou E., Politi D.

ISBN: 9781138035836

Price: £127.00

Available from: www.waterstones.com

This book looks at sociology, management, economics, ecology, and technology involved in wetland preservation and provides assessment methods and implementation tools. Wetland evolution over the last century is also discussed and the authors examine the biochemistry of wetlands, review restoration practices from an economic and efficiency viewpoint, and present several case studies.



A Comprehensive Guide to Insects of Britain & Ireland

Author: Brock P.D.

ISBN: 9781874357902

Price: £24.95

Available from: www.nhbs.com

This guide covers over 2,300 species from all insect groups including beetles, flies, ants, bees and wasps. The aim of this book is to provide clear photographs of a wide range of insects to assist in their identification. Information is given on their behaviour as well as their present-day conservation status; pointers are given to help avoid misidentification with species of similar appearance.

Free downloads that may be of interest to members:

The State of Nature 2019
Available from: nbn.org.uk/stateofnature2019/reports/

Nature-Based Solutions and Protected Areas to Improve Urban Biodiversity and Health
Available from: https://doi.org/10.1007/978-3-030-02318-8_16

Anticipating arrival: Tackling the national challenges associated with the redistribution of biodiversity driven by climate change

Nathalie Pettorelli, Jennifer Smith, Gretta T. Pecl, Jane K. Hill, Ken Norris

Journal of Applied Ecology 2019, 56(10): 2298-2304
https://doi.org/10.1111/1365-2664.13465


County Wicklow River, Ireland

To date, there has been restricted understanding of the benefits and risks that the redistribution of species in response to climate change may pose to individual countries. To assess the level of ecological, economic and societal risks and opportunities associated with this change, this study reviewed the available information on changes in animal species distribution suspected to be linked to climate change in the United Kingdom over the past 10 years. Results show that at least 55 species have arrived in new locations due to climate change, with 22 of them suspected to impact the recipient ecosystems, or nearby human communities.

Correspondence: nathalie.pettorelli@ioz.ac.uk

The contribution of constructed green infrastructure to urban biodiversity: A synthesis and meta-analysis

Alessandro Filazzola, Namrata Shrestha, J. Scott MacIvor

Journal of Applied Ecology 2019, 56(9): 2131-2143
https://doi.org/10.1111/1365-2664.13475

This review aimed to determine whether green infrastructure provides additional benefits to biodiversity over conventional infrastructure or natural counterparts. Results show that green infrastructure significantly improves biodiversity over conventional infrastructure equivalents, and that in some cases GI had comparable measures of biodiversity to natural counterparts. However, they also identified that ignoring multi-trophic interactions and landscape-level patterns can limit our understanding of green infrastructure's effects on biodiversity.

Correspondence: filazzol@ualberta.ca

Nitrogen alters effects of disturbance on annual grassland community diversity: Implications for restoration

Angela J. Brandt, Eric W. Seabloom, Marc W. Cadotte

Journal of Ecology 2019, 107(5): 2054-2064 (Open access)
https://doi.org/10.1111/1365-2745.13245

Understanding how ecological communities respond to disturbance regimes is essential for successful habitat restoration. This study examines how manipulations of disturbance (raking to remove above-ground vegetation) and nitrogen supply affect diversity of annual grassland communities. Results suggest that disturbing these grassland communities by removing above-ground vegetation increased community diversity. Seed addition following this type of disturbance is therefore likely to be an effective restoration technique. However, these results show that disturbance combined with nitrogen enrichment reduces community diversity.


Malvern Hills, West Midlands

Correspondence: brandta@landcareresearch.co.nz

Road verges support pollinators in agricultural landscapes, but are diminished by heavy traffic and summer cutting

Benjamin B. Phillips, Kevin J. Gaston, James M. Bullock, Juliet L. Osborne

Journal of Applied Ecology 2019, 56(10): 2316-2327 (Open access)
https://doi.org/10.1111/1365-2664.13470


Hover fly *Syrphidae* on Thyme

Road verges and hedges are used by pollinators for feeding and reproduction. In this study, researchers looked at the role of road verges and their associated hedges in supporting pollinators in an agricultural landscape in southwest England and the impacts of traffic and verge cutting. Results showed that road verges and their associated hedges can provide hotspots of resources for pollinators in agricultural landscapes, but their capacity to do so is reduced by heavy traffic and summer verge cutting.

