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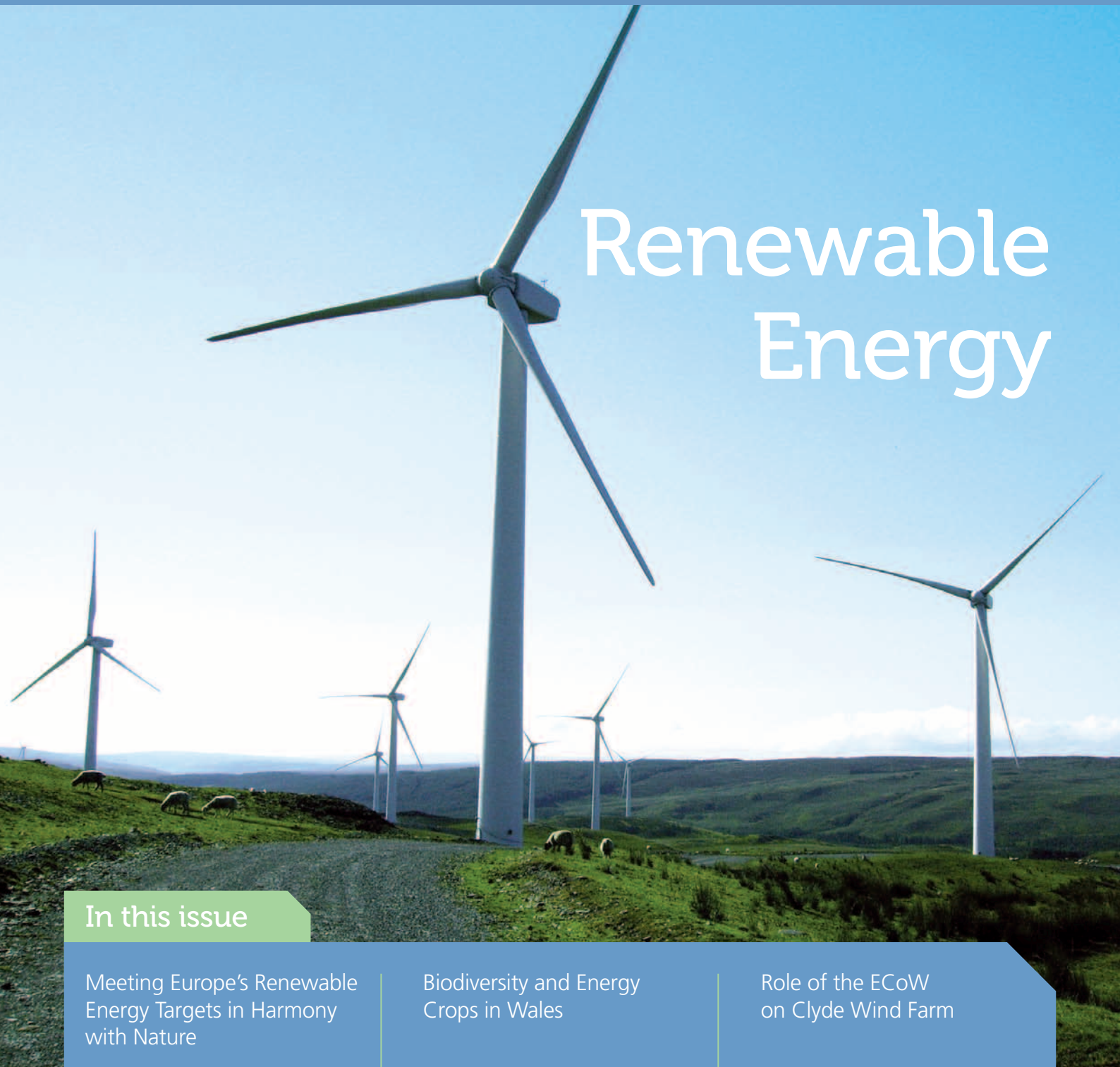

Renewable Energy

In this issue

From your President

Our 21st year has been momentous. We have received notice that our petition for a Royal Charter has been granted and we will become a Chartered Institute in 2013. We will also be able to establish a new Register of Chartered Ecologists. The Privy Council decision was announced right in the middle of our Annual Conference, a wonderful piece of serendipity. We now have 5,000 members which makes us an Institute with clout. We can confidently expect to be accorded respect by those who we deal with on a daily basis. All our members want IEEM do the right thing, both for them as individual members and, on their behalf, as a corporate body that deals with Governments and a wide range of agencies, authorities and voluntary bodies. The new Advisory Forum will harness representation by the Geographic Sections at the upper levels of IEEM through the Vice-Presidents. The new Fellows Forum will use their collective wisdom to provide useful reality checks for the Governing Board which has replaced Council.

The credit for all this progress goes to Sally Hayns, our Chief Executive, and her team in Winchester, to all the Committees and Council, and to Penny Anderson who, as President, has kept a light but firm hand on the tiller for the past two years. I have known Penny ever since the 1980s when she was commissioned to update the evidence base for the network of green spaces in Telford as part of the local development plan process. Her work at Stansted, Manchester and Heathrow airports and her superb moorland restoration work in the Pennines are well known through her writings. Penny produced the definitive book on habitat creation with Oliver Gilbert, the urban ecologist and lichen expert from Sheffield. This complements Penny's habitat translocation work that culminated in the manual written for the Highways Agency and published by CIRIA. Penny brought integrity, professionalism and innovation to all of her work. These qualities stood her in good stead during her two years as IEEM President. She will be a hard act to follow.

The presentations for our Annual Conference were excellent and contributed to a very positive feeling about ecology and the renewable energy sector. Novel methods of ecological survey, assessment and mitigation are required in this sector and we can produce these which can then be applied to other sectors. The message that I took from the conference in relation to wind energy is that landscape-scale mitigation and biodiversity enhancement is required to deal with multiple wind farm sites in upland areas where birds like curlew, golden plover, hen harrier and black grouse can be affected. And there are real opportunities for biodiversity gain on agricultural land being developed for solar photovoltaic parks. The debate on the new proposals for the Severn Barrage was timely and interesting and the power of the environmental arguments is having a significant impact on the debate. The Institute may be only 21 years old but we are a force to be reckoned with.

John Box CEnv FIEEM

IEEM President

Information

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Editor

Mr Jason Reeves (jasonreeves@ieem.net)

Editorial Board

IEEM Office

43 Southgate Street, Winchester, Hampshire, SO23 9EH, UK

T: 01962 868626

E: enquiries@ieem.net

W: www.ieem.net

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Cover Photograph
Cefn Croes wind farm. Photo by Mick Green

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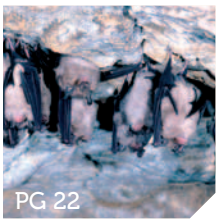

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CEH awarded 6-year contract to support biological recording

JNCC has set up a 6-year contract with the Centre for Ecology and Hydrology (CEH) to support biological recording, analysis and interpretation, so that data collected can have a bigger impact in conserving our natural environment.

http://jncc.defra.gov.uk/page-6254

Government bans imports of ash trees

A ban on the import of ash trees to combat the threat of the tree disease ash dieback is being imposed with immediate effect, Environment Secretary Owen Paterson announced on 29th October. The disease, caused by the fungus *Chalara fraxinea*, leads to leaf loss and has already affected trees in England and Scotland, and killed trees in parts of mainland Europe. The ban is being put in place before the main planting season gets underway in late November. Movement restrictions will also be imposed, so that trees from infected areas will not be able to be moved to other locations within the UK.

bitly.com/TPaTUJ

RSPB publishes ecological review of birds and wave and tidal stream energy

The RSPB has published *Birds and wave & tidal stream energy: an ecological review.* The review notes that there is a paucity of applicable data on the impacts of wave and tidal devices on birds. This lack of data has implications for understanding the overall impacts of these novel technologies, and for impact assessment of individual schemes. In the final section these knowledge gaps and approaches to filling them are discussed. The key information that is lacking can be summarised as spatial and behavioural. The review identifies the practical issues for data collection: a need for standardisation throughout the industry, the use and development of remote sensing, further refinement of modelling techniques; refining sensitivity indices, defining the scale of impacts, and cumulative impact assessment.

bitly.com/TkcoGD

Biological Recording Programme saved!

The Biological Recording and Species Identification Programme previously administered by the University of Birmingham has now been transferred to Manchester Metropolitan University (MMU). Whilst the awarding institution has changed, the programme and personnel remain the same. The pressure of a public awareness campaign made the University of Birmingham acknowledge that there was a real need for the courses and that they should look to another institution to transfer the programmes in their entirety. The programme offers a highly respected and nationally recognised course in field skills and caters for people in full-time employment. MMU is to be congratulated on their forward thinking in providing a new home for the Biological Recording and Species Identification programmes in their entirety. MMU have retained all of the programmes, personnel and key partners, whose work has enabled the programmes to have such high industry recognition. *For further information please contact Dr Sarah Whild (s.j.whild@bham.ac.uk) or Linda Marsh (l.marsh@bham.ac.uk).*

New invasive shrimp found in UK

A new species of invasive shrimp *Dikerogammarus haemobaphes*, a close relation of the Killer shrimp *D. villosus* has been found for the first time in the UK. The Demon shrimp *(D. haemobaphes)* was reported by the Environment Agency on the River Severn at Tewkesbury and Bevere near Worcester. It has also been found on two canals in Worcestershire. The Demon shrimp feeds on a range of freshwater invertebrates and small fish. It is believed that the shrimp is able to tolerate changing environments and can survive in a range of freshwater habitats, unlike the Killer shrimp which is restricted to hard river bed habitats. *Dikerogammarus haemobaphes* is native to rivers flowing into the Black, Caspian and Azov Seas. It was first recorded outside its native range 20 years ago. Since then its range has expanded into large parts of Germany, Poland, the Netherlands, Belgium and France. It is believed to have invaded Western Europe via the Danube.

bitly.com/QSXicn

Review of planning practice guidance to support the NPPF

The Government announced on 16 October 2012 that Lord Matthew Taylor of Goss Moor would lead and chair an external group conducting a review of the existing 6,000 pages of planning practice guidance which supports the implementation of National Planning Policy Framework (NPPF), and which the Department for Communities and Local Government owns or has jointly badged with other Government Departments or agencies. The aim is to enable the production of an accessible and more effective set of practice guidance, dramatically reducing the existing guidance, and ensuring that new guidance supports effective planning.

bitly.com/RBtdhS

Badger cull update

Environment Secretary Owen Paterson announced on 23rd October that the badger cull due to take place this year in England has been postponed until the summer of 2013 at the request of the National Farmers Union.

bitly.com/VlMUlj

Furthermore, following a debate in the House of Commons on Thursday 25th October 2012, MPs voted against the government's policy of culling badgers in two pilot schemes in England in order to control the spread of bovine tuberculosis. In a non-binding vote, MPs rejected the policy by 147 votes to 28, calling instead for vaccination, improved testing and bio security.

bitly.com/TIgkik
bitly.com/UlsgGL

Guidance on competent authority co-ordination under the Habitats Regulations

Defra has published guidance for competent authorities on how and when they should undertake co-ordination to fulfil their responsibilities under the Habitats Directive. The Government believes that competent authorities will be able to fulfil their duties more efficiently and effectively if they follow this advice. Competent authorities are required to have regard to the guidance in paragraphs 5 to 7 of this document. This document applies to England and UK offshore waters (except in relation to functions exercised within devolved competence).

bitly.com/Xs1xiG

Photo by www.wildstock.co.uk

Defra published evidence plans for Nationally Significant Infrastructure Projects in relation to the Habitats Regulations

Following the Habitats and Wild Birds Directives Implementation Review, Defra has published guidance for nationally significant infrastructure projects. The guidance explains the new process that will allow developers of nationally significant infrastructure projects in England to agree evidence plans with relevant statutory nature conservation bodies to ensure they comply with the Habitats and Wild Birds Directives.

bitly.com/SU4EZl

Criteria for identifying Nature Improvement Areas

In the Natural Environment White Paper, Defra set out their vision for Nature Improvement Areas (NIAs) to be created wherever the opportunities or benefits are greatest, driven by the knowledge and vision of local partners. These landscape-scale initiatives aim to ensure that land is used sustainably to achieve multiple benefits for people, wildlife and the local economy. It is not the intention of NIAs to stifle sustainable development within the area; economic development within an NIA will remain vital, and many development proposals will have no or minimal impacts on the overall integrity or objectives of the NIA. Defra have set out a role for Local Nature Partnerships to work with and support the 12 Government-funded NIAs as well as to help establish new, locally determined NIAs. It is for Local Planning Authorities to decide whether and how to recognise an NIA in their local plans. The criteria are intended to help Local Authorities, Local Nature Partnerships and other local partnerships identify the locally determined NIAs.

bitly.com/VZoFzZ

Environmental Stewardship schemes support agricultural productivity

A report commissioned by Natural England reveals the important role that Environmental Stewardship (ES) schemes play in supporting agricultural productivity. The new report, *Ecosystem services from Environmental Stewardship that benefit agricultural production*, highlights the role of Environmental Stewardship in protecting the environment and agricultural food production. The report found that ES schemes are delivering a range of vital goods and services, known as eco-systems services - which benefit the natural environment and in doing so help sustain and develop agricultural productivity.

bitly.com/PCgwBg

Appointment of chief executive to Natural Resources Wales

Dr Emyr Roberts

Professor Peter Matthews, chair of the Welsh Government's new body for managing natural resources in Wales, has announced the appointment of Dr Emyr Roberts as the body's chief executive. The appointment will take effect from 1 November 2012. After a career with the National Farmers' Union, Emyr joined the Welsh Office in 1991 and was promoted to the senior civil service in 1997. Since then he has held a number of posts within the Welsh Government, most recently as Director General of Education and Skills.

bitly.com/Qz3KTT

Draft developer advice published

The Environment Agency, Natural England and Forestry Commission have published a joint consultation document, *Building a better environment: Our role in development and how we can help*. The document has been developed to help explain, succinctly and in a single place, the role of the Environment Agency, Natural England and Forestry Commission. The document is intended to be a 'first stop' for information to help developers and local authorities understand their respective roles relating to new development, their positive approach to enabling growth in a sustainable way, and how they can assist through early involvement in the process.

http://www.environment-agency.gov.uk/developeradvice

Invasive sea squirt species found in Strangford Lough

Northern Ireland Environment Agency (NIEA) has confirmed that a colonial sea squirt found in a recent survey of marinas and harbours is the invasive non-native species *Didemnum vexillum.* The common name of *D. vexillum* is carpet sea squirt, which well describes the potential problems it poses. It hangs from hard surfaces such as docks, lines and ship hulls or forms mats on seabeds and can grow rapidly to smother marine life such as sea weeds and marine fauna including mussels and oysters. It is mainly transported over longer distances on boat hulls but larvae and fragments can also be spread by fishing equipment, the movement of aquaculture nets and tidal currents.

bitly.com/TRH57W

EU Ministers debate CAP and CFP reform

Agriculture and Fisheries Ministers debated reform of the Common Agricultural Policy (CAP) and reform of the Common Fisheries Policy (CFP) at the most recent meeting of the Council of the European Union on 24-25 September 2012. Debate on the reform of the CAP focused on the proposal for a Regulation on support for rural development and the proposal for a Regulation establishing a common organisation of the markets in agricultural products. Debate on the reform of the CFP focused on the proposal for a Regulation on the European Maritime and Fisheries Fund, which would replace the existing European fisheries fund.

bitly.com/VZpzwb

JRC launches European alien species information network

The European Commission Joint Research Centre (JRC) has announced the creation of an information network to help eliminate the threat of alien species to biodiversity and natural resources in Europe. The European Alien Species Information Network (EASIN) aims to map and classify alien species in Europe, to reduce the economic impact of alien species, which is estimated at _12 billion yearly. The network combines databases including the: Global Biodiversity Information Facility (GBIF); Global Invasive Species Information Network (GISIN); and Regional Euro-Asian Biological Invasion Centre (REABIC). Combatting invasive species is one of the objectives of the EU 2020 Biodiversity Policy.

bitly.com/Xs2RBZ

Biofuels study highlights opportunities and risks for biodiversity

The Secretariat of the Convention on Biological Diversity (CBD) has released a report analysing and summarising some of the major issues related to biofuels and biodiversity on the basis of the best available scientific information. Circulated as CBD Technical Series no. 65, the report highlights the complexities behind the topic, noting opportunities for biofuels to contribute to sustainable development, but also risks.

bitly.com/QcGETc

Wales' single environmental body named and non-executive directors announced

The name for the new single body will be Natural Resources Wales/Cyfoeth Naturiol Cymru. The non-executive directors are: Dr Mike Brooker, Rev. Hywel Davies, Dr Ruth Hall, Dr Madeleine Havard, Harry Legge-Bourke, Andy Middleton, Morgan Parry, Nigel Reader, Prof. Lynda Warren and Sir Paul Williams.

bitly.com/PLCoMG

FAQs on links between Nature Directives and Marine Directive

The European Commission has published *Links between the Marine Strategy Framework Directive (MSFD 2008/56/EC) and the Nature Directives (Birds Directive 2009/147/EEC (BD) and Habitats Directive 92/43/EEC (HD))*. This document addresses some Frequently Asked Questions about links between the Marine Strategy Framework Directive and the Nature Directives in relation to interactions, overlaps, and potential areas for closer co-ordination. However, the document has no formal legal status.

bitly.com/ZiVafZ

CBD report highlights potential benefits of marine spatial planning

The Secretariat of the Convention on Biological Diversity (CBD), in collaboration with the Scientific and Technical Advisory Panel (STAP) of the Global Environment Facility (GEF), has published a report on marine spatial planning. The report concludes that comprehensive marine spatial planning has the potential to improve management of marine ecosystems, reduce the loss of ecosystem services, help address or avoid conflict, and create economies of scale and efficiencies for enforcement and management.

bitly.com/RrxUci

Meeting Europe's Renewable Energy Targets in Harmony with Nature

Ivan Scrase and Benedict Gove
RSPB

Introduction

Europe is seeking to position itself as a global leader in the development and deployment of renewable energy technologies. Successfully delivering against its aspirations in this area is central to meeting its greenhouse gas emissions targets and doing its fair share to stabilise the global climate. BirdLife Europe strongly supports these commitments: the potentially severe impacts of climate change on biodiversity, and the knock-on impacts for society if nature is impoverished, demand a rapid but sustainable transition to a low carbon economy.

Renewable energy must become the backbone of Europe's energy supply. Yet many renewable energy technologies can present risks to birds and other wildlife if they are not developed sensitively. The challenge we face is to protect nature whilst deploying renewables at the scale and pace required. BirdLife's report *Meeting Europe's Renewable Energy Targets in Harmony with Nature*[1] sets out how European governments can step up to this challenge and ensure that we meet our 2020 renewable energy targets, and also our commitment to halt and reverse biodiversity decline by the same year.

Birdlife is a network of leading bird and wildlife conservation organisations. Seventeen organisations participated in this work, based in Germany, Spain, the UK, France, Italy, Poland, Greece, Belgium, Romania, Bulgaria, Ireland, Slovenia, Montenegro, Croatia and Portugal. This report is the product of a year-long process that brought these organisations together to: review the scientific evidence about ecological impacts of renewables; consider how policy frameworks support or undermine biodiversity-friendly renewables; review the EU's renewable energy ambitions in terms of technologies and locations; and make recommendations for European and national governments. In addition, detailed reviews were undertaken of Member States' National Renewable Energy Action Plans (NREAPs) and the scientific evidence on the ecological impacts of the major renewable energy technologies and power lines.

The Twin Imperatives

Global average temperatures are increasing, and burning fossil fuels is the principal cause. Unless drastic action is taken to cut emissions, the world could experience a dangerous level of warming within decades. This would be a disaster for people and for wildlife. *A Climatic Atlas of European Breeding Birds*[2] predicts that on average bird populations in Europe would need to shift 550km north-east by the end of this century. A study published in *Nature* estimated that 15-37% of plants and animals will be *"committed to extinction"* by 2050 as a result of a mid-range warming scenario[3]. Even if greenhouse gas emissions were to cease tomorrow, biodiversity would still have to adapt to warming caused by past emissions. Moreover, biodiversity is already being driven into decline by a range of factors, particularly agriculture, fisheries and forestry practices (and other causes of habitat loss or degradation) and invasive species. This means the ecosystem services that biodiversity provides to society, such as pollinating food crops, are diminishing.

Rapid and large reductions in greenhouse gas emissions are a necessary part of the plan if we are to meet our goal of reversing biodiversity loss. BirdLife Europe, therefore supports the EU's target to cut greenhouse gas emissions by 20% by 2020, and is calling for this ambition to be increased to 30%. We also support the renewable energy targets in the Renewable Energy Directive (2009/28/EC) as they have become a key driver in promoting the use of renewable energy and cutting EU carbon emissions. But these targets

Top - Electricity cables, pylons and wind turbines at sunset – near Diepholz, Lower Saxony, Germany. Photo by Nick Upton (rspb-images.com)

Middle - Installation of solar panels on Visitor Centre roof at Sandwell Valley RSPB reserve by Solar Century. Photo by Andy Hay (rspb-images.com)

Bottom - Common or Eurasian crane *Grus grus* flock flying close to wind turbine – near Diepholz, Lower Saxony, Germany. Photo by Nick Upton (rspb-images.com)

must be seen alongside the EU commitment to *"halting the loss of biodiversity and the degradation of ecosystem services..."* by 2020.

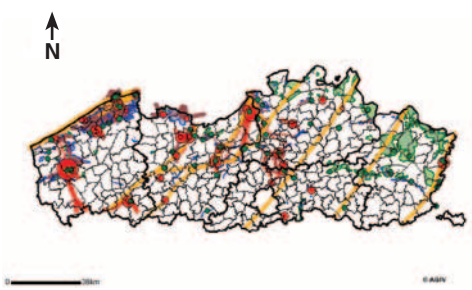
A stable climate and flourishing biodiversity are twin imperatives – two sides of the same coin. The risk is that failure to plan ahead for rapid expansion in renewables deployment, and to take environmental considerations into account in plans, will endanger Europe's most valuable sites for wildlife and its most vulnerable species. This can already be seen in some parts of Europe; for example, failures in the Spanish regions to plan for wind development, and to apply legislation on environmental assessment of plans, has resulted in risks to Special Areas of Conservation (SACs) for important habitats and Special Protection Areas (SPAs) for birds. These SACs and SPAs are part of the Natura 2000 network of Europe's most valuable wildlife sites, protected under the Birds and Habitats Directives.

These risks are by no means inevitable however. Europe's climate, renewable energy and biodiversity targets must all be met, and much can be done to make them compatible and mutually reinforcing.

Renewable Energy Technologies and Ecological Sustainability

BirdLife Europe supports achieving and going beyond Europe's 2020 renewables target, in line with four key principles:

1. Renewables must be low carbon.
2. A strategic approach to deployment is needed.
3. Harm to birds and biodiversity must be avoided.
4. Europe's most important sites for wildlife must be protected.



Bird sensitivity Map for Flanders Region of Belgium. Details and searchable interactive map available at http://geo-vlaanderen.agiv.be/geo-vlaanderen/vogelatlas. © Agentschap voor Geografische Informatie Vlaanderen-Geovlaanderen-Vogelatlas

Table 1. Ecological risks associated with technologies needed to meet Europe's renewable energy targets.

Low risk	Medium risk	High risk
• Energy savings measures (e.g.power domestic insulation) • Vehicles using renewable electricity • Heat pumps • Rooftop solar thermal and PV panels	• Solar PV arrays • Concentrated solar power • Onshore wind power • Offshore wind power • Tidal stream power • Wave power • Biomass for heat and power	• Liquid biofuels • Tidal range power • New hydro power

After a preliminary review of the risks posed by all forms of renewable energy, technologies were classified based on the risks they pose to wildlife. This categorisation is set out in Table 1. Technologies that are small-scale, involve little or no additional new infrastructure, and/or do not result in any land use charge, are very unlikely to present significant risks to biodiversity. This 'low risk' category includes roof-mounted solar panels, heat pumps and electric vehicles. Energy saving measures, while not renewables technologies, are relevant here since they make achievement of renewables targets easier. Conversely, technologies that result in complete changes in land use will inevitably present significant risks for the wildlife present, for example, where valuable habitats are lost to intensive land use for energy crops or through the construction of dams for hydro or tidal power. The 'high risk' category refers to technologies that present unacceptable risks in most instances with currently available technologies, such as new large hydropower dams and liquid biofuels. With adequate safeguards and/or technical innovation some use of these technologies may become possible without significant ecological risks, but BirdLife sees current potential as extremely limited.

Most technologies fall into the second, 'medium risk', category and require sensitive deployment. This category provides much of the focus for *Meeting Europe's Renewable Energy Targets in Harmony with Nature*. It contains a detailed review of current scientific evidence regarding potential ecological risks associated with wind, solar, wave and tidal stream power, and biomass for heat and electricity. It also reviews the scientific evidence on the most effective ways to avoid those risks, and even to achieve benefits for wildlife. The power lines needed to distribute and transmit renewable electricity are also considered. Table 2 summarises the technologies and impact/enhancement areas covered in detail in this review.

The Ecological Sustainability of Europe's 2020 Renewables Plans

We analysed the EU Member States' National Renewable Energy Action Plans (NREAPs) to generate a clear picture of ambition across Europe for different renewable energy technologies. The NREAPs present Member State plans for each technology in terms of the role they will play in 2020 (additional to 2005). Over two thirds of the additional renewable energy consumed in 2020 will be provided by 'medium conservation risk technologies', as identified in our report. These include wind, biomass, tidal and wave power. This heavy dependence on such technologies clearly demonstrates the need for proactive policy intervention to ensure ecological impacts are minimised.

Twelve percent of the increase in renewable energy will be provided by 'low conservation risk technologies', including solar thermal and heat pumps, as well as renewable electricity consumed in electric vehicles. These technologies are win-wins for the environment and the climate. In addition, the NREAPs identify additional energy savings measures that reduce total energy consumption in 2020 by 10% relative to 'business as usual' scenarios. Energy savings are a very low risk means to make the renewables targets easier to achieve.

Significant differences in ambition to save energy and use low-risk technologies were found between Member States, some of which can only be explained by political will, rather than suitability of individual technologies. For example, Poland and Belgium intend to make significant use of

Table 2. Summary of technologies covered in the review of scientific evidence and examples of impacts and mitigation/enhancement measures covered

TECHNOLOGY	MAIN CONSERVATION RISKS	AVOIDING AND MITIGATING RISKS	ACHIEVING BENEFITS FOR WILDLIFE
Solar PV arrays	• Habitat loss • Direct impacts on birds, mammals and insects • Habitat fragmentation and/or modification	• Avoid protected areas • Retain trees and hedges • Time construction and maintenance to avoid disturbance of birds and bats during breeding seasons	• Manage vegetation around/ beneath panels for wildlife • Use some revenues to support on-site conservation
Onshore wind power	• Disturbance/displacement • Barrier effects • Collision mortality • Habitat loss	• Spatial planning (sensitivity mapping and location guidance) and site selection • Modelling collision risks and estimating displacement impacts • Improved tools and methodologies to assist pre- and post-construction monitoring and research • On- or off-site ecological enhancements	• Positive land management changes • Create wildlife areas on- or off-site as part of community-benefit packages
Offshore wind power	• Disturbance/displacement • Collision risk • Habitat loss • Pollution	• Spatial planning and site selection. • Baseline surveys and targeted pre-construction studies • Remote sensing techniques	• Reef effects • No-take zones • Contributions to marine ecological data
Tidal stream and wave power	• Collision risk • Entrapment • Disturbance/displacement • Indirect effects	• *None recommended due to early stage of development of wave and tidal technologies*	• *None recommended due to early stage of development of wave and tidal technologies*
Biomass for heat and power	• Pressure on existing habitats in forests and on farm land • Direct and indirect land-use change	• Location guidance • Good practice guidelines • Sustainability standards and certification • Avoid using biomass from sources where sustainability cannot be guaranteed	• Manage neglected forests for biodiversity gains and sustainable biomass production • Grow patches of wildlife-friendly energy crops, planned to improve habitat connectivity
Power lines	• Electrocution • Collision risk • Habitat loss	• Avoid sensitive locations • Retrofitting 'killer poles' • Underground cables	• Manage land beneath pylons as biodiversity 'stepping stones' • Provide ecological enhancements to affected communities

White fronted geese *Anser albifrons* and pink-footed geese *Anser brachyrhyncus* in flight and in a stubble field near electricity pylons and wind turbine in late autumn – near Diepholz, Lower Saxony, Germany. Credit: Nick Upton (rspb-images.com)

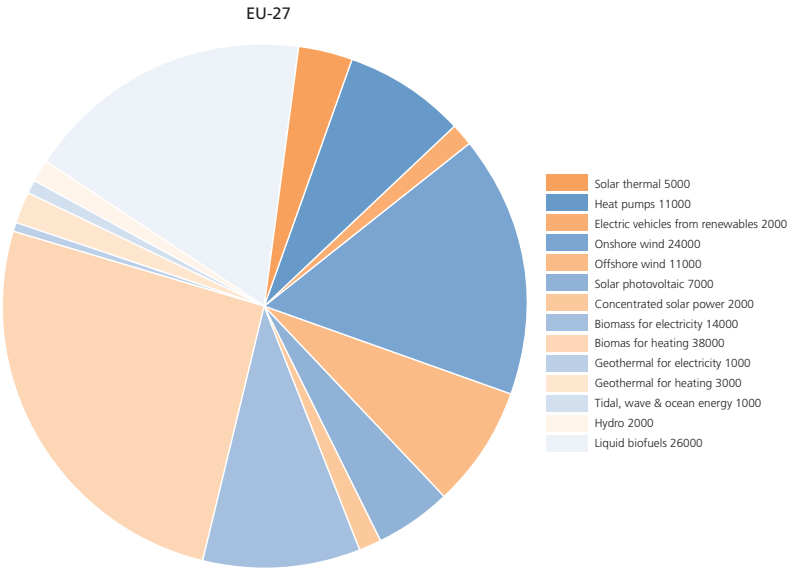
solar thermal energy for space heating, while other northern European countries with similar weather do not consider it in their NREAPs. Similarly, heat pumps are seen to have great potential in the UK, France and Italy and 13 other EU Member States, while others have not stated an intention to make significantly greater use of this technology. BirdLife believes that Member States should review the potential for these technologies and maximise their deployment.

Nineteen percent of the increase in renewable energy will be provided by 'high-risk technologies'. Additional hydropower provides a little over 1%, partly accounted for by 'repowering' existing facilities.

The remaining 18% of the increase in consumption is attributed to liquid biofuels. While repowering hydro facilities and wind farms can be achieved with low ecological risks, and can even benefit the environment, new hydro and liquid biofuels are identified here as technologies that carry high ecological risks. BirdLife recommends that further expansion of use of these technologies should be reviewed and any shortfall in meeting the 2020 renewables target should be made up using less risky technology and/or more ambitious energy savings.

Onshore wind power is expected to contribute 24,000ktoe[4] more energy to Europe's mix in 2020 than in 2005. This is the largest additional contribution to renewable electricity consumption in 2020. Offshore wind also makes a significant additional contribution in 2020, of 11,000ktoe. To illustrate what this could mean on the ground, this would require installation of approximately 59,000 2-MW onshore wind turbines and 6,600 8-MW offshore wind turbines. These would occupy surface areas of approximately 11,800km^2 onshore and 5,300km^2 offshore. These areas are relevant to ecological influences such as avoidance by birds and fishing exclusion zones, but the actual footprints of the turbines would, of course, be far smaller.

Biomass for heat is the biggest contributing technology to meeting the 2020 target overall. Again, simply to illustrate the scale of this ambition, if this were all to be met using



Additional renewable energy consumption in 2020 compared to 2005, by technology (ktoe). © Sandra Pape (RSPB)

Composite Sensitivity Map of Scotland for location of onshore wind farms with respect to a suite of sensitive bird species (presented here at tetrad level to protect locations of sensitive species). © RSPB and Scottish Natural Heritage

wood fuel, an additional annual consumption of approximately 88 million oven dry tonnes (odt) would be required. In addition, meeting the biomass for electricity target using wood fuel would require an additional 194 million odt of wood in 2020. For reference, total wood biomass production across the EU each year for all purposes is approximately 500 million odt. To meet the target for solar photovoltaic (PV) to provide an additional 7,000ktoe in 2020 using domestic rooftops the EU would require an additional 19.4 million 4-kW PV home systems.

The UK is by far the most ambitious nation in terms of developing tidal, wave and ocean energy according to the NREAPs, although five other countries see potential for these technologies to deliver significant quantities of electricity by 2020. BirdLife considers that with directed innovation funding and sensitive deployment, wave and tidal stream technologies are potentially significant and ecologically acceptable technologies. However, large tidal power 'barrages' are likely to present very significant ecological risks through loss of intertidal habitats.

Hydropower makes only a small additional contribution in 2020 according to the NREAPs. While much of this will involve repowering existing facilities or small installations, there is a risk that large dams

will be built on some of Europe's last remaining ecologically-rich rivers.

Liquid biofuels feature in every NREAP, reflecting the mandatory requirement to meet 10% of transport fuel needs using biofuels, hydrogen or renewable electricity. This is expected to be delivered largely through liquid biofuels.

How to Achieve a Renewables Revolution in Harmony with Nature

The report identifies eight areas where policy-makers must help to enable a renewables revolution in harmony with nature. Action in these areas would support investment, minimise ecological impacts and also improve the public acceptability of investment plans and specific projects.

1. Commit politically and financially

The major obstacle to renewables investment in the coming decade is likely to be difficulty accessing adequate finance at a reasonable cost. Investor confidence falls, and the cost of venture capital rises, where incentives and policy frameworks are unstable. Certainty needs to be offered both in terms of commitment to renewable energy at a political and a practical level. This means that:

i) Europe should urgently set binding targets for renewables as a share of energy consumption in 2030.

ii) Member States should ensure suitable locations are identified for the major renewables technologies.

iii) Stable incentive frameworks are needed to give investors and all stakeholders more confidence that sufficient renewables will be delivered.

iv) R&D budgets for lower cost and biodiversity-friendly renewables need to be increased by an order of magnitude.

2. Minimise overall infrastructure needs

High level strategic planning and energy-system optimisation will reduce the overall amount of new resources, capacity and infrastructure required. This reduces impacts and keeps costs to consumers and industry down.

3. Introduce strategic spatial planning for renewables

Renewable energy investments are often controversial, with supporters and opponents both having legitimate opinions. Planning is the process through which these concerns are reconciled in the public interest, both within and between EU Member States (e.g. in offshore areas). Good planning, based on transparency and public participation, ensures suitable locations are identified for various land uses, and improves the public acceptability of investments. Maps indicating where the most sensitive habitats and species are located are a valuable planning tool for identifying broad zones where renewables development is most appropriate. Strategic Environmental Assessment provides an ideal structured framework for environmentally sensitive planning.

4. Ensure all stakeholders are engaged and working together

At every stage in developing and implementing policies and plans for renewables, policy-makers, public institutions, developers, conservation organisations and other stakeholders can benefit from working together to find mutually beneficial solutions and to avoid unnecessary conflicts.

5. Ensure project impacts are minimised

Renewables developers routinely take steps to avoid and minimise the impacts of their projects, through use of tools such as Environmental Impact Assessment (EIA). Policy-makers can help by ensuring the legislative and institutional frameworks in every Member State are adequate to ensure environmental assessments are carried out to a high and scientifically rigorous standard, and that agreed mitigation measures are always implemented and monitored for effectiveness. And of course, unacceptably damaging proposals should be rejected in the planning system.

6. Deliver ecological enhancements

Ecological 'enhancements' are improvements that go beyond measures required to mitigate or compensate for damage. Developers often provide incentives to communities to make their proposals more readily acceptable, such as paying for community facilities. Providing attractive and wildlife-rich habitats is another way to provide community benefits, and to contribute to local and national biodiversity strategies and targets.

7. Guidance and capacity building

Legislation, regulation and good practice for biodiversity-friendly renewables development are not always well-understood by all parties concerned. Moreover, institutions often lack the necessary capacity to ensure they are properly applied, particularly in the newer and less wealthy EU Member States. Big gains can be made for quite small investments here, and BirdLife Partners are keen to help.

8. Protect biodiversity

Renewables will help limit climate change, but healthy ecosystems and protected habitats will be essential to enable society and nature to survive the warming that we are already experiencing and cannot avoid. In particular, the Natura 2000 network of internationally important sites for biodiversity needs robust protection, while also accommodating economic activities that present no significant conservation risks or that contribute to conservation goals.

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4. Kilo tonnes of equivalent oil

About the Authors

Dr Ivan Scrase is Senior Climate Change Policy Officer with the RSPB. He works on renewable energy and energy infrastructure issues at UK and EU levels. He previously worked in academic research on energy policy and innovation.

Contact Ivan at:
Ivan.Scrase@rspb.org.uk

Dr Benedict Gove is Senior Conservation Scientist with the RSPB. His work focuses on research and analysis around various topic areas including impacts on birds and other wildlife of bioenergy, onshore wind power developments and disturbance. He previously worked for Natural England on science and policy relating to bioenergy and genetically modified crops.

Contact Benedict at:
Benedict.Gove@rspb.org.uk

Redpoll caught in SRC

Willow warbler fitted with transmitter – aerial just visible from tail

Biodiversity and Energy Crops in Wales

Fred Slater CEnv FIEEM
Honorary Senior Research Fellow, Cardiff University

Summary

Wales not only has a language different to England but also a wetter, more oceanic climate and a largely upland pastoral landscape in contrast to the flatter drier, arable acres where currently much of Britain's biomass crops are grown. Short rotation willow coppice can grow well in suitable upland soils in Wales but grows even better in the lowland maritime fringe where energy grass crops also prosper in the moist, mild climate. With wildlife-sensitive herbiciding, newly planted willow coppice offers a window of opportunity for granivorous birds to harvest the arable weed seeds as the crop matures it harbours the warblers and finches characteristic of young deciduous woodland which is rejuvenated on rotation every 3-4 years. Wide untreated headlands with enclosing hedgerows allow a rich mammal and insect fauna in both willow coppice and energy grass plantations. In some situations the latter have been shown to be strongholds of harvest mice and water shrews when compared to surrounding conventional crops. When replacing improved pasture or arable, energy crops show a positive benefit for biodiversity.

Introduction

Energy crops have economic, social and landscape impacts but the question of their positive or negative impact upon biodiversity still creates debate. For anyone wishing to delve deeper into this subject there could be no better way to start than by entering 'RELU biomass' or 'Rufus Sage' into Google Scholar. The profusion of publications this produces is impressive, but generally lacks reference to the wetter side of Britain to the west of Offa's Dyke. Climatic, topographical and land use differences between lowland, arable, eastern England and the predominantly upland, pastoral, lands of Wales deserve separate consideration. Two types of crops, grown specifically for biomass, are being increasingly planted in Wales, namely short rotation willow coppice (SRC) and the grasses *Miscanthus* and reed canary.

Redshank growing in first year willow

Woody Crops

Of woody crops grown specifically for biomass, SRC has become the crop of choice in Wales. In the early 1990s only Forestry Commission (Wales) and the now Cardiff University seemed interested in the possibility of using some of Wales' less productive land for renewable energy production. Using material from the then National Willow Collection at Long Aston and over the next decade, adding new varieties mainly bred in Sweden, several experimental sites were established across Wales to determine varietal suitability.

In the context of Wales, SRC impacts biodiversity in two main ways:

- At establishment it creates a pseudo-arable environment for weeds in a predominantly pastoral landscape.
- It creates and maintains early succession woodland conditions on a rotational basis.
- It can create woody stepping stones across an otherwise grassy landscape.

SRC and Associated Plants

One of the biodiversity benefits of SRC is that it requires minimal chemical intervention as, once established, it out competes most weeds. Glyphosate is often used to clear the site before it is ploughed and planted and, particularly in the first year, if herbiciding is not too severe, the weed seed bank germinates and grows benefiting birds and small mammals. Depending somewhat on husbandry, weed diversity declines in the first year of second and subsequent rotations as the annual and biennial weeds get replaced by perennials such as creeping buttercup. The sites used by ourselves (Cardiff University) on our own or in conjunction with IBERS (Institute of Biological, Environmental and Rural Sciences) at Aberystwyth University are shown in Figure 1 and are well distributed throughout Wales.

Our first experimental site was on wet peaty clay at 280m OD near Llysdinam in mid-Wales where our biomass projects were based, and consisted of a soft rush *Juncus effusus*, purple moor grass *Molinia caeulea* rough grassland – a habitat known as *rhos* in Wales. The site was treated with glyphosate, ploughed and planted with SRC. In year one there was an abundance of whorled caraway *Carum verticillatum*, a scarce species on the eastern edge of its range – an early example of SRC enhancing desirable species abundance.

Work on IBERS plots in various parts of Wales by Danielle Fry emphasised the value

Reed Bunting from SRC

to birds and small mammals of the weed seed production in year one. A sea of pink flowers of redshank *Persicaria maculosa* in late summer was followed in autumn by seed eating finches and other small passerines. A second year crop of SRC in Pembrokeshire was heavily infested with biennial spear thistle *Cirsium vulgare*. As the seed heads matured they became a food source for goldfinches but later when the plants fell to the ground the thrush family (blackbird, song and mistle thrush, fieldfare and redwing) cleared the remaining seed heads. In north Wales at Glynllifon Agricultural College, wide headlands planted with winter seed crops for birds brought species such as redpolls and finches to the willow and also, in summer, added to the insect diversity.

As with energy grass crops it is the generally low chemical input required by SRC which allows biodiversity to develop in headland and inter-plot areas, although inter-harvest herbiciding and surface amendments such as farmyard manure and pre-crop lime in acidic areas is not infrequent. The botanical value of these largely coarse grass headlands is often not great *per se* but favours, for example, meadow brown and ringlet butterflies and offers small mammal cover, which, in our experience, is utilised by barn owls.

Over the years, depending on regulations in force at the time, we variously used digested sewage sludge, and animal manures as amendments together with inorganic fertilisers and lime. In 1991, Sarah Lynn applied 100, 200 and 400m^3 of digested sewage sludge to the ground flora of birch woodland and monitored the effect on the general biodiversity. Because plants such as bramble appeared to respond to the amendments mainly in the year following either a spring or autumn application, it was thought that nutrient release might be related to fungal activity geared to the autumn breakdown of fallen leaves. After two years, when the ephemeral fungal colonisers had gone, there were none of the 10 fruiting fungus species in the control plots which did not also occur in the treated plots whereas 20 species were found in the treated plots which were not in the control. Clearly fungi seem to be stimulated (at least to fruit) by organic amendments but this was not SRC. Willow is generally grown for SRC on a 3-4 year rotation and mainly without soil amendment but even in untreated plots there were a range of mainly mycorrhizal soil fungi such as *Hebeloma* spp. appearing harmlessly within the crop, but of more economic significance were the species or cultivar specific leaf rusts of the genus *Melampsora*.

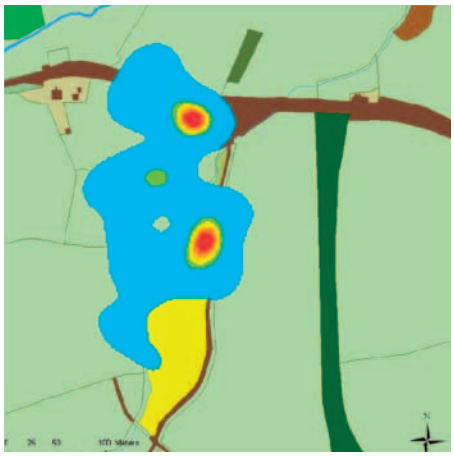
The ground and soil invertebrates of willow have been well studied and although initial planting disturbs the soil, once established the soil structure improves through root binding and humus and organic matter increases through leaf litter decomposition, fine root turnover and decomposition of

Figure 1. Biomass research sites in Wales used by Cardiff University and/or IBERS

organic mulches. The increased structure and stability encourages soil invertebrates such as earthworms, woodlice and carabid beetles, which may enhance nutrient availability and beetles may help keep slugs and slug damage down reducing the need for chemicals.

The willows, the weeds and the hedgerows, not forgetting the fungi, form the food resource for the herbivorous link of the food chain. The field headlands are, in reality, not really areas of 'weeds' but grasslands in their own right with the insect fauna to match from a wide range of families. The hedgerows not only add tree and shrub diversity with their associated invertebrates, but also provide shade, shelter, organic input from leaves, and environmental corridors, in addition to bird and mammal habitat as well as adding to visual landscape quality. More flying insects were found at the margins than within the crop including shiny chrysomelid willow beetles (*Phratora vitellina* and *P. vulgatissima*). The latter left the crop in September and at one site which was surrounded by gorse, hundreds were caught in spiders' webs. There are a reported 266 species of insects associated with willow in the UK, including the common pests, giant willow aphids *Tuberolachnum salignus*, chrysomelid beetles and sawflies, although willows, in variety, and when flowering, provide rich and often prolonged forage for bees.

Map for triangulating Warbler locations



Radio tracked willow warbler territories (blue with orange-red core) in SRC (yellow)

Bird exclusion net

First year SRC with wide headland

Giant Willow Aphids

Burning Miscanthus

Sawflies on willow

Spear Thistle first winter prior to flowering

It is not only insects that eat willow, we have seen entire experimental plots of a new willow variety completely eaten out by rabbits leaving other varieties completely untouched. In field-sized plots rabbits have not been as much of a problem as hares, which find young SRC, particularly in the highest sites, a favourable habitat and eat new shoots particularly in the first year after planting. Deer, fortunately not common in our study areas, will graze SRC and damaged one of our *Miscanthus* sites on the English border.