Correspondence: B.B.Phillips@exeter.ac.uk

Setting ecological expectations for adaptive management of marine protected areas

Kerry J. Nickols, J. Wilson White, Dan Malone, Mark H. Carr, Richard M. Starr, Marissa L. Baskett, Alan Hastings, Louis W. Botsford

Journal of Applied Ecology 2019, 56(10): 2376-2385 (Open access)
https://doi.org/10.1111/1365-2664.13463

In order to implement adaptive management of Marine Protected Areas (MPA) and determine whether they are working as expected, a prediction of the responses of previously harvested populations is needed. Using monitoring data and population models, researchers quantified expected responses of targeted species to MPA implementation and compared them to monitoring data. Harvest rates prior to MPA implementation play a large role in whether a response to MPA establishment is detectable.

Correspondence: kerry.nickols@csun.edu

Forthcoming Events

For information on these events please see *www.cieem.net*.

Conferences		
Date	**Title**	**Location**
4 March 2020	**2020 Spring Conference:** Assessing and Mitigating Air Quality Impacts on Biodiversity	Sheffield
21-22 April 2020	**2020 Irish Conference:** Conservation Approaches to Benefit National Biodiversity: Big Ideas for Big Challenges	Galway, Ireland

Training Courses		
January 2020		
7	Biodiversity Net Gain Through Development	Nottingham
14-15	Developing Skills in Ecological Impact Assessment	London
15	Biodiversity Net Gain Through Development	Birmingham
15-16	Developing Skills in Ecological Impact Assessment (Scotland)	Glasgow
22	Ecological Clerk of Works	Leeds
22	Biodiversity Net Gain Through Development	London
23	BS42020 Biodiversity: Code of Practice for Planning and Development	Sheffield
23-24	QGIS for Ecologists and Conservation Practitioners	Athlone
27	Making the Most of the Ecology Assessment in BREEAM and the BREEAM Family	London
28	Advanced Ecological Impact Assessment	London
29	Report Writing for Ecological Impact Assessment	London
29	Biodiversity Net Gain Through Development	Bristol
30	Effective Workplace Mentoring	Reading
February 2020		
4-5	Intermediate QGIS for Ecologists and Environmental Practitioners	Leeds
6	BS42020 Biodiversity: Code of Practice for Planning and Development	Reading
11-12	Train the Trainer for Ecologists	London
11	Introduction to Ecological Impact Assessment	Birmingham
12	Ecological Report Writing	Birmingham
12	Wind Farm Bird Collision Risk Modelling	Edinburgh
13	Habitats Regulations Assessment (HRA) of Projects (England & Wales)	Leeds
18	Effective Communication Skills for Women	London
19	Biodiversity Net Gain Through Development	Exeter
20	Advanced Ecological Impact Assessment (Scotland)	Edinburgh
24	Eurasian Beaver Ecology and Survey Techniques	Brecon
24-25	Pine Marten and Wildcat Ecology and Survey	Birnam
25	Eurasian Beaver Mitigation and Management	Brecon
25-26	Developing Skills in Ecological Impact Assessment	Sheffield
27	Habitats Regulations Appraisal of Plans / Projects (Scotland)	Perth
27	Eurasian Beaver Ecology and Survey Techniques	Lifton
27-28	QGIS for Ecologists and Conservation Practitioners	Kingston
28	Eurasian Beaver Mitigation and Management	Lifton
March 2020		
2-3	Ground Water Dependent Terrestrial Ecosystems	Perth
3	Advanced Ecological Impact Assessment	Crewe
5	Using Bioacoustics for Field Survey	Midlands
10	Habitats Regulations Assessment (HRA) of Projects (England & Wales)	Cardiff
10	Ecological Clerk of Works	Perth
11	BS42020 Biodiversity: Code of Practice for Planning and Development	Perth
11	Effective Workplace Mentoring	Perth
12	Effective Communication Skills	Perth
12-13	Intermediate QGIS for Ecologists and Environmental Practitioners	Kingston
12-13	Intermediate QGIS for Ecologists and Environmental Practitioners (Ireland)	Athlone
19	Peregrine Falcon: Ecology, Survey and Mitigation	Tamworth
24	Breeding Bird Surveys and Checks	Tamworth
25	Barn Owl: Ecology, Surveying and Mitigation	Birmingham
26	Otter Ecology and Surveys	Cirencester
31 – 1	Train the Trainer for Ecologists (Ireland)	Belfast

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