As for small mammal damage, keeping bank voles and wood mice in experimental cages with newly sprouted willow, we found only voles ate the shoots although a few shoots were incorporated into mouse bedding. Within SRC, although the predominant small mammal was the wood mouse, willow was also utilised by other larger animals such as mole, badger (used for cover and forage, particularly in dry conditions when, below canopy cover, the ground remained moister), foxes were frequent, and although not quantified, bats were often seen flying above and within more open parts of the coppice. By including the hedgerows and headlands not unexpectedly the small mammal fauna is almost exactly the same as that in headlands around energy grass crops (see Table 1).

Danielle Fry examined the use of SRC by birds to variously, feed, roost, breed or shelter depending on the species and the time of year. In early rotation willow, annual weeds dominate and granivorous birds utilise this resource. To assess seed production and utilisation some inter-row areas were netted to exclude birds with other areas left as controls. In energy terms the seed production at two sites was 7.15 and 5.13MJ.m^{-2} or 0.28-0.39kg.m^{-2} sufficient for birds to forage well into the winter.

Table 1. Small mammal combined totals for a south Pembrokeshire SRC site for 7 trapping occasions.

(All 10 traps per location)	Hedgerow	Headland	5m in crop	Crop centre
Bank Vole	16	2	3	0
Common Shrew	5	5	0	0
Pygmy Shrew	4	1	0	1
Short-tailed Vole/Field Vole	10	18	4	2
Wood Mouse	11	54	85	99
Yellow-necked Mouse	2	3	0	1

Starlings and winter thrushes (fieldfares and redwings) roosted in flocks within taller willow; groups of snipe regularly fed in winter within a wet willow site in Anglesey; barn owls fed along the headlands as coarse grass areas are often scarce on pastoral areas; at our Anglesey site SRC was also used as cover for game birds. Amongst the many species of birds utilising SRC for breeding were a range of finches, warblers, thrushes and buntings. The commonest breeding bird in all our sites was the willow warbler, which through radio-tracking was shown to occupy territories which rarely extended beyond the willow plantation. Indeed the highest densities of warblers in the vicinities of SRC plantations were in the plantations themselves.

Perennial Rhizomatous Grasses as Energy Crops

Some years ago, with a group of students, I visited a large plot of 3m high *Miscanthus* in Herefordshire in search of leaf eating insects. Ten man hours later our total catch was one (unidentified) caterpillar and except for some deer damage this was all the ecological interaction with the native or near-native fauna that we could find. This was in keeping with the perceived wisdom of that time that biomass crops were ecologically barren. But a brief snapshot of one measure of diversity in one field on one day holds little of scientific value.

In 2002, with Defra contract CFP 374/22, Semere and Slater began an investigation into the biodiversity of early establishment energy grass plantations looking at *Miscanthus*, reed canary grass *Phalaris arundinacea* and switch grass *Panicum virgatum*. Because of the difference in establishment support between England and Wales, much of our early work on perennial rhizomatous energy grasses took place in Herefordshire often only a few metres from the Welsh border beyond which public support was scarce. Of these three species, switch grass, from continental USA, was sown in spring 2002, but, in spite of initial rigorous weed control, its slow first year growth resulted in the loss of the crop to native invasive weeds and so was excluded from the

full trial, although in later years, plug grown plants of this and prairie cord grass *Spartina pectinata* were planted out for demonstration purposes in west Wales with good growth and survival rates.

In the largely arable landscape of Herefordshire, energy grasses, which require minimal chemical input in comparison to arable crops, benefit in terms of biodiversity because of untreated headlands and some weed species within the crops. *Miscanthus*, which takes several years to develop a closed canopy, was used by skylarks, lapwings, meadow pipits and grey partridge, most of the remaining 35 species of birds recorded from the crop were associated with the hedgerow/headland interface. The survey found that within the crop plus its headland there were 83 species of flowering plants and ferns, 69 species of beetle, 9 species of small mammal and 8 species of butterfly in addition to the birds.

Using Longworth traps, and sampling from mid-June to early October, small mammals were found in the following descending order of abundance: wood mouse *Apodemus sylvaticus* > field vole *Microtus agrestis* > yellow-necked mouse *Apodemus flavicollis* > bank vole *Myodes gareolus* > pygmy shrew *Sorex minutus* > common shrew *Sorex araneus* > water shrew *Neomys fodiens* > weasel* *Mustela nivalis* > house mouse* *Mus musculus* (*single records). Wood mouse was always most abundant within the crop and the field vole within the field margin. Water shrew was only found within established reed canary grass.

Subsequently, working with reed canary grass and *Miscanthus* in the pastoral landscape of upland mid-Wales, where the latter is at its climatic limit of cultivation, the biodiversity story was not greatly different, particularly as far as small mammals were concerned. Wood mice and yellow-necked mice roamed below the forest of *Miscanthus* canes. However, in the reed canary grass Victoria Tombs found some of the highest densities of field voles that we have ever recorded in any mid-Wales habitat.

To consolidate our information about the biodiversity potential of energy grass crops, Jenny Clapham studied sites across Wales from the English/Welsh border through mid-Wales to the far south-west in Pembrokeshire. In total, across her survey, eight small mammal species were found: wood and yellow-necked mouse, field and bank vole, plus common, pygmy and water shrew with harvest mouse *Micromys minutus* in Pembrokeshire. *Miscanthus* crops contained six species of small mammals with wood mice most abundant, and reed canary grass carried all eight species albeit in lower abundance. Grassy field margins carried only half the small mammal species of *Miscanthus*, and grazed pasture only two species.

At the Pembrokeshire site, in a study between spring 2009 and spring 2010, harvest mice were targeted and trapped in *Miscanthus* and reed canary grass as well as hedge-lines, spring barley and maize. Eighty harvest mouse captures/recaptures were made in the period of September to March with most coming from the reed canary grass, less from the *Miscanthus*, and none from any other habitat, although some old nests were found in the hedges around the biomass fields. Nests were found in the reed canary grass but none in *Miscanthus*. However, nests in *Miscanthus* are reported from Staffordshire and they are found in such crops in Japan. Unexpectedly high numbers of water shrew were also found, particularly in reed canary crops. Clearly these two energy grass crops show considerable value, particularly for small mammals but their value for other species should not be overlooked. In the Welsh environment, birds were also important, with migrant warblers present in spring and flocks of reed bunting using the *Miscanthus* as reed-like roosting sites in winter. Most of the farmland and hedgerow birds also foraged within the crops, particularly for weed seeds before canopy closure.

The harvesting of biomass crops tends to be in harmony with their wildlife. That willow is harvested on a short rotation ensures that all the stages of the crop are always present and energy grasses such as *Miscanthus* are not harvested until spring when their moisture content is lowest giving wildlife the value of winter cover.

Should we be concerned about the loss of food producing land to biomass? Taking a parochial view of Wales I think the answer is no. Much of the land is given over to the production of sheep and wiser council than mine once said that if all the sheep were removed from Wales, not a single person in the world (other than perhaps sheep farmers) would starve – but perhaps the next generation of energy crops grown for ethanol from cellulose might cause more concern.

Comparing SRC with previous arable crops in Yorkshire, the Game Conservancy Trust (Rich *et al*. 2001) reached the conclusion that *"no significant displacement of species has occurred. Some species may have actually been encouraged"* – modest but positive! The view of our researchers is even more positive and I believe that biomass crops in Wales, be they woody or grass have demonstrable benefits for biodiversity, particularly where they replace improved pasture or arable. Indeed, in biodiversity terms, we can convert an arable desert to a rich forest, albeit partly grass, with significant net gains in energy thrown in – a pretty good deal in my view!

Acknowledgements

Thanks to all the students and staff of Cardiff University who have helped to collected the data that I have used here, unreferenced statements are from unpublished reports.

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About the Author

Fred Slater was a pioneer of biomass crops in Wales, an interest which has continued for two decades. For 35 years he was Director of Cardiff University's Llysdinam Field Centre in mid-Wales supervising a wide spectrum of ecological teaching and research. He became a Fellow of IEEM in 1998.

Contact Fred at:
slaterfm@cf.ac.uk

Figure 2. Aerial view of Central Section. Picture credit: SSE Renewables

Role of the ECoW on Clyde Wind Farm

Joe Deimel MIEEM
Land Use Consultants (LUC)

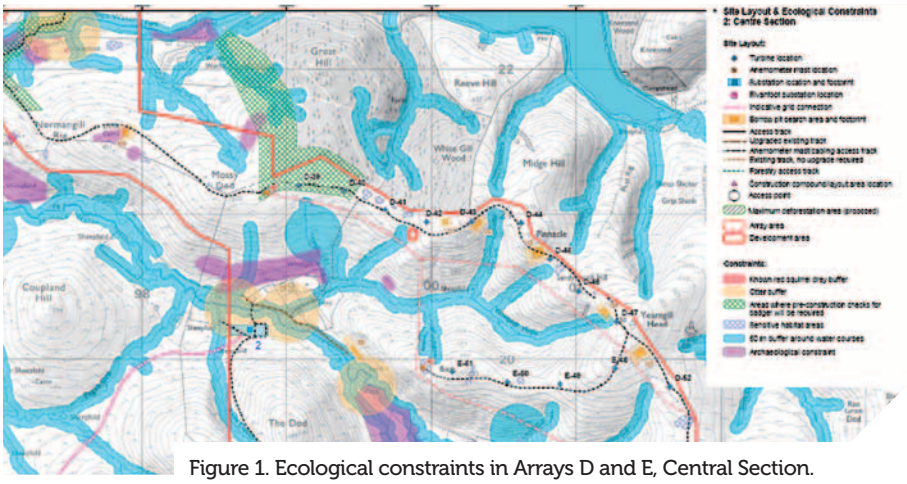

Figure 1. Ecological constraints in Arrays D and E, Central Section.

Introduction

Clyde Wind Farm, a development by SSE Renewables, is one of the largest wind farm sites in Europe with 152 turbines spread across 47km^2. The wind farm is located in the southern upland hills between Biggar and Moffat in South Lanarkshire, Scotland. Given the scale and location of the wind farm, sensitive environmental and particularly ecological management have been central to the project; the Ecological Clerk of Works (ECoW) develops and co-ordinates this management during construction.

On behalf of SSE Renewables, LUC has been involved in the project since 2002, undertaking ecological baseline surveys, producing the Environmental Statement and (following granting of planning permission) providing ECoW services. This article details the day-to-day duties and challenges faced by the ECoW over the last three years, as construction has progressed. Through delivery of this role, LUC has been able to ensure protection of species and habitats of ecological value, while

contributing to longer term management objectives through co-ordination with the Habitat Management Plan Officer for the Clyde Wind Farm.

The site

Key habitats and species of ecological value at the Clyde Wind Farm include:

- blanket bog
- dry and wet dwarf shrub heath
- unimproved acid grassland
- otter
- badger
- mountain hare
- red squirrel

Blanket bog and dwarf shrub heath occur throughout the upland areas of the site, with unimproved acid grassland at lower levels. Badger and red squirrel are present in areas of plantation forestry, with otters utilising watercourses across the site.

The Clyde Wind Farm is very extensive, with a 105km network of access tracks. The site is divided into three construction zones, defined as North, Central and South Sections. Driving from the main site compound of any given section to the most far-flung turbine arrays takes approximately an hour, so ECoW activities had to be carefully planned to ensure good coverage of construction works.

Due to the undulating, upland topography in which the wind farm is situated, weather conditions tend to be cool and generally wet. During winter 2010, temperatures fell to -23°C, at which point construction activities were suspended as diesel in excavators and other machinery had frozen!

Figure 1 shows ecological constraints identified in Turbine Arrays D and E, Central Section, with Figure 2 providing an aerial view of Central Section.

Role of the ECoW

The ECoW's responsibilities can broadly be split into four main areas:

- management of protected species;
- management of sensitive habitats;
- liaison and coordination of parties; and
- site monitoring (focusing on drainage) and reporting.

Management of Protected Species

Early-stage ECoW activities included checks for sensitive habitats (in particular blanket bog) and protected species (otter, red squirrel, badger, reptiles and mountain hare) immediately in advance of soil stripping during access track and turbine base installation. The resolution of any protected species issues on site, despite its scale, proved to be a relatively straightforward task. This was largely due to the comprehensive surveys LUC undertook as part of the EIA and at the pre-construction stage. Insufficient surveys at either of these stages could have resulted in unnecessary delays had new protected species interest been recorded during the construction stage.

The potential cost implications of such delays are illustrated by two pairs of swallows that established nests in tower sections of one of the final turbines to be erected on site in the Central Section. The nests were established in September 2012, in the week prior to the scheduled erection of the turbine. The ECoW (with guidance from the Ornithological Clerk of Works) monitored the nests until it was confirmed that they were no longer in active use. In this instance adverse weather conditions delayed tower installation until after the swallows had successfully fledged, however should lifting cranes have been required to stand idle while the nests were in active use, each additional day of delay would have resulted in substantial additional costs.

In general, establishment of 'no-work' ecological safeguard zones around otter shelter locations, red squirrel dreys and badger setts ensured that direct physical disturbance to protected species, and indirect disturbance from noise or light pollution, were prevented across the site.

Licences from Scottish Natural Heritage (SNH) were required in two areas to allow disturbance of a badger sett and an otter holt. The licence applications were supported by comprehensive mitigation plans, produced and then implemented by the ECoW. The ECoW closely monitored works in these areas to ensure that the conditions of each licence were followed. With respect to an otter licence, SSE Renewables provided a 'camera trap' (Bushnell Trophy Cam) to monitor the effectiveness of mitigation. Footage of otters investigating the shelter and moving along the bank of the adjacent watercourse was obtained on multiple occasions during and after construction of the bridge, indicating that mitigation had been successful in minimising disturbance to otters. A still from this monitoring footage is shown in Figure 3.

Figure 3. Adult otter investigating entrance to holt, during construction phase of nearby bridge.

Ornithology did not fall directly under the ECoW remit, with a separate Ornithological Clerk of Works (OCoW) employed at the wind farm to cover bird related aspects. However, the ECoW occasionally undertook monitoring and provided advice to SSE Renewables for ornithological issues, under guidance from the OCoW.

Management of Sensitive Habitats

As part of the original site team, the ECoW provided initial guidance on appropriate siting of access tracks. Although the overall site layout had been assessed during the EIA for the project, planning conditions allowed for a 50m micro-siting zone around the agreed footprint. From an early stage, the ECoW made use of this micro-siting tolerance to suggest route alterations to avoid sensitive habitats such as blanket bog.

Where construction activities were in close proximity to sensitive habitats, exclusion fencing or roping was set up to prevent disturbance during works. An exclusion zone around blanket bog in Array A, North Section, is shown in Figure 4.

As far as possible, construction in sensitive habitats was avoided through micro-siting. However, engineering constraints and the necessity to build tracks and other infrastructure at high elevations meant that some works in sensitive habitats were inevitable. Where such habitats could not be avoided during construction, careful management of stripped vegetation was carried out to maximise the opportunity for successful re-establishment of appropriate plant communities on track embankments and other areas that were restored following construction works.

For blanket bog habitat, soil stripping was carried out in stages, with peat turves containing the vegetated mat and the top 150mm of peat excavated and stored

Figure 4. Fencing erected around blanket bog to mark exclusion zone during works at adjacent turbine.

adjacent to the works area, separate from the sterile, deeper layers of peat. Following backfilling or restoration of works areas, turves were replaced with the vegetated surface uppermost, on top of restored sterile deep peat. Handling of turves was kept to a minimum as this could have affected the integrity of the vegetated mat layer, reducing the likelihood of successful vegetation regeneration. The ECoW provided well-received toolbox talk briefings alongside direct guidance to contractor crews, to ensure that any difficulties in applying these techniques were overcome.

Due to engineering and topographical constraints, some areas of the site were not suitable for effective reinstatement of the original vegetation. In these sectors, supplementary seeding was applied to bare embankments and cuttings, using seed mixes containing species representative of the surrounding habitat types. The constituent species were discussed and agree with the Habitat Management Plan officer for the site, to ensure they contributed to the establishment of the desired post-construction habitats. The ECoW co-ordinated design and implementation of the seeding programme, in close liaison with SSE Renewables and the engineering Principal Contractors (PCs).

Liaison and Co-ordination of Parties

Given the scale of the project, one of the major challenges encountered by the ECoW at Clyde Wind Farm has been the management of positive communication.

Under planning conditions for the wind farm, the ECoW held responsibility for co-ordinating ecological and environmental monitoring and protection activities carried out by SSE Renewables, the major PCs on site and their sub-contractors, environmental consultants

specialising in peat management and water quality, and drainage designers.

Over the course of the construction at Clyde there have been five PCs, each employing a number of engineering sub-contractors: at the peak of construction works approximately 400 personnel were working on site. This created a challenge for the ECoW to ensure that all staff were fully aware of the environmental sensitivities of the site and their responsibilities. Each PC employed their own environmental specialists, with whom the ECoW worked closely to ensure that environmental procedures were followed. Due to some variation in content of environmental and ecological method statements between PCs, the ECoW provided a co-ordinating role to the PC environmental managers, to ensure consistency of approach. At times of high construction activity and works in sensitive areas, two ECoWs were present on site to manage the workload and to ensure effective communication.

To enable this extensive team of specialists to work effectively together, a number of technical reporting mechanisms were set up to allow for comments or objections to be collated and resolved in an efficient manner. These included technical queries (TQs) and temporary works approval requests (TWARs) through which the PCs provided details of additional or amended work proposals. TQs and TWARs were issued to the ECoW and other project environmental specialists, to enable comments and environmental requirements to be collated.

In addition to this, the ECoW chaired fortnightly Environmental and Ecological Protection Group meetings, attended by SSE Renewables, Planning Monitoring Officers (PMOs), and site environmental specialists. These meetings proved to be a key tool to ensure that information was disseminated successfully around the project team, providing a forum for open discussion of environmental problems arising on site and enabling common goals to be agreed. The regularity of the meetings enabled issues arising on site to be rapidly addressed by gathering all interested parties together in one room at one time, not an easy feat on a project of this scale.

SSE Renewables were keen to co-operate closely with the statutory regulators and the ECoW provided specialist liaison with SNH and the Scottish Environment Protection Agency (SEPA) during resolution of ecological issues. This was particularly important during occasions of silt run-off into watercourses, which required prompt environmental responses. Through the ECoW, SSE Renewables were able to keep SEPA informed when such problems occurred; the ECoW was then able to discuss remediation options with SEPA and provide guidance back to SSE Renewables, to ensure the most effective solutions were used.

Figure 5. 'French drain' installed alongside link track in North Section.

Site Monitoring and Reporting

One of the main day–to-day tasks of the ECoW is to provide an on-site presence, driving across sections of the site to view ongoing construction activities and monitor site drainage. At Clyde Wind Farm drainage has been a key issue due to the high volumes of rainfall at the site, and the large number of small watercourses present. Run-off contaminated with silt represents one of the major ecological impacts of construction work, with potential to reduce the quality of fish spawning areas in watercourses downstream of the works, and to reduce the diversity of aquatic invertebrate communities. The ECoW worked closely with SSE Renewables and the PCs to advise where upgrades to site drainage measures were required, and to recommend where these could be best sited for minimal adverse impact on surrounding habitats. An example of an effective additional drainage installation, a clean-stone 'French drain' built to treat silty run-off arising from the link track between Arrays A and C, North Section, is shown in Figure 5.

The findings from the site monitoring inspections are recorded within monthly

reports, distributed both to the site construction team and to the statutory regulators. These reports detail the actions arising from each month, for example, where drainage issues have been encountered and additional pollution prevention measures are required. The monthly reports are used as reference documents; any required actions are discussed within the following month's report to ensure that they were resolved swiftly. Other reporting carried out includes the management of a species log, which records sightings or evidence of protected species; all members of the site team are encouraged to report sightings to the ECoW and many are keen to be involved. The log successfully enables the ECoW to action additional measures required with respect to protected species as and when they arise.

Key Tools Used by the ECoW

The work of the ECoW is guided by mitigation recommendations given in the Environmental Statement and other planning documentation, including the 'Ecological Protection Plan' (EPP) for the wind farm construction phase. Together these documents provided comprehensive guidance for all ecological issues likely to be encountered during construction works (with the exception of ornithology, covered separately). On a site the scale of Clyde Wind Farm it has been extremely important to have this established set of procedures and by having these agreed with all parties during the planning process, it has allowed rapid mitigation decisions to be made.

The EPP is the core working document for the ECoW. It contains a description of the roles and responsibilities of the ECoW, details of Protection Plans for mammals, reptiles, terrestrial habitats and freshwater habitats, and detailed guidance on the responsibilities of the PCs. Step-by-step instructions are given for responses to potential ecological issues, in a format suitable for incorporation into contractor method statements. Guidance within the EPP, supplemented by photographs and figures, is used as the basis for toolbox talks provided by the ECoW at the start of each construction phase and incorporated into contractor health, safety and environment briefings.

The ECoW has been able to use the EPP to support decisions which sometimes have had programme and/or cost implications. For example, during construction of the North Section enabling works track, a dry stone wall was present at a field boundary; track construction was delayed for a number of days until a works crew could be organised to conduct a destructive search of this wall, in case reptiles were sheltering within it. The ECoW was able to refer to the Reptile Protection Plan to provide reasoned justification for the delay, providing reassurance to SSE Renewables and the PCs that such a delay, until completion of the destructive search, was a requirement under the planning conditions.

The Next Steps - Contribution to Habitat Management Plan

Long-term habitat management at the Clyde Wind Farm will be delivered through a Habitat Management Plan (HMP). The HMP is managed by SSE Renewables and covers an area of 31.5km^2, providing a valuable opportunity for large-scale habitat management. The key aims of the HMP include:

- management and enhancement of the existing ecological value of the HMP area; and
- restoration and creation of valuable habitats, including upland heath, grassland and native broadleaf woodland, on previously forested areas.

In 2011, SSE Renewables appointed a dedicated officer to manage the ongoing development and implementation of the HMP. This not only demonstrated SSE Renewables's commitment to habitat management but provided a specialist point of contact for the ECoW through the main construction phase. The early establishment and ongoing development of an effective working relationship between the ECoW and HMP Officer has ensured that the aims of the HMP were not adversely impacted during construction.

A key area of liaison with the HMP Officer has been with regards to reinstatement. In areas where reinstatement using turves had been a challenge or unsuccessful, the ECoW worked closely with the officer as well as SNH to ensure that proposed seed mixes or plug plants, in specific locations, were suitable for the site and met the requirements of the proposed habitat management.

Close liaison with the HMP Officer also proved to be valuable in supporting management decisions with third parties, including PMOs, SNH and with SSE Renewables. Following completion of the construction phase the HMP will continue to be implemented by SSE Renewables throughout the lifetime of the wind farm.

Conclusions

The ECoW services provided at Clyde Wind Farm are a good example of the challenges faced by ecologists working on large-scale wind farms. At Clyde Wind farm the complex terrain provided both environmental and engineering challenges with the key concern centred on drainage and the provision of effective control of silty run-off. Whilst ecologists may be well-trained in protected species surveys and the recognition of sensitive habitats, these concerns highlighted the need for ECoWs to have a working understanding of wider environmental issues and the construction/engineering process.

The Ecological Protection Plan, developed at an early stage in the Clyde Wind Farm development, was a highly effective reference document. Its approval during the planning submission process prevented the need for lengthy discussions during the construction phase and allowed for the speedy and successful resolution of ecological issues.

The early establishment of open lines of communication and close collaborative working with the Habitat Management Plan Officer, the SSE Renewables site team, Principal Contractors and other parties has been crucial to the success of the ECoW role at Clyde Wind Farm. This approach has enabled the effective protection of the site's ecological value during the construction phase, contributing to the future success of the Cyde Wind Farm Habitat Management Plan.

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About the Author

Joe Deimel has been working for LUC as an ECoW on Clyde Wind Farm since January 2011. Joe is a full member of the Institute of Ecology and Environmental Management, and a member of the Association of Environmental and Ecological Clerks of Works.

Contact Joe at:

joe.deimel@landuse.co.uk

Wind Speed and Bat Activity: Assessing and Mitigating the Effects of Wind Turbines

Mike Gray CEnv MIEEM
Arcus Consultancy Services

Peter Owens MIEEM
Arcus Consultancy Services

Mike Armitage CEnv MIEEM
Arcus Consultancy Services

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Summary

Wind turbines pose a novel hazard to bats, but the effects of wind turbines on bats in the UK are poorly understood, despite the large number of operational wind farms. Methods for the assessment and mitigation of the potential effects of wind turbines on bats in the UK are not yet well developed or evidence-based and so assessments remain open to scrutiny and disagreement. We outline a method for assessing both the risk to bats and for establishing mitigation based on an analysis of bat activity in relation to wind speed.

Introduction

Methods for the survey, assessment and monitoring of birds are reasonably well established (e.g. Band *et al*. 2007; Scottish Natural Heritage 2005; Natural England 2010), but similar methods for bats are only recently emerging (Hundt 2012) which may help to improve consistency among wind farm assessments and ensure that results and conclusions are more robust. Nonetheless, there remains a lack of sound UK-based research and evidence to help ecologists, developers and statutory nature conservation organisations (SNCOs) understand the results of surveys and to make well-informed assessments and decisions. In the absence of such evidence, decisions about the effects of wind energy developments are based on precautionary principles, general guidance, or examples from other countries, which may risk over- or under-estimating the effects of a development. The risk of under-estimating the effects of wind turbines on bats may allow developments to proceed with harmful effects. The risk of over-estimating the effects of wind turbines on bats may mean that a development is refused planning permission

or that mitigation is proposed which is either unnecessary or makes a development unviable. Given that the effects of wind turbines may not be known for many years, despite ongoing research into the subject (e.g. Jones *et al*. 2009), there is an urgent need for practical and straightforward tools that provide decision-makers with suitable information on which to base their decisions.

The method described analyses bat activity in relation to wind speed and provides a tool for assessing the risk to bats and can be extended to help inform mitigation proposals. The method is site- and species-specific and is appropriate to all sizes of development. We do not intend for this method to be the only way in which the effects on bats can be assessed – other methods, including professional judgement and experience, remain valuable – but it does provide an objective approach to an often subjective issue. The method should therefore provide decision-makers with valuable information on which to base their decisions, and may improve the accuracy and transparency of assessments. We describe only the basic elements of our approach, but a detailed, step-by-step method and example data sets are available from the authors, and we would welcome correspondence with readers interested in discussing or applying the methods in their own work.

Bats and Wind

Research into the effects of wind farms on bats is reasonably well established in North America and some northern European countries, notably Denmark and Germany, where small- to large-scale research projects have investigated many aspects of wind farms, including: pre- and post-construction monitoring techniques; the efficacy of mitigation; the behaviour of bats; and causes of mortality. Comprehensive reviews of current research into the effects of wind energy on bats are provided by Jones *et al*. (2009) and Ellison (2012), the former particularly focussed on the UK situation. Some of the most important research to date, in terms of our understanding of effective assessment and mitigation, has come from wind farms in North America which show that environmental variables, particularly wind speed, may have a valuable role to play in predicting and mitigating effects.

Bat activity is generally acknowledged to be negatively associated with wind speed, whereas the operation of wind turbines is positively associated with wind speed until an upper limit is reached. In other words: at higher wind speeds, bat activity is likely to be relatively low whereas turbines are more likely to be operating, and vice versa. Turbine operation and bat activity are therefore inextricably linked by wind speed, but it is only relatively recently that research has demonstrated how this link can be used to inform mitigation. Research from North America (Baerwald *et al*. 2009; Arnett *et al*. 2011) demonstrates how the cut-in speed of wind turbines (i.e. the minimum wind speed at which wind turbines begin rotating) can be manipulated to significantly reduce bat mortality. A recent collaboration between wind turbine manufacturer Nordex and researchers at Biotope has provided a system which models a multitude of environmental variables to predict bat activity near turbines and to modify the operation of turbines accordingly. However, these examples have resulted from long-term, well-funded collaborative research (between developers, national agencies and academics) which is unlikely to be viable or appropriate for the many smaller-scale UK developments. Whilst a consideration of many environmental variables may provide accurate predictive models of bat behaviour, such models may be time-consuming and difficult to parameterise or may lack applicability among sites, regions or species. Simpler models with fewer parameters and fewer assumptions are more easily understood and offer an intuitive, transparent approach to predicting bat activity, albeit at the cost of some accuracy.

Survey Methods

The method described assumes that a meteorological (met) mast is installed within the development site. Met masts have anemometry equipment mounted at known heights, and it is recommended that automated bat monitoring equipment is mounted at corresponding heights; 30m and 50m are typical and correspond, approximately, to the lower and middle reaches of the rotor-swept height of a typical medium-large turbine. Although the method described is based on remotely monitoring bat activity with AnaBats (with extended microphones), it is applicable, with modifications, to data generated by other remote monitoring and handheld bat detectors. Bat monitoring equipment is best mounted at the same time as met mast installation, although methods for retro-fitting such equipment on fixed met masts, and for monitoring bat activity and wind speed at height in the absence of fixed met masts, are available.

The equipment setup should therefore comprise AnaBats (or microphones) mounted at ground level, 30m and 50m above ground level. Every bat call recorded by an AnaBat can therefore be attributed to a wind speed at that point in time (because AnaBat files and wind speed data are time stamped), thereby providing an opportunity to investigate relationships between bat activity and wind speed. The larger the sample size (i.e. number of nights and/or times of year), the more robust the analyses. Wind speed is seldom measured at ground level, however wind speeds at heights beyond the range from which actual wind speeds were recorded can be accurately estimated (see Bowdler *et al*. 2009), although these are not discussed here.

Analyses

It is important that investigations of bat activity and wind speed do not oversimplify a potentially complex and sensitive association, for example, by crudely comparing nightly bat activity with nightly mean wind speeds. AnaBat files should be analysed in the usual manner to identify species, but the following analyses require that wind speed and AnaBat data are recorded simultaneously and output into the same time period. For example, mean wind speed per 10 minute time period and mean number of AnaBat files for the same 10 minute period. These outputs allow the mean number of AnaBat files (or passes/registrations) to be associated with a given mean wind speed at a given height. The frequency of bat passes for a given wind speed range can now be calculated from the whole dataset (i.e. pooled across all heights) to examine bat activity in relation to wind speed irrespective of height above ground, typically presented as a histogram or tabulated as in Table 1. Note that only wind speed data from periods when AnaBats are recording (typically from around dusk until dawn) should be included in the analysis. The dataset can also be divided, if sample sizes are sufficiently large, into smaller subsets to investigate patterns for individual species or groups of species, such as 'high-risk' or congeneric species.

Table 1. Bat activity and wind speed (example Site A)

Wind Speed (m/s)	Number of passes	Cumulative number of passes	Cumulative % (N = 485)
0.0–<0.5	33	33	7%
0.5–<1.0	20	53	11%
1.0–<1.5	32	85	18%
1.5–<2.0	37	122	25%
2.0–<2.5	38	160	33%
2.5–<3.0	29	189	39%
3.0–<3.5	50	239	49%
3.5–<4.0	67	306	63%
4.0–<4.5	62	368	76%
4.5–<5.0	37	405	84%
5.0–<5.5	20	425	88%
5.5–<6.0	28	453	93%
6.0–<6.5	20	473	98%
6.5–<7.0	4	477	98%
7.0–<7.5	7	484	100%
7.5–<8.0	1	485	100%
8.0–<8.5	0	485	100%

The dataset for example Site A (Table 1) shows the mean number of bat passes per wind speed interval and thus provides an initial indication of how bat activity is associated with wind speed. However, the association between bat activity and wind speed is more clearly understood by calculating the cumulative number or percentage of bat passes with increasing wind speeds which shows how much of the total recorded activity is likely to occur at a given wind speed, particularly at the cut-in speed for the candidate turbines.

The way in which bat activity is associated with wind speed is more clearly seen by plotting an activity accumulation curve (see Figure 1) which can be valuable in demonstrating the strength of association or inflection points – critical wind speeds at which bat activity changes markedly. At Site A, bat activity is less affected by wind speed and only 39% of bat activity was recorded at wind speeds below 3m.s^{-1} (the cut-in speed for many candidate turbines); however, at site B, bat activity is more clearly affected by wind speed and over 70% of activity was recorded at wind speeds below 3m.s^{-1}. The figure also provides a valuable tool for estimating bat activity at alternative cut-in wind speeds: raising the cut-in speed to 5m.s^{-1} would mean that only approximately 84% of bat activity at Site A, and 94% of activity at Site B would occur when turbines would not be operating. The threshold for determining what might constitute a significant collision risk, or for setting acceptable cut-in speeds, will depend on many other factors, including absolute number of bat passes (rather than percentages), species biology, development proposals and economics.

Wind shear is the difference in wind speed at different heights above ground. For example, a 60m hub-height wind speed of 3m.s^{-1} may be measured at 20m and 80m above ground level at 1.5m.s^{-1} and 5m.s^{-1}, respectively. It is clear, therefore, that comparisons between wind speed measured at height and bat activity measured at ground level require careful interpretation, and the effects of wind shear must be considered in analyses and when determining potential operational mitigation.

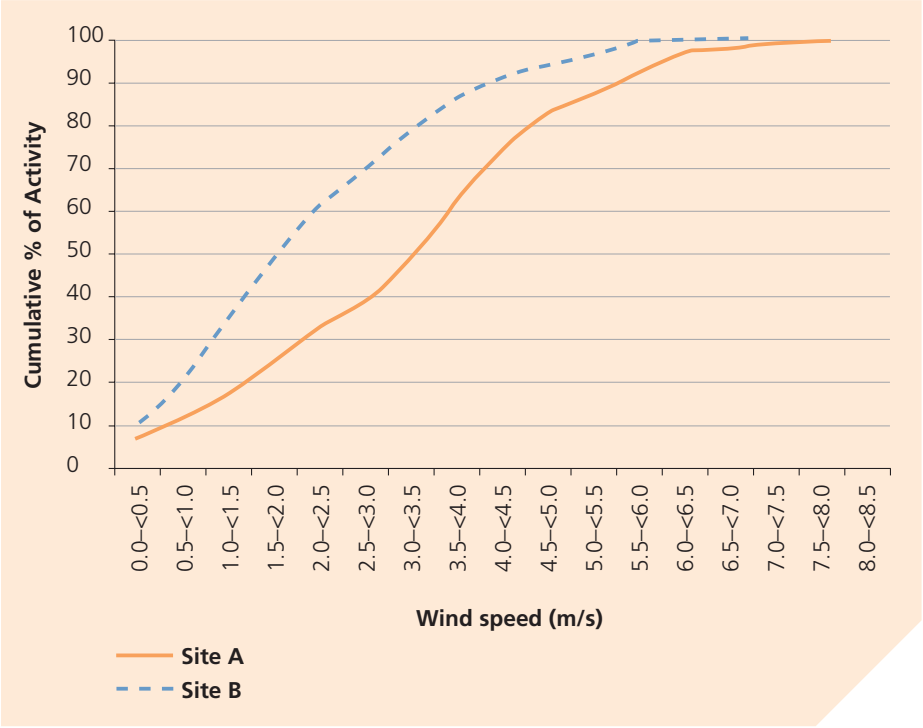
These basic analyses can be extended in many ways, for example by examining bat passes per unit time (sometimes called a Bat Activity Index), analysing data from two or more met mast monitoring locations within a site, examining nightly and seasonal temporal patterns of activity, or estimating how bat activity differs between different heights at a given wind speed, the latter demonstrating how bat activity only in the rotor-swept zone is affected by wind speeds.

Conclusions

It is important to note that the sampled bat activity is likely to represent only a proportion of that present across a wind farm, and so the analysis of bat activity and wind speed as described, whilst providing an important and quantifiable part of an assessment, should be combined with other survey results, local knowledge, development proposals, etc. to inform assessments. The method is also more suited to sites with high levels of bat activity, which are also inherently more sensitive, since small sample sizes will yield unreliable results. In addition, if limited bat activity is recorded at height, then examining bat activity and wind speed may not be necessary because the sample size would be small and collision-risk might reasonably be considered unlikely.

The lack of empirical evidence about the effects of wind farms on bats is not a reason to hold back their development but, instead, should be the impetus for more research to make sure that decision-makers are well-informed and that the necessary safeguards to conserve bats are in place.

Figure 1. Activity accumulation curve



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Training event

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About the Authors

Dr Mike Gray is a Principal Ecologist with Arcus, specialising in the Ecological Impact Assessment of onshore wind farms.

Peter Owens is a Senior Ecologist and Natural England-licenced bat worker with Arcus, specialising in the survey and assessment of bats for onshore wind farms.

Mike Armitage is an Associate Director with Arcus, specialising in the Ecological Impact Assessment of onshore and offshore wind farms.

Contact them at:
info@arcusconsulting.com

How Not to Write an Ecological Impact Assessment

Katherine Drayson
Oxford Brookes University

Stewart Thompson MIEEM
Oxford Brookes University

This slightly tongue-in-cheek opinion piece aims to give practitioners an insight into some of the pitfalls that are all too easy to fall into when writing an Ecological Impact Assessment (EcIA) chapter.

EcIA is *"a formal process of defining, quantifying and evaluating the potential impacts of defined actions on ecosystems"*[1]. Given this definition, you would be forgiven for thinking that EcIA chapters are dull academic documents, dry as dust and full of statistics and graphs. But in the course of reviewing 112 EcIAs over the past three years, we have discovered not only some disappointing facts[2] but some comedy gems.

In the interests of science communication, and hopefully improving EcIAs at the same time, here are a few of the choicest (anonymous) findings. As you read on, it is worth bearing in mind that all of the EcIAs were submitted from 2000 onwards (i.e. they're relatively recent) and all were granted planning permission (so these errors have been missed by the decision-making authority and consultees).

Emotive/Unscientific Language

Ecology is a science[3], although a young one[4]. To maintain a credible reputation, ecological consultants have the unenviable task of having to balance scientific accuracy with readability. The majority of EcIAs managed this balancing act well, but there were enough EcIAs wobbling on the tightrope to give some cause for concern. This included EcIAs co-ordinated by large and reputable ecological consultancies. Having gone through the EcIAs, we have picked out words or short phrases that should be avoided because of their imprecision and/or emotiveness (Table 1).

A personal favourite was this EcIA sentence explaining why trapping was not conducted for an invertebrate survey: *"Furthermore, because of a misguided sense of animal rights, many urban-dwelling people are offended by traps that kill insects."* Whilst there was certainly an issue to be addressed, a more balanced approach in this instance might have been: *"Insect trapping was avoided, as previous experience in the area has shown high rates of trap removal by the public"*, followed by a description of the other methodologies used.

Table 1. Examples of emotive or unscientific language to avoid in EcIAs.

Emotive/Unscientific Language To Avoid	
Notoriously	More-or-less
Strange	Somewhat
Simply	One kind or another
Theoretically conceivable	Eminently re-creatable
Burdened	Once cattle or whatever were sourced
Improbable notion	Modest
Conjured	Believed
Self-evidently	Bereft

Spelling and Grammar

Given the number of times EcIAs should have been reviewed before submission to the developer, there is no excuse for poor spelling and grammar. Letting simple errors through does not induce confidence in the reader that larger errors were avoided. Here, we have selected some of the best (or worst, depending on your point of view) examples of spelling and grammatical errors, in no particular order (Table 2). It should be noted that several of these errors would have been picked up by commercially available spelling and grammar checking facilities.

Table 2. Examples of spelling and grammatical errors in EcIAs.

Offending Sentence (errors are in bold)
The Phase 1 Habitat Survey assessing higher plants identified **mascular** plant communities as set out in Figure 1.
Refuse Searches 8.8.6 Terrestrial shelter (rubbish, logs, stones **etc**) was searched to try and locate the presence of any newts in land surrounding the water bodies.
The construction process, demolition of buildings and loss of **tress** within the ZoI could have a negligible to slight negative residual effect, but not significant, effect within the ZoI.
No signs of water voles were found anywhere other than in **the .**
Details relating to whether or not these **pants** may be conserved *in situ*, require translocation or other means of conservation, will be agreed with English Nature.
Typically flounder **feed invertebrate** with the incoming tide.
The…breeding bird survey did not identify **shell duck** or wheatear as confirmed breeding species.
Linnett (*Carduelis cannabina*)
…with other grass species present in smaller proportions including Yorkshire fog (*Holcus lanatus*), **red rescue** (*Festuca rubra*) and meadow grasses (*Poa species*).
The best period to undertake felling works for trees that do not have confirmed bat **roast** status is in spring…

Lack of Rigour

It is easy to rush through an EcIA when you are over budget and lacking sleep from too many bat surveys. But it is important to make sure your writing is clear and your arguments fully justified, both to create a good impression with the readers of the EcIA and to prevent requests for clarification from the developer, planning authority or consultees. These were just a few of the shortest examples of poor argument and reasoning we came across (Table 3).

Conclusion

With a review of 112 documents at an average of 35 pages each (although some were several hundred pages long), it was inevitable that there would be some mistakes and errors in judgement. On the whole, the writing style of EcIAs is appropriate but there is still plenty of room for improvement. With IEEM applying for a Royal Charter, its members need to take greater responsibility for the reports that they write.

Table 3. Examples of poor argument and reasoning.

Poor Reasoning	Comments
The rest of the building was in a poor state of repair and so offered limited bat potential. The two marina office buildings are in a good state of repair and consequently have limited bat potential.	This indicates that both poor and good states of repair result in limited bat potential. There was no further explanation of this in the EcIA.
A further potential impact is damage to the Copse during construction through access to the site by contractors. Since the site lies outwith the application boundary, there will be no effect.	This suggests that all impacts beyond the site boundary are to be dismissed, contrary to IEEM's recommendations of identifying the Zone of Influence.
The effects of lighting on bat activity are poorly understood, and conflicting reports exist regarding the disorienting effects of strong lighting and, conversely, the beneficial effects of certain types of lighting in attracting insect food for bats. Overall, there are unlikely to be any significant impacts on bats associated with this phase of the development.	Acknowledgement of the poor state of knowledge is good, but either the Precautionary Principle should have been employed here, or a further explanation as to why it is considered that there won't be any significant impacts provided.
The mitigation/compensation measures would substantially ameliorate these impacts; however, short term losses of irreplaceable habitats would only be compensated fully in the long term.	The loss of irreplaceable habitats cannot, by definition, be compensated fully.

Cyclamen *Cyclamen hederifolium*, Kent. Photo by Katherine Drayson

Common red soldier beetle *Rhagonycha fulva*, Kent. Photo by Katherine Drayson

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Training event

IEEM are offering a suite of courses on EcIA at beginner, intermediate and advanced levels. For further details and to book a place visit www.ieem.net/events.

About the Author

Katherine Drayson is a final year PhD student at Oxford Brookes University's Faculty of Health and Life Sciences, supervised by Stewart Thompson. She previously worked as an ecological consultant for two years.

Contact Katherine at:
katherine.drayson@brookes.ac.uk

Stewart Thompson is a Professor in Biodiversity Conservation at Oxford Brookes University's Faculty of Health and Life Sciences.

Contact Stewart at:
sthompson@brookes.ac.uk

Improving the Evidence in Evidence-Based Conservation

John Altringham
Professor of Animal Ecology and Conservation, University of Leeds

Harp traps at cave

Introduction

The importance of giving conservation an 'evidence-base' is widely acknowledged, but the concept is not always fully understood or applied. Evidence-based conservation is as much a question of approach as the application of technology and technique. All we have to do is think more carefully about our objectives, follow some simple rules, and bring a little science into the process. So it should be easy, right? If only! Clear thinking and planning can be hard work, and simple rules may be difficult to apply to complex situations. But, if we are to raise standards we have to try. This article is a call for the wider application of a more objective and thoughtful approach to some areas of practical conservation.

A core principle of evidence-based conservation is that methods of assessment, management, monitoring and mitigation must be tried and tested – they must be known to work. If the evidence for their effectiveness is lacking then obtaining that evidence should be an integral part of the conservation process. Gaps in our knowledge should be progressively filled and methods improved. However, practice lags behind theory and we often have little or no objective evidence to demonstrate whether or not our actions have had the desired effect – we cannot distinguish success from failure. Some of the problems result from time and cost constraints that can be hard to overcome when dealing with planners, builders and others whose first concern may not be nature conservation. We may also be limited by technology and expertise, which is why we constantly seek to improve both. However, failure is often also due to a lack

of clarity and rigour in planning, executing and reporting conservation work. These are things we ought to be able to do something about. Some aspects of good practice may appear self-evident and beneath discussion, but my experience suggests otherwise, so this article will cover issues that may seem trivial. I apologise if I offend or bore some of my readers, but all stem from real cases I have encountered, primarily in my work with bats. However, the issues are not restricted to bats – most are generic and relevant to other areas of conservation practice.

Consultants *Should be* Scientists

In conversation with ecologists from a well-known consultancy I was told: *"We aren't scientists, we don't do science, it's not our job."* I think they are wrong and I know many other consultants would agree with me, but the view does appear to be widespread. Many of the core activities in ecological consultancy must adhere to basic scientific principles. Conclusions drawn and recommendations made should, whenever possible, be supported by verifiable, repeatable, unbiased data. Just because the nature and volume of data that can be collected are constrained by time, money and the client's needs, does not mean that the basic rules can be ignored. We must gather and present our evidence objectively and we must still assess that presented by others with the same objectivity.

The view that consultants should be scientists is supported by the law itself. To comply with EU law, planners, in determining whether or not to approve a development, must assess the possible detrimental effects of the development and be confident that *"...no reasonable scientific doubt remains as to the absence of such effects"* (European Court of Justice Case C-127/02, Waddenzee Case 2004). The onus is therefore on planners to demonstrate scientifically-based confidence in the mitigation. This confidence must generally come from the evidence prepared by the consultants in the case. It is often all too easy to drive a bus through the holes in this evidence because work has not been conceived or carried out on even the most basic scientific principles. The weak evidence that results from poorly designed and executed work is often the source of expensive disputes between developers and conservationists.

Working Together

In a recent article, Hill and Arnold (2012) made an important distinction between consultancy and academic research: academic evidence must be compelling before it can be published, but consultants must often make judgements based on poor evidence. I accept the distinction, but consultants who apply research principles to their work whenever possible, make better judgments and contribute to the evidence base. We need to improve data sharing between consultants, NGOs, SNCOs and academics to build the conservation evidence base. Practical conservation research is low on the agenda of most funding agencies, so academics are as resource-constrained as everyone else. Sharing data has the potential to do great good – but the data need to be fit for purpose. In universities there are PhD, masters and undergraduate students eager to make use of good data from consultants and licence returns.

Let's work through the steps of a hypothetical case study, from starting brief to final report and recommendations, and take a look at some of the issues. If it feels like you have been dragged back into a university lecture – sorry, but I hope you find some points useful!

What, *Precisely*, Do You Want to Find Out?

Whatever the project, it will involve some form of information gathering. This information will be the raw material you use to answer the questions set, explicitly or implicitly, vaguely or precisely, by the client. The link between data collection and the important questions is sometimes rather sketchy – we have a bad habit of working out the details later, when it is too late to correct our mistakes. For example, if you are contracted to assess the impact of a new road, and the effectiveness of mitigation features, it is not enough to ask: *"Do bats use the underpass placed on the flightline severed by the new road?"* But recent reviews (Altringham 2008; O'Connor *et al*. 2012) revealed that this is precisely what most studies have asked, over many years. So bats use an underpass – does this make it an effective conservation tool? Not if most refuse to cross the road or risk death on the road itself.

Devising the right questions can be the most important part of the whole process, and the most difficult. First, questions must

Brown long-eared bat

Harp trap over stream

be relevant to the legal requirements of the case. For example: *"Will the underpass help maintain the bats in Favourable Conservation Status (FCS)?"* It's a better question, but it has practical problems – FCS is all about maintaining population size, and it is very hard to count bats, never mind monitor change. Are there questions we can ask that are relevant but more easily answered? Maintaining FCS means not creating a significant barrier through the middle of valuable habitat, which would reduce habitat quality and area, and hence carrying capacity. It also means not killing bats on the new road. Better questions therefore include: *"Has the building of the new road led to change in activity along the severed flightline?"*; *"What proportion of the bats that still use this flightline use the underpass and what proportion cross the road?"*; and *"What proportion of the bats crossing the road do so at heights that place them in the path of traffic?"* With care (and only modest resources) questions like these can be answered with some precision (e.g. Berthinussen and Altringham 2012b).

The take home message is: devise simple and explicit questions that you can actually answer and that will give relevant and unambiguous results.

What Do We *Really* Know Already?

We often start a project by reviewing the existing literature to see what we can learn from past studies. Past work that is important to your case should be read in the original, not second or third hand. Read it carefully, understand it, evaluate it, be critical but objective and don't let preconceived ideas cloud your judgement. Much of what we read has gone into print through a form of Chinese whispers and may not be faithful to the original. Guesswork is reported as careful deduction, conjecture as fact. How often is the final whisper checked against the original document, or the reliability of the original checked? Are the conclusions supported by good data and logical interpretation? If not, treat them with caution and don't quote them as if they were. In the worst cases you should discard them. Know the difference between evidence and anecdote or received wisdom, and treat the latter two with caution. Professional judgement should be based on years of assessing evidence, not on accumulating received wisdom.

How *Exactly* Will We Collect Our Data?

Take the questions you have formulated so carefully and construct your data collection protocols around them. Ask yourself the question: will the data I collect be able to answer these questions? Good questions and good protocols go hand in hand but the best combinations must often be arrived at by iteration. A good theoretical question may be hard to address in practical terms, so may need modifying – does it still answer the question?

Methodology and protocols must be written up in sufficient detail for the informed reader to be able to repeat the study. Statements such as *"The monitoring was carried out by an experienced ecologist using appropriate equipment."* contain no useful information. If we are told what has been done, where, when, how many times, with what equipment, taking into account what confounding variables, etc., we do not need to place our faith in subjective and uninformative words like 'experienced' and 'appropriate'.

Consistency in methodology, whether in comparing sites or in monitoring change over time, ought to be a given, yet mid-project changes in equipment, method and protocol are common in reports. These changes almost invariably make the data impossible to evaluate quantitatively or even qualitatively. This may sometimes be a consequence of changes in contracted consultant, but reasons are not always evident. Without consistency the value of time series or replicated data is diminished and data can even become meaningless. If you take over an ongoing project consider which methods are best in the circumstances. Even if the methods used previously are flawed, they may be a better option than changing the methodology.

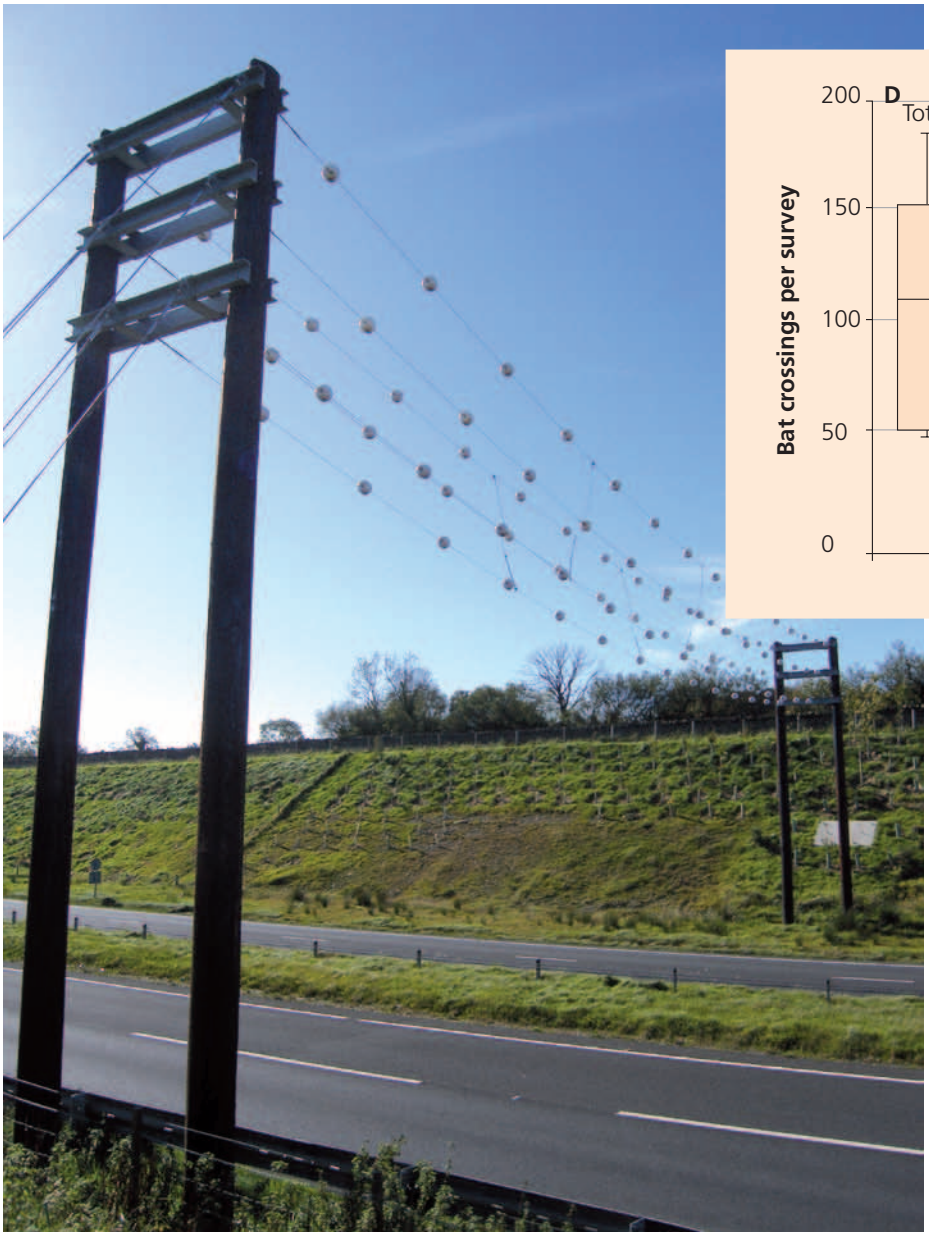
The question of how often and for how long a project needs to be surveyed or monitored is a particularly thorny one. There's usually too little time and money to do as much as you would like. This makes it all the more important to make the most of what you can do. This is no place for taxon-specific guidelines - I'll stick to some general principles. Once is almost never enough, unless all you have to do is establish the presence of a species on a site - and you find it first time! If diversity is important, generally the more you look, the more you will find, but with diminishing returns. If you are not able to carry out enough work to describe the full picture, maybe species-accumulation curves or their equivalent will demonstrate this. If you need to quantify something, think about how many replicates you will need to arrive at a reliable estimate, taking into account the biology of the species. Two or three counts are very much better than one, but there may be diminishing returns beyond this. How accurate must the estimate be for the purpose? How accurate can it be?

Timing and timescale are frequently contentious issues too. Clients can be reluctant to pay for adequate pre-development survey or sufficiently long-term post-development monitoring. And they often want the work done at a biologically inappropriate time of the year. Consultants must make strong and logical arguments in support of the survey and monitoring schemes they devise. SNCOs and planners must support them, otherwise consultants have little leverage - which is why inadequate survey and monitoring, or no monitoring at all, have been common features of many developments. I have heard concerns from all parties in the process (consultants, planners, SNCOs) about levels of rigour, knowledge and training.

And How Will We Present It?

Make full use of pictures and diagrams. You want busy people with many other distractions to grasp your key messages quickly and unambiguously. Good figures make it as easy as possible for them to do this. Consign raw data to appendices: unprocessed data rarely have a place in the main text.

Figure 1 show results from a study by Berthinussen and Altringham (2012b) on the effectiveness of road crossing gantries for bats. The important feature of Figure 1 is that it shows the data as medians with a statistical representation of the amount of variation around the median. Means or medians without some form of representation of the variation in the data are fairly meaningless, yet they appear in a very high proportion of consultancy reports. Apparently large differences can be due entirely to chance - which they are likely to be if the error bars are also large - and completely erroneous conclusions can be drawn. There are technical issues around error bars since the correct form to use is determined by



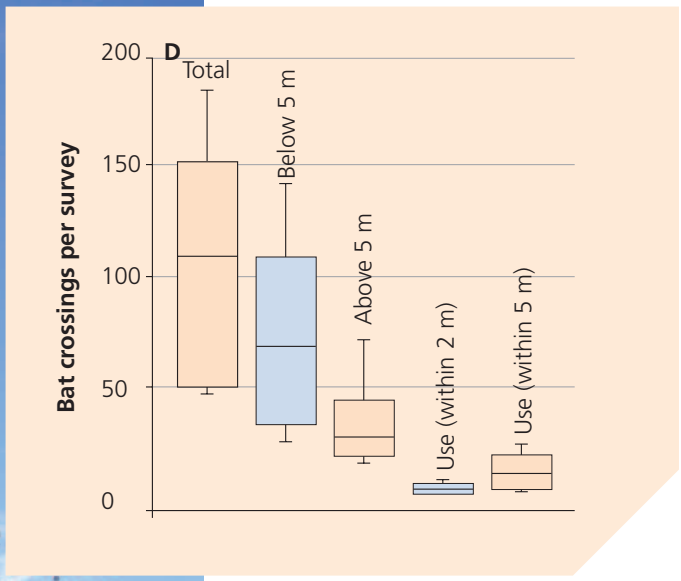


Figure 1. Left: a typical wire bat gantry. Above: Median number of bats crossing a road in the locality of a wire bat gantry, showing the total numbers crossing the road, the numbers crossing at safe (>5m) and unsafe (<5m) heights and the numbers 'using' the gantry. Use was defined as flying within 2m or 5m, for reasons discussed in Berthinussen and Altringham (2012b). Data are shown as boxplots, with medians and upper and lower quartiles. Photo by Anna Berthinussen.

the mathematical distribution of your data. Statisticians may shake their heads and sigh, but *anything* is better than nothing!

Some statistical comparison (before and after, with and without, treatment A versus treatment B...) is likely to be informative, but not always essential. The statistical significance of the differences in Figure 1 are largely irrelevant: most of the bats don't use the gantry and most are not safe from collision with traffic – the mitigation is not effective. Figure 2 tells the same story as Figure 1 in a different way, and perhaps has more immediate impact.

Sometimes statistics are essential. Berthinussen and Altringham (2012a) tested the hypothesis that bat activity and diversity would be low near motorways relative to the surrounding countryside. Because bat activity is also influenced by time of night, habitat and weather, isolating the effect of the road required a little thought. We minimised these effects by collecting data on dry, still, warm nights, in a short time window, and on transects chosen to avoid extreme variation in habitat. These variables were nevertheless included in the statistical model used to test for the effect of the motorway. Result: a marked and highly significant effect – motorways depress activity and diversity. This effect is far from clear in the raw data because of the influence of other variables. Sometimes it is impossible to draw conclusions without statistics.

Defining Success: Use v Effectiveness

A critical aspect of much consultancy work is answering the question: *"Does it work?"* Was the artificial roost adopted by the colony? Does the underpass prevent significant casualties on the road above? In the bat world there appears be a need for more rigorous definitions of success than those commonly applied. A new roost built to replace one destroyed by development is not a success unless it is used by as many bats as used the roost it replaced. A bat bridge or an underpass on a severed flightline is not necessarily a success just because it is used by bats. Ten bats recorded in an underpass do not constitute successful mitigation if 50 are flying through dense traffic on the road above and 100 have abandoned the flightline altogether. Far too many reports equate use of a mitigation structure with effectiveness. This is a serious error.

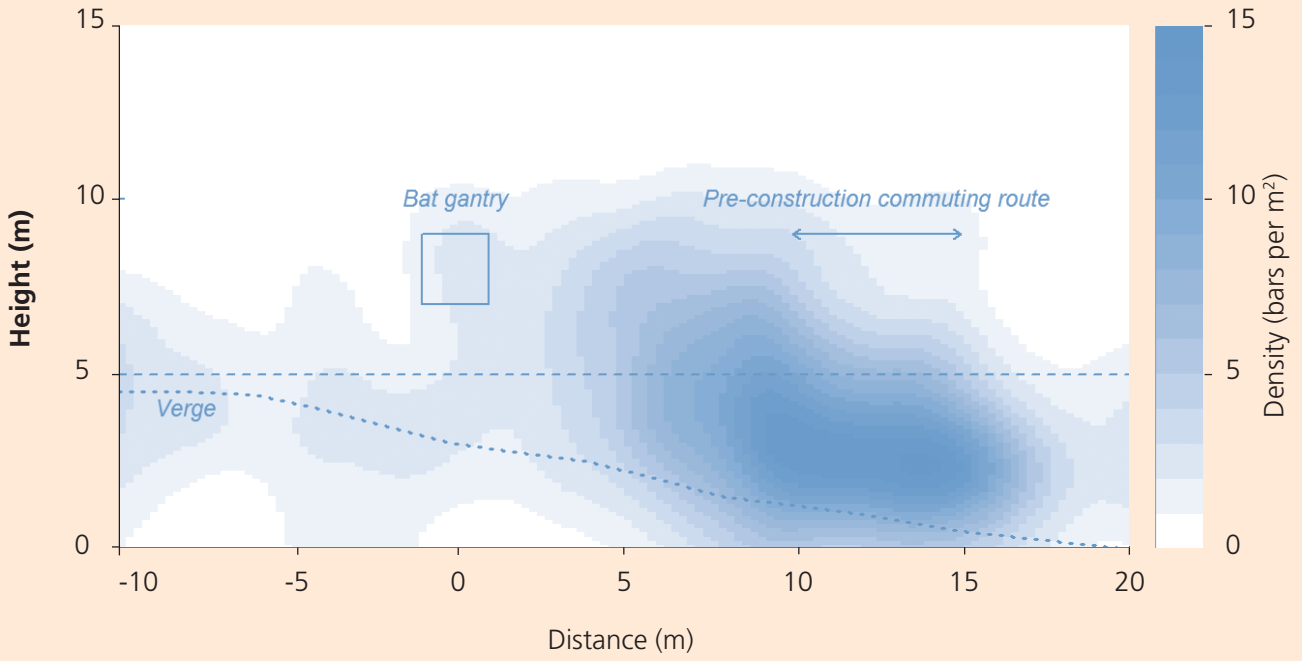


Figure 2. Density of bats (bats/m² over the duration of the study) crossing a road on a commuting route severed by a road, in relation to the position of a gantry that has been in position for nine years. Bats crossing below the horizontal dotted line are at risk of collision with traffic.

How widespread are these problems in other areas of conservation? How often are there good answers to the following questions: Has diversity increased under the new management regime? Did the species re-establish fully? Did translocation save the population? Does the rope bridge/culvert/underpass allow dormice/red squirrels/badgers/otters/etc. safe and unimpeded access to habitat on both sides of the road? Time to look more closely at the evidence?

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About the Author

John Altringham is Professor of Animal Ecology and Conservation at the University of Leeds. John has wide-ranging interests in biology and conservation. He has studied bats for 30 years, published three major books on bats and numerous scientific papers, and makes regular contributions to non-academic journals and magazines. He is frequently asked to review planning documents for developments that may have an impact on bats.

Contact John at:
j.d.altringham@leeds.ac.uk

Standardised Biodiversity Quality Assessment: Lichens and Bryophytes as Bioindicators?

Violaine Drapeau[a,b], Alan Feest MIEEM[b,c] and Kate Hayward MIEEM[b]
[a]School of Biological Sciences, University of Bristol [b]Ecosulis Ltd [c]Institute of Advanced Studies, University of Bristol

Sphagnum moss, Cairngorms, Scotland

Summary

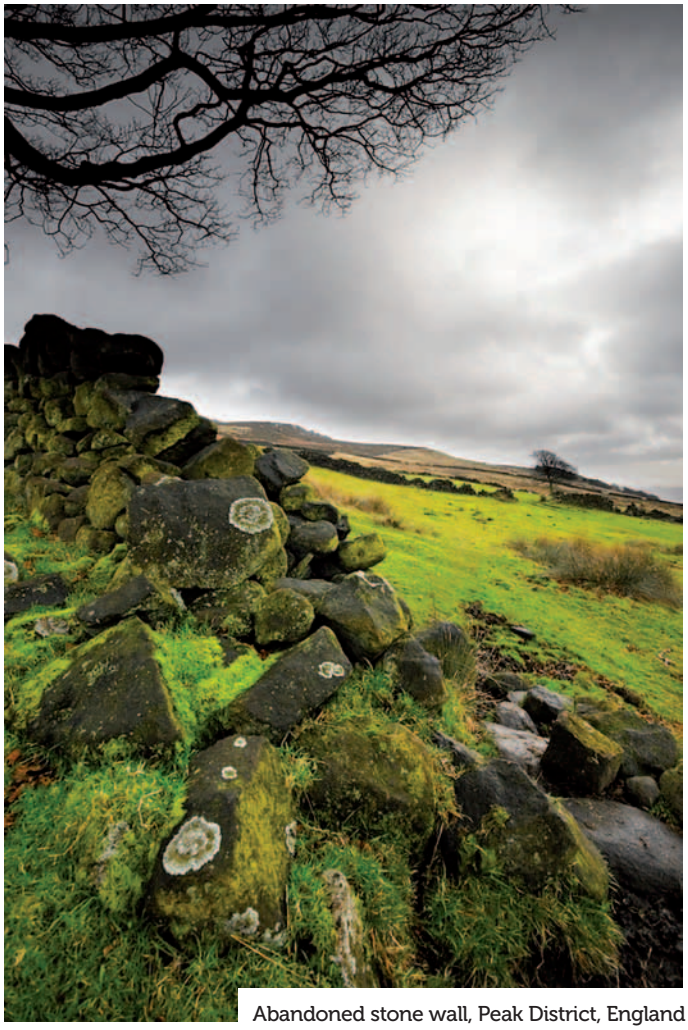
On behalf of Natural England, Ecosulis applied a unique method for measuring biodiversity quality allowing a totally repeatable and comparable survey to be undertaken across 12 Sites of Special Scientific Interest (SSSIs). By applying this method to creating baseline indices for lichens and bryophytes, an important step is reached because these species are valid indicators of air quality which can then be followed over time. Future monitoring of these sites using this biodiversity assessment method will allow greater comparison across the sites/habitats and identification of specific conservation objectives and management prescriptions. This assessment method is a valuable conservation management and biodiversity measurement tool, which can be applied to many sites and to most taxonomic target groups.

Introduction

Biodiversity Check-Up

In 1992, the Convention on Biological Diversity[1] defined biodiversity as the *"**variability** among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems".* As specified by the 2005 Millennium Ecosystem Assessment report[2], humanity is highly dependent on wild nature, hence the necessity to know how biodiversity is affected by human activity[3]. It remains technically difficult to assess biodiversity within species and between ecosystems and species richness

Stone bridge, Wales



Abandoned stone wall, Peak District, England

recording is commonly used to assess quality of sites (as a proxy for biodiversity). The 2005 Millennium Ecosystem Assessment also reported a change in biodiversity, due to human activities, more rapid in the past 50 years than any time before. Aiming for a significant reduction in the rate of biodiversity loss, the report also insisted on the necessity to improve measurement of biodiversity and a better prediction of its change. Furthermore in 2010, Butchart *et al*.[4] showed no significant decrease in biodiversity loss and an increase in the pressure on biodiversity instead, which contrasts with the target determined by the CBD. Therefore, in order to compare biodiversity progress over time and between locations, standardising the methods and achieving measurement of biodiversity becomes a key element. Such a standardised method would allow comparison over time and between sites without methodological bias. In 1991, Coddington *et al*.[5] stressed that research on biodiversity loss should use fast, reliable, simple and cheap sampling methods. Since 1999, Alan Feest has developed a straightforward sampling methodology providing simple calculations of biodiversity indices which relate to some of the headline indicators developed by SEBI 2010 (Streamlined European 2010 Biodiversity Indicators) to monitor biodiversity across Europe with a target of halting its loss by 2010[6]. The method has been validated to assess the biodiversity quality of sites in several groups of organisms such as: macrofungi[7], butterflies[8], spiders[9] and carabid beetles[10]. In 2010, Ecosulis (Newton St Loe) was contracted by Natural England to assess biodiversity on 12 SSSIs in the North West and East Midlands regions of England. The method was used to assess the sites' quality based on biodiversity indices of lichens and bryophytes populations, aiming together with Natural England for actions towards a healthier natural environment.

What is a Site?

According to the *National Range and Pasture Handbook*[11], an ecological site is a distinctive kind of land with specific physical characteristics that differs from other kinds of land in its ability to produce a distinctive kind and amount of vegetation. It is the product of all the environmental factors responsible for its development, and it has a set of key characteristics (soils, hydrology, and vegetation) that are included in the ecological site description. The development of the vegetation, the soil, and the hydrology are all interrelated. The SSSIs of Natural England are of very variable sizes and some cover multiple types of habitats. For this reason, in order to remain faithful to the definition of ecological site, the homogeneity of the surveyed area needs sometimes to be restored by breaking down the SSSI into various habitats to survey separately. From a consultancy point of view, it is also opportune to evaluate biodiversity in a piece of land that might need different

management policy because of different habitat and therefore a simple definition of a site might be *"an area subject to a uniform management"*. This definition seems to have considerable practical utility.

Lichens and Bryophytes:

Bryophytes are the liverworts, mosses and hornworts classes of plants. They do not have a true vascular tissue system and are therefore called non-vascular plants. Lichens are composite organisms completed by the symbiotic relationship between a fungus and a photosynthetic partner. In the British Isles, there are about 1,900 species of lichens and 1,100 species of bryophytes – a lot more numerous in species than the total of 1,400 flowering plants. Britain has 40% of the European lichen flora, 60% of the European bryophyte flora, but only 15% of the flowering plant flora. The main habitats where bryophytes and lichens are found are woodlands, heaths, montane habitats, flushes, bogs, rock habitats, dune habitats, rivers and ravines, upland lake margins, metal-rich habitats and man-made structures. Due to their anatomical and physiological properties, bryophytes and lichens are well suited for the bio-indication of air quality[12]. For example, bryophytes have a surface unprotected from rain, dew and fog, no mechanism to neutralise harmful substances, a metabolism activity peak matching pollutant loads peak (autumn, winter) and short reproductive cycles allowing fast response to environmental changes. Furthermore, bryophytes have a large distribution area, are potentially omnipresent and can be studied all year round, which is convenient. As part of the solution for better assessment of biodiversity[6], the IUCN (International Union for Conservation of Nature) is funding the European Species Assessment to evaluate the regional extinction risk of, amongst others, lichens and bryophytes, showing the importance of the biodiversity assessment of these taxa.

The Sampling Method

The assessment method was based on the Pollard and Yates method described in *Monitoring for Ecology and Conservation*[13], adapted originally by Alan Feest for macrofungi and latterly for a range of organism groups. After a desktop study evaluating habitat and potential bryophytes and lichen species to sample, surveys were carried out in six SSSIs in the North West and six in the East Midlands during October and November 2010. One to four different individual surveys were conducted to assess different habitat types constituting the totality of the sites in the East Midlands. For other taxa, the period when the surveys are performed would be important because species presence/detection is often season dependant. The transect route for each survey was determined to cover the habitats of interest for bryophytes and lichens (non-vascular plants present) so there was more than one survey per site if it covered various habitat types. Along a transect route, the sampling was completed for 10 minutes at 20 spots of 4m radius (4m radius = c.50m^2). The total area sampled in each survey was therefore a constant (1,000m^2) which is an important characteristic of this investigation. Each sub-sample spot was defined by GPS co-ordinates and the habitats of the sites were described in detail with pictures to illustrate. A list of species was compiled for each survey in a recording sheet where columns are the 20 sub-sampling spots and a new species is added in a new line when it is recorded. In some cases, carefully taken into account when conclusions are drawn, the sub-sampling spots are fewer. Indeed, in two surveys of the following study, the sampling was stopped earlier because the number of new species discovered in the sampling spots was not increasing anymore. An advantage of this simple method is that it can be adapted to the species groups surveyed: count of bird songs, count of butterflies, presence/absence, pitfall trap collection for invertebrates, total count of fruit bodies (per m^2) for fungi, etc. The species monitored were identified on site (to species level when possible) or a fragment was collected for further reliable identification if necessary. In our case, the presence or absence of the bryophytes and lichens was indicated. After sampling, the data of each site was compiled with the FUNGIB computer programme to obtain a set of biodiversity quality indices.

Capillary thread moss *Bryum capillare*

The Indices Extracted:

- Species richness: The number of species in a sampling area of 1,000m^2.

- Chao (with SD): The estimated expected number of species within the site derived from the occurrence (presence/absence of species in the whole sample (Chao 2 index)). This estimation is based on the unequal probability sampling theory because different species have a different probability of being discovered in a sample.

- Simpson Index: Also called the biodiversity index, it measures the evenness between the different species. It can also indicate if there is dominance by a single species. This is preferred to the usual Shannon-Wiener as it is more resistant to the influence of species richness[14].

- Species density: The density of species found within a sampling spot area of 1,000m^2. It corresponds to the total number of occurrences of all species in the site (species density as opposed to population density).

- Species Conservation Value Index (with SD): The mean SCVIs of each species recorded. The SCVIs are assigned to species according to their commonness/rarity locally/regionally/nationally: 2 for abundant, 3

for common, 4 for frequent, 5 for local/occasional, 10 for rare, 20 for really rare, and 100 for really, really rare (e.g. Red Data Book species). Regional SCVI values were used and for bryophyte assessment, national values were expressed as well, with the values 50 if nationally scarce and 100 if nationally rare.

- Rare species: The number of species recorded with a SCVI of 10 or above.

- Ellenberg Nitrogen Index: The nitrophilic/nitrophobic tendency of the species, 1 indicating highly nitrophobic (nutrient poor sites) species and 9, highly nitrophilic (nutrient rich sites) ones. The values were extracted from Siebel (1993).

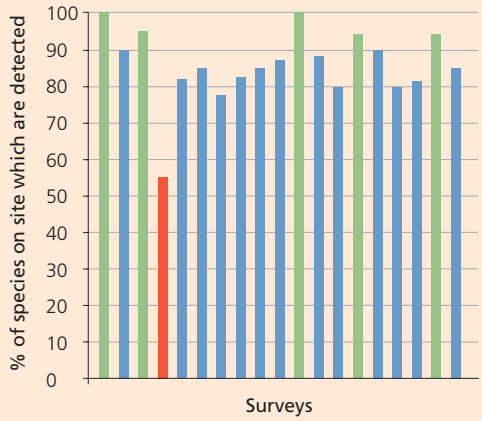


Figure 1. Percentage of species of the site which are actually monitored for each of the surveys. In red, blue and green are the surveys monitoring less than 70%, between 70 and 90% and more than 90% species, respectively.

What the Indices Tell Us...

...About the Methodology

The Chao index (see Table 1) is a valuable indication of the expected number of species to be found in a complete sample of the site. Knowing the actual number of species found (see Table 1, richness) and the Chao estimate, it is possible to have an idea of the percentage of species of the site detected during the survey. In Figure 1, this percentage is depicted: 4 out of 34 sites had less than 70% of their expected number of species monitored (minimum of 50%). Most of the sites (22) had between 70% and 90% of their species detected. And for eight sites, more than 90% of the expected number of species was monitored. Therefore for most sites, it would appear that the limitation to 1,000m^2 of sampling records most of the species present (>80%). This is a good illustration of how much the richness can be skewed in some cases and why using the Chao index is a meaningful alternative.

...About the Differences Between Sites

All of the indices obtained with this method (Table 1 for bryophytes, Table 2 for lichens) allow comparisons between sites. The mean richness of the sites is 48 species for bryophytes and 41 for lichens, but great variation can be noticed. For instance, the ash wood of Cressbrook Dale has only 13 species of lichens (100% of expected species number) whereas the calcareous grassland of Cressbrook Dale has 68 species. For bryophytes, the woodland of Monks Dale has 72 species (90% of expected species number) when the Eden Gorge woodland has only 16 species. The species density also shows large variation between the sites, with a maximum of bryophytes species occurrences of 347 in the woodland of Monks Dale and a minimum of 27 in Eden Gorge. The species density of lichens varies from a minimum of 48 species occurrences in the upland of Hellvellyn and Fairfield to a maximum of 293 species occurrences in the calcareous grassland of Cressbrook Dale.

The Simpson indices variations give an idea of how even (or dominated) the species population of the sites are. In that case, the site with the least even species populations of lichen is the ash wood of Cressbrook Dale (7.9) and the site with the most even lichen species population is the calcareous grassland

Table 1. Indices calculated for the bryophyte population for each sites surveyed.

Area	Sites	Habitats	Species richness	Chao	Simpson Index	Density	Mean SCVI	Rare species	Ellenberg N Score
North West England	Helvellyn and Fairfield	upland	41	63.5 +/- 10.9	28.9	90	3.85 +/- 1.39	1	2.94
	Lyne Woods	woodland	31	47.7 +/- 11	20.6	104	3.9 +/- 3.29	2	3.99
	Moorhouse and Cross Fell	rills, ledges, flushes, scree	32	44.3 +/- 7.0	19.8	74	4.31 +/- 2.96	1	2.54
	Eden Gorge	woodland	16	24.1 +/- 5.8	11.6	27	3.31 +/- 0.97	0	4.93
East Midlands	Cressbrook Dale	calcareous grassland	61	93 +/- 13.7	29.2	292	4.44 +/- 6.16	5	3.7
		sheltered rock faces	49	69 +/- 10.1	23.2	242	7.35 +/- 12.81	6	4.51
	Eastern Peak District Moors	Priddock Wood	51	96 +/- 21.4	25.1	342	4.45 +/- 6.75	4	3.39
	Lathkill Dale	calcareous grassland	69	99 +/- 12.7	30.5	311	5.39 +/- 8.34	7	3.6
		vertical limestone faces	56	70 +/- 7.5	27.8	260	4.3 +/- 6.34	3	4.57
	Monks Dale	woodland	72	90 +/- 7.9	34.3	347	4.15 +/- 5.66	4	4.84
		vertical limestone faces	54	90 +/- 17.2	26.8	273	4.57 +/- 6.54	5	4.3
		calcareous grassland	47	61 +/- 8.7	26.7	303	4.4 +/- 6.91	3	3.47

Table 2. Indices calculated for the lichen population for each sites surveyed.

Area	Sites	Habitats	Species richness	Chao	Simpson Index	Species density	Mean SCVI	Rare species
North West England	Black Snib	bog	32	34.7 +/- 2.74	22.3	105	4.09 +/- 3.01	1
	Eden Gorge	woodland	44	54.7 +/- 5.8	28.4	109	3.7 +/- 1.03	0
	Helbeck Wood	woodland	37	43.7 +/- 4.5	26.5	105	3.73 +/- 0.98	0
	Helvellyn and Fairfield	upland	32	84.9 +/- 22.8	22.6	48	5.22 +/- 3.07	3
	Lyne Woods	woodland	36	56.2 +/- 12.7	24.6	127	3.56 +/- 1.19	0
	Moorhouse and Cross Fell	rills, ledges, flushes, scree	32	44.3 +/- 7.0	19.8	74	4.31 +/- 2.96	1
East Midlands	Cressbrook Dale	ash Wood	13	13 +/- 0.3	7.9	80	3.15 +/- 1.1	0
		acid grassland	56	71 +/- 7.4	26.9	211	3.84 +/- 1.36	1
		calcareous grassland	68	98 +/-12.7	33.7	293	4.24 +/- 1.36	2
	Eastern Peak District Moors	bamford Edge	43	50 +/- 4.6	19.6	225	4 +/- 1.3	1
		drystone wall	40	52 +/- 7.7	22.1	237	4.1 +/- 1.7	2
		Bamford Wood	24	44 +/- 14	12.6	144	4.2 +/- 2.4	2
		Priddock Wood	39	59 +/- 11	20.6	168	4.3 +/- 2.2	4
	Lathkill Dale	calcareous grassland	59	68 +/- 5.3	30.8	286	4.5 +/- 1.8	4
		limestone outcrops & walls	60	79 +/-	27.7	282	4.2 +/- 1.2	1
		woodland	49	107 +/- 24.3	20.9	213	4.9 +/- 2.5	8
	Monks Dale	limestone rocks & walls	55	63 +/- 4.8	27.6	272	3.85 +/- 1	0
		woodland	28	38 +/- 6.5	11.5	133	4.5 +/- 2.5	4
	Hamps and Manifold Valley	woodland	30	58 +/- 15.1	12.7	150	4.3 +/- 2.5	4
	Brampton Bryan Park	veteran oak A	41	57 +/- 8.8	19.9	172	4.1 +/- 1.4	1
		veteran oak B	45	54 +/- 5.2	21.6	177	3.98 +/- 1	0
		veteran other trees	33	36 +/- 2.4	15.9	123	4.48 +/- 1.67	2

of Cressbrook Dale (33.7). For the bryophyte species, the minimum evenness (i.e. Simpson index) is 11.6 for Eden Gorge and the maximum evenness is 34.3 for the woodland of Monks Dale.

Finally, the rarity and the mean SCVI are good indices of the conservation interest of the sites but interestingly, their highest numbers specifying sites of greater conservation interest do not necessarily indicate the species richest sites. For example, the site with the largest SCVI for bryophytes (7.35 - found with six rare species) has a richness of 49 bryophyte species, which is close to the average of 48. Also, the site with the largest richness in bryophytes (72) does not have a particularly large SCVI (4.15). These values raise the question of what is important in biodiversity assessment. Should protected habitats be those that host a large number of species, species existing evenly, or rare species?

Figure 2. Species density, species richness and species rarity (number of rare species) for the grassland sites (green) and woodland sites (brown) for the bryophyte (A) and lichen populations (B).

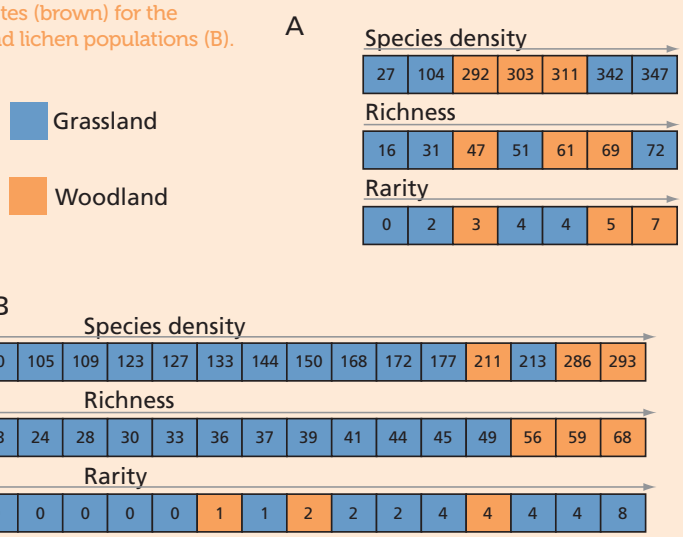
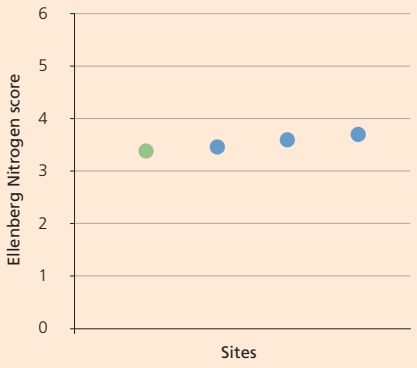


Figure 3. Ellenberg Nitrogen scores of the grassland sites (blue) and woodland sites (green) for the bryophyte population.



...About the Differences Between Habitats

The aggregate differences between sites can also show the differences between habitats. Figure 2 shows the increase of species density, richness and rarity in the woodland and grassland habitats for both bryophytes and lichens. It seems that grassland habitats have a higher richness and species density. This is at least verified for lichens (Figure 2, B). But once again, the rarity does not seem to follow the same pattern. On the contrary, the sites with the largest numbers of rare species are woodland area in the case of lichens. This is a typical example where policy protecting diverse habitats and the ones protecting rare species could deviate. It is more difficult to see any distinct pattern in the increase of the three variables in the case of bryophyte, but the number of transects was lower.

The Nitrogen scores compared between habitats also seem to reveals differences. Most of the sites with greatest Ellenberg indices are woodland habitats (see Figure 3). This observation would mean that woodlands are more nutrient rich habitats for biodiversity. This is consistent with previous studies attributing higher nitrogen fertility of soils under tree canopies than in open grasslands[15], and justifies the reference to such an index in biodiversity assessment of a site.

Conclusions

As biodiversity loss is not decreasing, giving rapid and accurate assessment of its state becomes crucial. The method devised by Alan Feest is straightforward and evaluates richness, diversity, conservation value and eutrophication of sites even for organisms that cannot have population estimates beyond presence/absence data. It allows the setting of a range of baselines that can be compared between sites and over time. Following changes in these baselines will allow trends to be observed over time. The application of this methodology has also allowed the calculation of other indices (in this case the Ellenberg nitrogen sensitivity index) indicating eutrophication or its amelioration over time.

The method is repeatable through time and adaptable to various taxonomic groups, which validates its importance as tool for the biodiversity evaluation in decades to come. Indeed, the method is already established for macrofungi, butterflies, spiders and carabid beetles, and these results show the validation of these indices with bryophytes and lichens.

The setting of a standardised sampling methodology has further advantages in that it allows better estimation of the time that a survey will take whilst at the same time a comparison between samples is possible. The completeness of a sample (Chao estimation) also allows estimation of either the uniformity of a site (a site of different habitats will have a Chao estimate that shows a low completeness of sample) or the completeness of the sample (in, for example, a very extensive site).

Additionally, the data presented here point out the importance of grassland habitat in species diversity as opposed to the presence of rare species. These conclusions raise the question of what should be the main concern in future targets towards halting diversity losses: species richness or rarity? Indeed, protecting one over the other has proven contradictory by our results and we believe that prioritising richness might be more relevant to aim towards a healthier overall environment.

About the Author

Dr Violaine Drapeau is an intern in research and development at Ecosulis Ltd. She completed her PhD in ecology of bats at the University of Bristol in 2012.

Dr Alan Feest is a Senior Research Fellow in the Institute of Advanced Studies at Bristol University and a Scientific Advisor to Ecosulis Ltd.

Contact Alan at:

A.Feest@bristol.ac.uk

Kate Hayward is an ecologist and director at Ecosulis Ltd.

Acknowledgements

We thank the excellent field ecologists who performed the surveys (Ivan Pedley, Sharon Pilkington, Matt Rung and Justin Smith) for following the sampling methodology so carefully and Natural England for the contract and permission to publish the results.

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Ecology Legal Update

Court case on "deliberate killing" of birds and bats by wind turbines

Penny Simpson
Associate, DLA Piper UK LLP

A recent High Court case (*Eaton vs Natural England and RWE Npower Renewables Ltd*, 23 August 2012) has considered once again the word 'deliberate' in the context of species protection under the Habitats and Birds Directives.

In this case Mrs Eaton sought an injunction from the Court to prevent wind farm operator RWE from continuing with its construction of a 10 turbine wind farm in Essex. She brought the action on the basis that the operation of the turbines, in the knowledge that there was low risk of wild birds and bats being killed through turbine collision, would lead to RWE committing the criminal offence of 'deliberate killing' if a wild bird or bat was in fact killed by a turbine.

The judge was unhappy about a number of legal issues relating to the manner in which the case had been brought but I will not go into that here. The judge nevertheless considered the key issue above which I focus upon below.

'Deliberate killing' of wild birds or bats (the expression comes from the prohibitions in Art. 5 of the Wild Birds Directive (for birds); and from Art. 12(1) of the Habitats Directive (for bats)) clearly covers the situation where a person goes out with the sole purpose of killing a wild bird or bat and does so. The judge acknowledged this in the Eaton case.

However, more difficult is the common commercial situation where the killing may be an indirect consequence of some other activity, such as operating wind turbines or perhaps a road where there is the risk of bird or bat turbine/vehicle collision.

For some time Natural England has taken the view that 'deliberate' in this situation is triggered by reference to the assessed level of risk of the prohibited act. For example, in their guidance *Disturbance and protected species: understanding and applying the law in England and Wales* (dated 2007 and still available on Natural England's website) they considered what 'deliberate disturbance' meant. Natural England stated *"where disturbance is still sufficiently significant to cause an offence (e.g. because the breeding success of a significant group is significantly affected) then it is unlikely to be seen to be 'deliberate' where available guidance had been followed and preventative measures put in place that had reduced the risk of significant disturbance to such an extent that it was considered very unlikely"* (my emphasis).

This is in my view a reasonable approach, based on the caselaw from the European Court on 'deliberate'. The European Commission's 2007 Guidance Document on the strict protection of animal species of Community interest under the Habitats Directive considered this caselaw and concluded that deliberate included *"conscious acceptance of consequences"*, *"accepting the possibility of killing"*, *"consciously accepting the foreseeable results of an action"*, *"where a person is sufficiently informed and aware of the consequences his action will most likely have."*

The argument brought by Mrs Eaton however challenged this approach. She argued that the level of risk does not matter. Her argument was that even a very low level of risk of death will lead to an offence of deliberate killing if that low risk is foreseen (e.g. through an Environmental Impact Assessment) and the death then does actually transpire.

The judge could not accept this.

In relation to bats, the judge focussed on the provisions of Art. 12(4) of the Habitats Directive which talks about the need for Member States to monitor *"incidental capture and killing"*. He felt that this indicated that the Habitats Directive acknowledged that 'incidental killing' was acceptable as long as

it did not have a significant impact on the species concerned. The judge drew from the Commission's Guidance of 2007 on this point and noted that the section of the Guidance dealing with incidental killing gave the examples of bat deaths in wind turbines or roadkills as relevant.

In relation to birds, the judge felt that a similar approach was indicated by the legal defence currently in the law under s4(2) of the Wildlife and Countryside Act 1981 (WCA 1981) where an act is *"the incidental result of a lawful operation that could not reasonably have been avoided."*

I am not surprised that the judge resisted Mrs Eaton's case. However I find the analysis provided a little surprising. Certainly I am surprised that the judge relied upon the WCA 1981 defence. Although still found within the WCA 1981, it is fairly clear that this defence is not acceptable under the European law. Indeed the Law Commission, in its report dated August 2012 (para. 6.73) on wildlife law (see more below), has proposed

to remove this defence from the WCA 1981 for this very reason. I can also see the point made by the judge about incidental killing under Art. 12(4). However I note that the judge did not grapple with one important issue, which is that Art. 12(4) only refers to incidental killing and capture. This means that Art. 12(4) throws no light on the meaning of deliberate in terms of 'deliberate disturbance' or 'deliberate destruction or taking of eggs' which are also prohibitions in Art. 12(1) of the Habitats Directive. His analysis therefore leaves a gap as to how to interpret 'deliberate' in relation to those other offences. Such a gap is unsatisfactory.

In my respectful view there is still an argument, akin to Natural England's previous approach, that where there is a low risk of killing or injury, it is not 'deliberate' if the killing or injury then happens. Mrs Eaton argued that where the risk is low (e.g. one death per year) then when a death took place it was foreseeable and so 'deliberate'. However the opposite argument is that, in the context of a low risk, it is far from foreseeable that a particular bat (i.e. the one that died) would be killed because the risk was so low. This argument to my mind remains unexplored by this case.

In any event, one can conclude that the courts are not sympathetic to arguments that commercial operations should be prevented when they give rise to low risks to Habitats and Birds Directives protected species. The case therefore endorses the approach of most developers, consultants and Natural England (i.e. that mitigation measures should be sought to reduce risk of death to the greatest extent possible).

About the Author
Penny Simpson is an environmental lawyer with DLA Piper UK LLP and a specialist in natural environment issues. She advises an array of both public sector and private sector clients on a wide range of issues including protected sites, protected species, water issues, planning issues, prosecution, wildlife licensing and compliance issues.

Contact Penny at:
penny.simpson@dlapiper.com

Training event

Penny will be leading an IEEM seminar on Wildlife Law in Birmingham on 1st March 2013, for further details and to book a place visit www.ieem.net/events.

Institute News

2012 AGM

We have a new President! At the 2012 AGM held in Cardiff on the 7th November, John Box CEnv FIEEM took office as the 9th President of IEEM. Over the years, John has worked for the Freshwater Biological Association, the University of Sydney, Telford Development Corporation, English Nature, Wardell Armstrong consultants and most recently Atkins. He has particular knowledge and experience of post-industrial ecology, urban ecology and Local Nature Reserves, habitat creation and restoration, and habitat translocation.

Retiring President Penny Anderson CEnv FIEEM was warmly thanked for her hard work and commitment to the Institute during her presidential term. John Box told those present that the integrity and innovation that has characterised Penny's professional life had been the hallmarks of her leadership and achievements whilst President.

Also at the AGM the following were elected:

Vice President (Wales):
Mike Willis MIEEM

Vice President (England):
Stephanie Wray CEnv FIEEM

Honorary Secretary:
Max Wade CEnv FIEEM

Honorary Treasurer:
Steve Pullan CEnv FIEEM

Governing Board Members:
Robin Buxton CEnv FIEEM
Phil Colebourn MIEEM
Paul Goriup CEnv FIEEM
Richard Handley MIEEM
Lisa Kerslake CEnv MIEEM

Advisory Forum Members:
Greg Carson CEnv MIEEM
Karen Colebourn MIEEM
Roger Crofts FIEEM
Mick Hall CEnv MIEEM
Tim Hounsome MIEEM
David Tyldesley FRTPI FIEEM FRSA
Sarah-Jane Chimbwandira CEnv MIEEM
Sue Swales CEnv MIEEM

At the Scottish AGM **Kathy Dale CEnv FIEEM** was elected **Vice President (Scotland)** and at the Irish AGM **Jenny Neff CEnv FIEEM** was elected **Vice President (Ireland).**

The AGM agenda included a report from the retiring President, Penny Anderson, based on the work of the Committees over the year and priorities for the year ahead; from Sally Hayns, Chief Executive Officer, on the work of the Secretariat, and from Richard Graves, the Treasurer, on the accounts and outturn for last year. All of the reports were very positive and reflected the material already published in the *Annual Review 2011-12* which is available on the website.

The unadopted minutes of the AGM are now available online in the members' area of the website.

John Box presents Penny Anderson with a gift from the Institute as she steps down as IEEM President

IEEM's new President and Vice Presidents (left to right – Jenny Neff, Stephanie Wray, John Box, Kathy Dale and Mike Willis)

New Fellows

Congratulations to three members who have recently been admitted to fellowship of the Institute.

Gray Grant is recognised as having an impressive track record in bringing ecological design into urban thinking in very practical ways at home and abroad. He is well known as a leading pioneer of vegetated architecture in the UK (green roofs and green walls) and is recognised as being committed to sharing his urban ecology expertise through his publications, his mentoring of other ecologists and his cross-disciplinary teaching, including at the Bartlett School (for architects) in London.

Grant Luscombe was, until recently, the Director of Landlife, a widely respected urban nature conservation charity based in Liverpool but whose reach has extended far beyond the region. Since the mid-seventies Grant has been instrumental in developing Landlife's work, undertaking a wide range of urban environmental projects which place engagement with the local community at the heart of the process. In 2000 his vision and ability to procure funding saw the establishment of the National Wildflower Centre which provides an invaluable public education resource.

Richard Graves has over 20 years experience as a practising ecologist and is commended as a champion of professionalism in ecological and environmental management practice. In his previous capacity as a Director of a major environmental and engineering consultancy he has managed the ecological component of some very large and high-profile development projects in the UK including those for Network Rail and the Dubai Ports development in the Thames Estuary. Richard has a particular expertise in bat ecology and has contributed to both editions of the Bat Conservation Trust's Survey Guidelines as well as a Biodiversity Charter for the construction industry through the Green Building Council and the development of key performance indicators for biodiversity for the Buildings Research Establishment.

Higher Education Degree Accreditation Scheme

We are planning to launch the new Higher Education Degree Accreditation Scheme early in 2013. The scheme will involve desk-based and site-based assessments of courses meeting strict eligibility criteria and delivering agreed learning outcomes. The Institute intends the scheme to:

- influence the content of relevant ecological and environmental degrees in order to ensure the core areas of knowledge and skill identified as required by employers in our sector are adequately covered;
- provide support for course programme leaders in maintaining delivery of these core areas, particularly in relation to practical skills;
- be an opportunity to raise the profile of IEEM amongst academic institutions and academics, with the additional benefit of potentially increasing academic membership;
- raise the profile of IEEM amongst students and potential students, again with the additional benefit of potentially increasing student membership; and
- enable a facilitation role, encouraging more employers to engage with academic courses and course leaders.

We are now urgently recruiting potential assessors for the scheme who will each receive an honorarium for the assessments that they undertake. Please see page 62 for further information.

2012 Professional Development Programme

The 2013 programme of workshops and training courses is now available online. We have tried to respond to ideas and suggestions for new courses as well as delivering those that are popular each year and increasing the geographical spread. We will be adding to the programme throughout the year so if you have further suggestions for suitable courses that you would like to see included in the programme please do get in touch with IEEM's Training and Professional Development Officer, Helen Boulden, on 01962 868626 or at helenboulden@ieem.net.

Membership Grades Review Working Group

Members of the Membership Grades Review Working Group, which was chaired by Dr Eirene Williams CEnv FIEEM, submitted their report to the Membership Admissions Committee in September with a number of recommendations regarding changes to the Institute's membership eligibility criteria and assessment process. Council later considered these recommendations and have agreed to adopt most of them. A full report and explanation of the changes will appear in *In Practice* next year but, in summary, the main changes are:

- Use of the new Competence Framework (see page 50) as the basis for membership grade eligibility criteria and assessment. This will affect both those joining the Institute for the first time and those upgrading their membership status.
- Creation of a new grade for Supporters (i.e. those who are interested in the subject but not practising) as distinct from the Affiliate grade which will be reserved for practitioners without relevant qualifications who are working towards Associate membership.
- Greater recognition of relevant voluntary work as part of the required professional experience.

Policy and Partnership Working

The last few months have been productive in terms of consultation responses and partnership activities. Consultation responses include those on the Natural Resources Body for Wales and the Law Commission's Review of Wildlife Legislation in England and Wales. For the latter we organised a workshop in Birmingham, kindly hosted by Atkins, and attended by the Law Commissioner leading on the Review, Ms Frances Patterson QC, and her colleagues together with IEEM members with an interest in the subject. This was a very useful event in not only helping to frame our response but in enabling the Law Commission to hear first-hand the views of members when challenging some of the proposals.

Sally Hayns, Chief Executive, has continued to represent IEEM on Natural England's Development Industry Group and, in October, facilitated a workshop for Group members on the barriers to, and opportunities for, biodiversity data sharing. Sally also participated in a quarterly review of the performance of Natural England's Land Use Directorate. Meanwhile Sally and Helen Boulden, Training and Professional Development Officer, continue to liaise with the Environment Agency and Natural England with regard to training and development, education and competency work. Our challenge is to try and engage more successfully with the other statutory agencies in this area.

In late summer we were approached by a representative of the Institute of Mechanical Engineering seeking to develop stronger links with our sector. IEEM member David Stubbs has kindly agreed to take this forward.

Welsh Section News

During the summer we have held two successful field events at either end of the Country which were well supported and avoided the worst of the weather (despite our mild Atlantic summers).

Gwent Wetlands – 28th June 2012

The Gwent afternoon was blessed with very fine weather and both RSPB and CCW provided an informed view on the evolution of the site, monitoring of the extent to which it has successfully compensated for losses at Cardiff Bay, issues with habitat creation on post industrial land and managing the hydrology of saline and freshwater systems. The importance of joint-working across the conservation sector for landscape-scale biodiversity enhancement was a key take home message.

Attendees came from across south Wales with several from mid Wales and as far as Aberystwyth. For the bird people we were treated to excellent views of avocet and marsh harrier – and for the botanists we were able to get up close to marsh helleborines, bee orchids and the much rarer true fox sedge.

Anglesey and Llŷn Fens LIFE+ Project – 13th September 2012

The Anglesey Fens/Corsydd Môn SAC represents an outstanding concentration of rich fen systems, the largest in Western Britain, and some of the best examples of these habitats in Western Europe. These sites are currently undergoing restoration through one of Europe's largest LIFE projects.

The IEEM site visit attracted a select but highly motivated group who were shown the work in progress at Cors Erddreiniog NNR. Here an area of 4.5ha of turf stripping and enriched topsoil/peat removal has been undertaken, revealing the underlying maerl sub-soil.

The machinery which was used to undertake this work, together with the wetland harvester, adapted from a German piste maintenance machine, was much admired. A lively discussion took place regarding the practical issues associated with the project combined with lessons learnt and the scope of ongoing work.

In contrast, after lunch the group visited Cors Bodeilio NNR, another fen within the Anglesey Fens/Corsydd Môn SAC, currently grazed by Welsh mountain ponies, but likely to receive more radical attention in the near future. Many thanks to the LIFE team for organising the visit, providing transport and feeding the hungry participants!

Welsh Section AGM

This is being planned for February 2013, associated with a workshop/seminar. Further details will follow shortly. Anyone interested in joining the Section Committee should please contact Mike Willis (Convenor) (m.willis@ccw.gov.uk) or Abbey Sanders (Secretary) (asecology@hotmail.com).

Mike Willis MIEEM
Welsh Geographic Section Convenor

West Midlands Section News

In the West Midlands, as part of IEEM's 21st anniversary celebrations, we held a joint event with Birmingham City Council's Sustainability Forum in the Banqueting Suite of the Council House in June. After a 'market' where different organisations promoted themselves, our President, Penny Anderson, offered a toast to celebrate our success. This was followed by the launch of Birmingham's draft Green Infrastructure Strategy for consultation. Over 50 participants then explored what this might mean for different areas in Birmingham.

In July the Section held a Bat Discussion Workshop for 30 participants at Worcester Woods Country Park, which was oversubscribed and provided a good opportunity for everyone to discuss their experiences with the new Bat Survey Guidelines. There were lively discussions about the pros and cons of the guidelines and the higher burden of survey effort required, particularly in respect of the area of static detector surveys. It was useful to explore the different approaches taken by consultants and to hear from local authority ecologists on their experiences and expectations. The discussions also covered the issue of when a non-licensable methods statement approach might be appropriate, and when an EPS licence application was unavoidable.

Our AGM was held in September. It was overseen by the IEEM CEO, Sally Hayns. Our Convenor, Paul Cobbing, kindly agreed to stand again and several new Committee members were co-opted, to enable the Section to continue and bring fresh energy to our work. We had lively talks from Johnny Birks on the Bechstein's Bat Project at Grafton Wood, Worcestershire, from Andy Jukes on invertebrates and their habitat requirements, and also from Mike Oxford who delivered a philosophically reflective presentation on the draft British Standard for Biodiversity Management.

Please keep an eye out in the coming months for new events we are planning, we look forward to seeing you there.

Veronica Lawrie CEnv MIEEM

West Midlands Geographic Section Committee Member

www.ieem.net/geographic-sections/13/07.-west-midlands

Irish Section News

Engaging with others

The Irish Section continues to establish links with other bodies including the Irish Planning Institute (IPI) and the National Biodiversity Data Centre. We are currently organising a joint event with the IPI in order to further our understanding of the planning system in Ireland, in particular, planning and ecology. Our first joint event in October 2012 will be on Planning and Appropriate Assessment or Habitats Directive Assessment. This aims to bring ecologists and planners together to provide a forum for discussion on changes to our Planning Act, especially with regard to the Habitats Directive.

Adelanthus decipiens (Photo by Joanne Denyer)

Autumn Bryophyte Outing to Killarney

A bryophyte outing to Killarney National Park took place on Saturday 11th August 2012. A variety of highly bryophyte-rich habitats within the Killarney National Park were visited, particularly Atlantic oak woodland and blanket bog. The group looked at the oceanic bryophytes in Derrycunihy Wood (Atlantic Oak Woodland) in Killarney National Park, such as *Adelanthus decipiens,* which is restricted to western oceanic habitats.

Thanks to Rory Hodd and Jo Denyer for organising this event.

Anne Murray MIEEM

Irish Geographic Section Convenor

North East Section News

The 11th AGM of the North East England Section was held on 10th October 2012 at the North of England Institute of Mining and Mechanical Engineers in central Newcastle. Prof. Penny Anderson, IEEM President, was our guest and gave a thought-provoking talk on the state of the UK's peatlands. Degradation of peatland is a major contribution to the UK's greenhouse gas emissions, and reduces the quality of water, biodiversity, grazing, game production, and cultural aspects of our upland landscapes. The value of ecosystem services provided by peatlands greatly exceeds the cost of appropriate management and repair, yet vast areas are in a state of decline. In addition to reviewing the causes of peatland decline, and approaches to restoration, Penny posed a number of questions and invited members to share their thoughts: How do you repair large areas of bare peat? How can water movement from areas stripped of peat be slowed to avoid further erosion downslope? Are peat pipes associated with burning and drainage using grips? How widespread were the practices of installing clay pipes to drain peat and cultivation of 'lazy beds' on margins of blanket bog for potato production in the 1940s and 1950s? Is small-scale damage to blanket bogs (evidenced as numerous bare patched) becoming more widespread and, if so, what is the cause? Are spring droughts and episodic rainfall, respectively, contributing to loss of crowberry and increased gulleying with peat erosion? These questions led to a productive Q&A session and members are encouraged to contact Penny with their experiences (penny.anderson@pennyanderson.com). The Committee plans to follow up this discussion with a meeting on peatland degradation/restoration in 2013.

Looking ahead, we are also planning events focussing on NNR visitor access and facilities, Marine Conservation Zones, the National Biodiversity Network, ancient woodland archaeology, and pond ecology. Members with suggestions for additional meetings are asked to contact any member of the Committee. The Section is now represented as a group on the social network LinkedIn (see the Section webpage at http://www.ieem.net/geographic-sections/11/05.-north-east-england for a direct link). LinkedIn has the potential to be a useful forum for sharing information about members' activities and informal training opportunities within the region. If you have a LinkedIn account please join our group and share your views.

Andrew Cherrill CEnv MIEEM

North East England Geographic Section Convenor

Scottish Section News

Visit to Blacklaw Wind Farm

IEEM members were invited to ScottishPower Renewables (SPR) Blacklaw wind farm in September to look at practicable habitat management at an upland site. The aim of the event was to highlight to professionals, responsible for developing habitat management schemes, the implications and difficulties of delivering often elaborate plans that focus on the end product and not on the practicalities to achieve such goals. Attendees were taken around the site by Peter Robson MIEEM who is responsible for habitat management at nine SPR onshore wind farms totalling 8,150ha. Blacklaw is located predominantly on an old forestry plantation and felling commenced in 2005 with the first phase of the wind farm operation in 2006. The focus of the event was on the practical implementation of habitat management plans and the restoration of mire. Peter is currently monitoring several approaches aimed at creating conditions suitable for blanket bog development, which include: management of water tables, removal of conifer self-seed re-grown, modification of the site's topography (ridge and furrow remnant from plantation) and methods to deal with remaining root masses. Early indications are promising and, if the right conditions are created, mire habitat can be reinstated given enough time. It is hoped that the attendees will take back with them the lessons learnt and implement them in the next habitat management plans.

Marcus Cross MIEEM

Scottish Geographic Section Committee Member

Pips in the Park

In celebration of European Bat Night the Scottish Section hosted a networking evening and bat walk in conjunction with Fife and Kinross Bat Group (FKBG) and the Daubenton's Roost investigation Project (DRIP) at Pittencrieff Park, Dunfermline.

Despite a somewhat damp evening the event was well attended, with a total of 16 participants comprising nine IEEM members and representatives from FKBG, DRIP and the Friends of Pittencrieff Park.

Pittencrieff Park is known to host several pipistrelle bat roosts as well as being situated a short distance from other known roosts and a hibernation site.

Following a short introductory talk by Richard Smith MIEEM, participants split into groups to conduct bat detector surveys at four locations throughout the park. These were conducted for one hour from sunset. Both soprano *Pipistrellus pygmaeus* and common pips *Pipistrellus pipistrelles* were detected at all four sampling locations almost continuously throughout the hour.

Post sampling we met for networking and coffee courtesy of the Friends of Pittencrief Park. The event was much enjoyed by all and will hopefully mark the commencement of an annual event to monitor the bats within the grounds of the park.

Photography Competition

To celebrate the 21st anniversary of IEEM, the Scottish Section Committee organised a photography competition to run in conjunction with the Scottish Section Annual Conference (23rd October 2012). The winning images were then displayed during the day. Entrants were asked to submit images of the Natural World, or anything invoking the spirit of IEEM. We were delighted with the number of entrants and had a tough time deciding the shortlist. The winning image, by Des Callaghan, is a striking image of a sporophyte of the epiphytic moss *Orthotrichum stramineum* taken in Rainhill, South Lancashire. Des says that he hopes it will encourage more people out into the field with a hand lens.

Sporophyte of the epiphytic moss *Orthotrichum stramineum*. The impressive transparent hairs on the calyptra are old paraphyses that once surrounded the archegonia in the original female inflorescence, subsequently elevated skywards on the calyptra following fertilisation and development of the sporophyte.
Photo by Des Callaghan

The runner up image was submitted by Charlie Phillips and is a great shot of bottlenose dolphins *Tursiops truncatus* in the Moray Firth.

The Committee would like to thank Wildcare and NHBS for donating prizes, Jessops Stirling for donating prints of the winning images, and all of the competition entrants.

Bad boys club – four sub-adult male bottlenose dolphins *Tursiops truncatus* in a social mood, just looking for trouble. Photo by Charlie Phillips

Managing Landscapes for Raptors

Sunday, 19th August 2012, Glenlude Estate, Scottish Borders

Following the highly successful 'Bugs in the Borders' event held at Glenlude Estate in August 2011, the Scottish Section Committee organised a second collaborative event with the John Muir Trust (JMT), this time with Lothian and Borders Raptor Study Group (LBRSG). Sandy Maxwell and Karen Purvis of JMT hosted us while Tony Lightley and Mike Thornton of the LBRSG shared their extensive ornithological expertise.

The c.400 acres of Glenlude Estate is comprised of open moorland with blanket bog, a gorge, plantation and native woodland, two small ponds and Glenlude and Paddock Burns. Baseline ecological information has been gathered and JMT have drafted a land management plan for the estate. Events such as these are helping to gather information and allow informed decisions to be made on the best ways for JMT to establish a biodiverse and healthy reserve.

In the morning there were a couple of hours of informal discussion in which Tony and Mike imparted their extensive knowledge and experience about the habits and ecological requirements of the different raptor groups. During a walk over of the estate in the afternoon participants looked at the different habitats on offer for raptors and ways in which they could be improved. This allowed the participants to suggest ways in which JMT could manage their estate to encourage more raptors into the area.

The event was well attended with excellent feedback from participants and JMT staff. We intend to work with JMT to run further events at Glenlude and some of their other properties in the future.

Mike and Tony educating us in the outdoor classroom for the morning

Discussing the pros and cons of predator control in a forest break in the afternoon

Many thanks to all those who helped to make this event such a success, especially to Mike and Tony for sharing their enthusiasm and expertise!

For more information about JMT (www.jmt.org/) and LBRSG (www.scottishraptorgroups.org/areas/lothian_and_borders.php) check out the websites.

Elaine Anderson GradIEEM

Scottish Geographic Section
Vice-Convener

fea144@hotmail.com

Scottish Section AGM, Conference and Study Tour

23-24 October 2012

Stunning autumn colours on the University of Stirling campus met this year's Scottish Section event at the Stirling Management Centre. The conference theme of 'Delivering Green Networks – from policy to reality' was highly relevant to many people's work, and the Green Networks concept (i.e. improving the connectivity, quality, siting and multi-functionality of green and blue infrastructure and active travel routes for the benefit of people and wildlife) is being progressed across Scotland, the rest of the UK and Europe – although the 'Green Network'/'Green Infrastructure' terminology may vary. The conference explored delivery and achievements on the ground in Scotland and further afield through presentations, workshops, site visits and informal discussions.

Stirling is within the Central Scotland Green Network area – a huge 10,000km2 area covering 19 local authorities. Agencies, planners, developers and local people are charged with producing a step-change in the area's environment during the next few decades for people and wildlife and to stimulate sustainable economic growth (see more at http://centralscotlandgreennetwork.org/). As the first presenter, David Liddell (Scottish Government Planner) reminded delegates that this ambitious project came through Scotland's second National Planning Framework (NPF), which is expected to carry through into the forthcoming third NPF, and there are tangible achievements already visible.

But Green Networks are not just about the Central Belt as David and the following speakers emphasised. All new strategic and

local development plans across Scotland refer to Green Networks – several having Supplementary Guidance (see, for example www.highland.gov.uk/yourenvironment/planning/developmentplans/localplans/GreenNetworksDraftSupplementaryGuidance.htm). Donald Balsillie (Stirling Council Planner), Aftab Majeed MIEEM and Alistair Watson MIEEM (Aberdeen City Council) all gave motivating overviews of how Green Network delivery has been tackled in their respective areas – through opportunity mapping and prioritisation, interactive GIS toolkits and a project amongst deprived communities along the River Don.

Good planning sets the context for which green space, access and biodiversity enhancements can be achieved - Craig McLaren (Royal Town Planning Institute) cited the Falkirk Council's Greenspace Initiative which has recently received a Scottish Award for Quality in Planning (www.scotland.gov.uk/Topics/Built-Environment/planning/National-Planning-Policy/awards) and Louise Bond MIEEM (Scottish Environment Protection Agency) showed how the statutory bringing together of people through River Basin Management Planning can bring about genuine multi-functional benefits.

Neil Langhorn (Forestry Commission Scotland) presented several recent examples of how the Central Scotland Development Fund has given community groups, NGOs and others the resources to deliver numerous Green Network initiatives locally (from greening contaminated land through to community orchards), often using new solutions to old problems (www.forestry.gov.uk/forestry/infd-85bgtl). Similarly, Philip Kearney MIEEM (Sustrans) showed that the need and demand for access and the health and well-being benefits generated, can also have biodiversity benefits through citizen science, volunteer recording, and practical conservation work along green corridors.

Delegates had a choice of afternoon workshops – identifying and using Integrated Habitat Network GIS mapping (Deborah Sandals, Scottish Natural Heritage); an overview of CIRIA's recent Green Infrastructure Guidance (Kathy Dale CEnv FIEEM, EnviroCentre and newly elected IEEM Vice-President for Scotland); and masterplanning through an engaging interactive board game (Diarmaid Lawlor, Architecture and Design Scotland).

A well-attended evening reception followed to celebrate IEEM's 21st anniversary. President Penny Anderson gave an enthusiastic overview of IEEM's successes over the last couple of decades, whilst welcoming the next 21 years to come.

This was followed by Kathy Dale recounting her experience as part of a group of artists and conservationist driving cattle and horses along one of Scotland's mountainous drove roads (see www.speygrian.org.uk/).

The second day's study tour visited several sites, all demonstrating different and complementary parts of the area's Green Network picture.

First off were two brownfield sites noted for their excellent Open Mosaic Habitats – one a former coal spoil heap (Fallin Bing), the other an ex-industrial works dumping ground and water system (Forge Dam/Carron Works) – illustrating informal access opportunities and strategic value as stepping stones for numerous notable and rare invertebrates (see www.buglife.org.uk/conservation/currentprojects/Habitats+Action/Brownfields/ for more info).

This was followed by a talk and walk around the Jupiter Wildlife Centre in the heart of industrial Grangemouth (http://scottishwildlifetrust.org.uk/reserve/jupiter-urban-wildlife-centre/), with a presentation on the Inner Forth Landscape Initiative – a large-scale partnership initiative to restore and enhance mudflats, woodland and the agricultural landscape over a large area of the River Forth (see www.rspb.org.uk/news/319044-heritage-lottery-fund-backs-major-inner-forth-project).

Finally, a wonderful 3-mile walk around the Falkirk Helix site – a huge multi-million pound regeneration project to produce high quality green space and access facilities on former derelict land (www.thehelix.co.uk/).

Special thanks go to Suzanne Bairner (Buglife), Zoe Clelland (RSPB), Rosie Black (Scottish Wildlife Trust), Ben Harrison (Falkirk Helix project), and to David Anderson and Aidan Lonergan (both of RSPB).

Overall, this was a wide-ranging and stimulating conference noted for its excellence of speakers, workshop facilitators and study tour presenters. Thanks go to all including the organisers and venue for making the conference a success.

See www.ieem.net/2012-scottish-section-conference for the slides from the conference and www.ieem.net/geographic-sections/7/01.-scotland for more information on the Scottish Section.

Phil Baarda CEnv MIEEM, Elaine Anderson GradIEEM and Nicola Tyrrell MIEEM

Scottish Geographic Section Committee

Partnership News

Society for the Environment

Sally Hayns, IEEM's CEO, and IEEM Fellow Robin Buxton, both Board members of the Society for the Environment, attended a Strategy Day for the Society in late September. Led by SocEnv's new CEO, Alex Galloway, the day was a chance to map out priorities for the Society over the coming years.

This very interesting event was followed by a meeting between Alex and Sally as part of Alex's initiative to meet with all of the Constituent Bodies to hear their views on the challenges and opportunities for the Society going forward. This was a very welcome opportunity to reflect on the strategic priorities and we are very grateful to all those Chartered Environmentalists amongst the membership who responded to the short and simple survey on your experiences.

The survey demonstrated that, whilst overall there is satisfaction regarding the CEnv accreditation there is a lot more that could be done to promote it as a standard of professional practice and make it more widely recognised. This would encourage more recognition and status for CEnvs and drive others towards achieving it. There is some concern about the range of bodies licensed to award CEnv and whether the same consistency of assessment standards is being applied across the SocEnv family.

In terms of how the Society could move forward it was suggested that it should be doing more to promote interdisciplinary understanding and learning with regional networking events for CEnvs, joint training courses and policy briefings.

These results were fed back to Alex who was very appreciative of the feedback and is always happy to talk directly to CEnvs with ideas and suggestions as to how the CEnv experience could be improved. The meeting was also an opportunity for IEEM to reiterate its commitment and support in helping to further develop the CEnv standard and the Society's role as an umbrella organisation.

www.socenv.org.uk

European Network of Environmental Professionals

ENEP held its latest General Assembly on 7th September 2012 in Brussels. The meeting approved a new Romanian member (bringing the total number of member associations to 22 in 12 countries) and discussed several lively issues including communications, membership expertise comparisons, a new targeted services proposal, and the future structure and functioning of the network. The minutes from the meeting can be found at www.efaep.org/documents/topic/132/.

On the evening prior to the General Assembly, the Biodiversity Working Group (Chaired by Mike Barker CEnv MIEEM) organised an informal dinner with two representatives from DG Environment. The evening was both interesting and informative. The Working Group continues to liaise with DG Environment, with recent work focussing on Green Infrastructure.

The Network's research into European accreditation for environmental professionals continues, but unfortunately at a slower pace than anticipated.

At the end of November, ENEP submitted a bid to the LIFE+ funding body (http://ec.europa.eu/environment/life/funding/lifeplus.htm), which if successful will involve IEEM in some of the proposed work.

Over the last three months ENEP has been grateful to have the services of Tessa Waite, who has helped immensely with the LIFE+ application. Tessa joined ENEP as an intern in Brussels through the Change Agents (www.changeagents.org.uk) programme for environmental graduates.

Please remember that, as an IEEM member, you can receive information directly from ENEP by signing up to the ENEP Platform at www.environmentalprofessionals.eu.

www.environmentalprofessionals.org

ENEP President, Jan Karel Mak (centre), with ENEP's Project Officer, Simon Pascoe (right), and intern Tessa Waite (left)

Applicants and Admissions

If any existing Member has any good reason to object to someone being admitted to the Institute, especially if this relates to compliance with the Code of Professional Conduct, they must inform the Chief Executive Officer by telephone or letter before 18th January 2013. Any communications will be handled discreetly. The decision on admission is usually taken by the Membership Admissions Committee under delegated authority from the Governing Board but may be taken directly by the Board itself. IEEM is pleased to welcome applications for membership from the following:

APPLICANTS

Applications For Full Membership

Miss Katie Burrough, Miss Orla Daly, Mr James Davies, Dr Gwennan Dean, Miss Vivienne Greenough, Mr Matt Johnson, Mr Julian Partridge, Dr Alexandra Pollard, Mr Julian Vulliamy

Applications For For Associate Membership

Dr Jonathan Daisley, Miss Sarah Grundy, Mr Espen Helland, Mr Sean McGrogan, Mr Daniel Thomas

Applications to Upgrade to Associate Membership

Miss Charlotte Bellamy, Mr Jean-Michel Bellas, Mr Nigel Brooke-Smith, Mr David Byett, Miss Stephanie Cooling, Miss Lisa Durrant, Mr Martin Green, Miss Kylie Jones, Miss Faye Midmore, Mr Gareth Parry, Miss Elizabeth Sturgess

ADMISSIONS

Full Members

Mr Christopher Aylward, Mr Mark Berry, Mrs Carolyn Billingsley, Mr Anthony Bird, Miss Stephanie Boocock, Mr Daniel Brown, Dr Lorna Brown, Mr Charles Campbell, Mr Henry Campbell-Ricketts, Miss Alexia Chapman, Miss Amanda Craig, Mr Ciaran Cronin, Ms Isabelle de Geofroy, Dr Lindsey Defew, Mrs Helen Embleton, Mr Adam Fraser, Mr Paul Hope, Dr Matthew Jones, Miss Ursula Jones, Ms Alice Kimpton, Dr Mark Lambert, Mr Reginald Land, Ms Francesca Lemon, Mrs Mary Martin, Mr Daniel Maughan, Dr Alison McCarthy, Dr Mark McLellan, Dr Barry Nicholls, Miss Nicola Orchard, Miss Claire Pooley, Mrs Joanna Saich, Dr Sajan Sebastian, Dr Lorna Shaw, Mr Phil Shepherd, Mr Warren Slaney, Mr Andrew Speer, Mr Tom Staton, Mr Ian Stone, Mr George Watola, Ms Tatiana White, Mr Timothy Worsfold, Dr Matt Zeale

Associate Members

Mr Alexander Ash, Miss Katherine Baker, Mrs Rachel Barker, Mr Gacin Bennett, Mr Michael Blackmore, Mr Richard Bull, Mr Matthew Harding, Mr Robert Harrison, Dr Jenny Owen, Miss Justine Saelens, Mr Daniel Simmons, Dr Robert Woods

Upgrades to Full Membership

Ms Fiona Baker, Mr Stuart Blair, Mrs Katie Caldecott, Mr Benjamin Carpenter, Mr Richard Craven, Miss Lynsey Blows, Mr John Condron, Miss Tanith Cook, Miss Mary Davies, Mr Harry Fox, Mr Andrew Gardner, Mr Thomas Haynes, Mr Mark Iley, Miss Tamsin Ismail, Mr Jonathan Jackson, Mr Niall Lusby, Miss Laura Moody, Mr Tom Moore, Mr Matt Oakley, Dr Heather Oaten, Miss Laura Plenty, Miss Rachel Price, Miss Hazel Robson, Mr James Segar

Upgrades to Associate Membership

Mr Thomas Ash, Mr Andrew Bodey, Mr Adam Earl, Miss Julia Ferguson, Miss Ceridwyn Jennings, Mrs Laura Kershaw, Mr Jonathan Moore, Miss Octavia Neeves, Miss Nicole Robinson, Miss Jenny Wallace, Miss Stacey Whiteley

Recent Graduate Members

Miss Sara L. Amos, Mr Mark Atherton, Mr James E. Bamford, Ms Kelly Barrett, Mr Richard R. Bates, Miss Nia Bowen, Mr Michael D. Brown, Miss Jennifer M. Carr, Mr Guy Cole, Mr Thomas Cole, Miss Andrea Cordon, Miss Natalie Crawley, Miss Kim Croasdale, Mr Benjamin J. Crossman, Mr Sean Davey, Mrs Chloe Eldong, Mr Dominic Fawcett, Mr Domhnall Finch, Miss Louise Floyd, Miss Caroline Ford, Miss Kimberley Gallaher, Miss Joanna Greetham, Mr Matthew A. Hanson, Miss Emma Heath-Clarke, Mr Jamie J.P. Hoy, Miss Sarah Ive, Miss Rosie Jackson, Mr James A. Johnston, Mrs Sarah J. Kerr, Miss Victoria Leigh, Miss Nicola Lloyd, Mr John R. Minney, Mr Michael Morrissey, Miss Kimberley Pearce, Miss Kirsty Pearman, Mr Oliver Pescott, Miss Emma Pickering, Mr Samuel G. Rees, Mr J. Leonardo Reyes Acosta, Miss Claire H. Sambridge, Miss Emily S. Scragg, Ms Emer Sexton, Miss Amy Sharples, Ms Alice Shoebridge, Ms Kelly Stroh, Miss Eniko Szucs, Mr David E. Taylor, Mr Daniel J. Toogood, Miss Amy Walker, Miss Natalie Whitehead, Mr Paul Wilson

Recent Student to Graduate Upgraded Members

Miss Louise Abbey, Ms Emma Bonham, Mr Stuart A. Brooker, Miss Lucy Elliott, Miss Cecily Goodwin, Mr Ryan Harris, Miss Samantha Ireton, Miss Amelia Kent, Miss Gemma C. Longman, Mr Benjamin McLean, Miss Julia Messenger, Mr William H. Mills, Mr Nitharshan Nallasivampillai, Mrs Clare J. Nisbet-Czuprynski, Miss Hannah E. Rowe, Miss Anita C. Sedgewick, Ms Georgina Tayler, Mr Luke G. Verrall

Recent Student Members

Miss Kathryn C. Adams, Miss Zoe Baty, Miss Camilla Beyts, Mr Timothy Body, Mr Jon R. Chambers, Miss Megan Coombs, Mr Nthan Coughlan, Miss Lamara Craine, Mr Paul Diamond, Miss Kathryn Dixon, Miss Emma Graver, Miss Rebecca E. Harrington, Miss Rebecca Harvey, Miss Lucy Jeffreys, Mr David Kent, Mr Mehrdad Khoshchin Gilak, Ms Julia Kiss, Mr John G. Knott, Miss Katherine Knox, Miss Sophie Lancaster, Mr Ben Lansbury, Mr Jason T. Mackay, Mr Philip Maund, Mr Andrew S. Mitchell, Mr Ben Moore, Miss Gemma Nixon, Mr Thomas M. Pearson, Mr Stephen J. Porch, Miss Gwendolyn Raes, Miss Laura C. Ritchie, Miss Samantha Rogers, Mr Jonathan P. Slessor, Mr Matthew Stones, Miss Kerry Taylor

Recent Affiliate Members

Mr David Evans, Mr Cameron L. Fleetwood, Ms Carol A. Flux, Mr Alex Gerard, Mr Chris Griffin, Miss Verity Roberts, Miss Amanda Sewry, Mr David P. Spencer, Mr Edmund W. Williams, Mr Howard Wood

The Institute Now Has a Competency Framework

Steve Pullan CEnv FIEEM
Chair of the IEEM Competency Framework Steering Committee

So what is competence? Competence is made up of several elements: knowledge and understanding (qualifications, education, experience of applying knowledge and understanding), skills (actual activity undertaken) and context (environment, time, location, skill, and knowledge and understanding specific to function). This is best demonstrated with an example from my own work. One of the key roles I undertake in my day-to-day work is to negotiate agri-environmental agreements. Negotiation is very much a transferable skill that a wide range of employers look for. In contrast, my father is a retired member of the Charted Institute of Purchasing and Supply and he specialised in negotiation of road maintenance contracts of behalf of local councils. We both have the transferable skill of negotiation, but we could not do each others task/function, as we have different knowledge and understanding and the context of our negotiations are very different in terms of the knowledge and understanding being applied (agriculture systems, environment and ecology, scheme rules vs road construction design, materials and quantities, contract law). One of the failings of a competency assessment, and why competence can have a bad name, is that too many managers only look for and assess the transferable skill, or the job specific skill, and forget the importance of knowledge and understanding and its application and the context of how the experience was gained and applied.

At its June 2012 meeting, Council approved the Institute's first comprehensive Competency Framework, but why does the Institute need such a framework? Up until now the Institute has defined its required knowledge and understanding in the document *What you need to know to be an ecologist and environmental manager* along with *Annex A* (IEEM 1995). This was very much the starting point for trying to set standards and was always seen as the first step. To develop the new Competency Framework, Council approved a contract with Hyder Consulting. Two members of Cresswell (a Hyder Consulting Ltd company), Will Trewhella MIEEM and Paola Reason MIEEM, were the main contacts and they gathered a significant amount of evidence relating to competency standards, both within the ecological sector and within the wider environmental industry. The Steering Committee met on a number of occasions, sometimes via teleconferencing, to oversee the contract but also to make the ultimate decisions on the definitions, themes and sub-themes that now make up the framework. The consultants undertook a wide-ranging consultation to ensure that our framework fits with several of the major employers' competency frameworks in use in the sector, including government agencies, in order to ensure its validity.

A number of difficult issues came out during the development of the framework. The first was the overall categories and definitions (Box 1). It was fairly easy to agree the number of levels and the lower level definitions for levels 1 and 2 which are, **'Basic'** and then **'Capable'**, with level 3 **'Accomplished'** taking longer to accept by the Steering Committee. Other definitions for level 3 which were considered were; professional, proficient and skilled, along with several more. However, the definition of level 4 came down to the chair's casting vote, **'Authoritative'**. The Steering Committee was very much split on two definitions, authoritative or expert, for this level.

As the Chair for the Steering Committee my justification for accepting authoritative for level 4 is simple, it has to work equally as a definition across the 14 themes and 46 sub-themes for both specific professional skills and the transferable skills. If we used 'expert' then there was a serious danger in my view that we would have two definitions, one for professional skills and one for the transferable skills. Do we really have expert members who are the same level of expertise if the definition, of for example a badger expert, is used across all themes, (e.g. habitat/species management) who has published in learned journals, is sought out by those outside the Institute and industrial sector for their advice at a national level on badger management versus, for instance, recruitment and selection of personnel or occupational health and safety? Surely those outside IEEM would look to the Chartered Institute of Personnel and Development and the Institute of Occupational Health and Safety for such expertise in these two transferable skill areas rather than IEEM, but for a badger expert they would look to IEEM. By using the term 'authoritative' as our level 4 definition this can be said to reflect more accurately those who do have such expertise within the industry in all situations that need to be covered. The framework needs to, for all themes, allow for those who have an in-depth knowledge of the topic, are routinely consulted by others on the topic, solve highly complex problems independently relating to the topic, and routinely provide guidance for their employer. Therefore, 'authoritative' is a clearer definition of level 4 which works equally well for all of the themes and sub-themes.

Another area that challenged the Steering Committee and required a decision on the format of the framework related to some of the themes and sub-themes, along with the order that they occurred (Box 2). One example that demonstrates the issues involved relates to: Environmental management (theme), Habitat/species management (sub-theme), Species management. At one stage we had a separate sub-theme for species management relating to protected species and one for livestock management (Box 3). In the end it was decided that the competency descriptions for these two areas read the same [e.g. Demonstrate an awareness of current research relating to conservation policy and practice of species management (protected species = Wildlife and Countryside Act, licensing procedures, nutrition for the species, animal welfare, species biology and behaviour vs

Livestock = movement licences, nutrition for species animal welfare, species biology and behaviour). Undertake practical species/ livestock management (protected species = capture techniques, handling equipment, accommodation, animal welfare vs livestock = handling equipment, accommodation, animal welfare, veterinary activities, milking, shearing)]. To demonstrate this issue I will use a personal example. I am at best 'Basic' in relation to two objectives relating to the Species management sub-theme (Box 3); *Evaluate whether a species management programme has been successful, Identify and what species management techniques are available, what they involve and how effective they are*. The evidence I can present is assessing planning applications in relation to SSSIs with protected status and in relation to species management when writing management prescriptions as part of an environmental stewardship agreement when it relates to protected species. In terms of livestock however I am 'Authoritative' for all objectives for this sub-theme based on evidence that; *You may deliver training at an advanced level to others on this topic* (teaching and assessment both at university and several agricultural colleges over several years and qualified to teach post-16 relating to these subjects), *You have an in-depth knowledge of the topic, You are routinely consulted by others on this topic, You can solve highly complex problems independently relating to this topic* (I have worked with milking and beef cows, pigs indoors and out along with limited experience with turkeys and egg-layers which has been assessed by the Chartered Institute of Agricultural Management, for which I am on the Professional register). What this clearly demonstrates is the importance of context as part of the definition of competence and why this must not be ignored when assessing competence.

Council has approved this framework for three years before it is reviewed. This is part of the iterative process and the framework will now be used in various ways to define standards within the profession, membership and accreditation of courses, etc. Finally, I would like to thank all those involved from Paula and Will, Sally and the Secretariat, the government agencies, Lantra and the many others from the industry who contributed. And finally to the members of the Steering Committee for the immense amount of work involved in putting this together.

Box 1. Categories of Competence

Category		Definition	Descriptor
Level 1	Basic	Has a basic knowledge with a simple understanding of terminology and concepts. Has some experience of practical application. Would be able to carry out standard activities, under supervision.	• You recognise the terminology and concepts, and broadly understand what this topic is about. • You have a basic understanding of the importance of this topic. • You have some (limited) experience of practical application in this topic. • You would not be expected to undertake tasks in relation to this topic unless under suitable supervision.
Level 2	Capable	Has the knowledge and experience essential to carry out standard activities unsupervised confidently and consistently. Would need to seek advice before carrying out complex or non-standard activities.	• You understand the terminology and concepts relating to this topic, and are aware of any drivers supporting this topic. • You have good experience of putting this topic it into practice. • You can carry out this activity to a good standard when straightforward, following advice and guidance if necessary. • You know where to source detailed guidance and information regarding this activity and use this confidently. • You can identify when things are generally being done as they should, and you know how to spot if things are not right. • You know your own limits with regards to this topic and who to defer to in the event of needing further advice.
Level 3	Accomplished	Has the knowledge and experience of this topic to carry out complex, specialist or non-standard activities confidently and consistently. Is aware of alternative options and approaches. Can provide guidance, instruction and advice to others on this topic.	• You have detailed knowledge of this topic and can talk about it confidently. • You have extensive experience of putting this topic into practice. • You can deal effectively with difficult or complex issues relating to this topic, and consider alternative solutions. • You can make decisions confidently regarding this topic. • You can provide guidance, instruction and advice relating to others on this topic and may provide 'beginner' level training on this topic.
Level 4	Authoritative	Has sufficient knowledge and experience of the topic to be widely recognised as an authority, both by others within the organisation and by external peers.	• You have an in-depth knowledge of the topic. • You are routinely consulted by others on this topic. • You can solve highly complex problems independently relating to this topic. • You routinely provide authoritative guidance, instruction and advice to others. • You may contribute to the development of industry policy, standards and guidelines relating to this topic. • You may be called upon as an expert witness on this topic. • You may deliver training at an advanced level to others on this topic.

Box 2. Competency Themes and Sub-Themes (ecological/environmental themes are in blue, transferable skills are in orange)

Theme	Sub-theme	What this includes
Surveying	Habitat/species survey design	Setting objectives for surveys. Selecting techniques and designing methodologies to test objectives in line with best practice.
	Survey planning and fieldwork skills	Fieldwork skills including planning, selection and use of equipment.
	Species identification and evaluation	Species identification, application of knowledge of species ecology, and assessment of species status.
	Species handling	Safe and legal species handling techniques.
	Habitat identification and evaluation	Describing, classifying and evaluating habitats in accordance with best practice guidelines.
	Physical environment survey	Identifying and evaluating the influence of the physical aspects of the environment that affect the range and complexity of the biodiversity.
Environmental management	Habitat management	Setting objectives for habitat management plans. Developing and implementing (using appropriate techniques and machinery) schemes for habitat management. Monitoring the impact of habitat management.
	Habitat creation/enhancement	Setting objectives for habitat creation/enhancement plans. Developing and implementing (using appropriate techniques and machinery) schemes for habitat creation/enhancement, including mitigation techniques. Monitoring the impact of habitat creation/enhancement.
	Species management	Setting objectives for species management plans. Developing and implementing (using appropriate techniques and machinery) schemes for species management, including mitigation techniques. Monitoring the impact of species management.
	Sustainable environmental design	Designing and/or implementing effective sustainable environmental management solutions for biodiversity benefit. Resolving complex or conflicting constraints to achieve positive outcomes for biodiversity.
	Environmental compliance	Design and implementation of site-based projects involving interactions with other professional disciplines. Environmental risk management on sites.
	Biosecurity	Consideration of biosecurity issues and risks as part of project design. Development and implementation of biosecurity protocols in accordance with best practice guidelines.
Environmental assessment	Strategic Environmental Assessment	Undertaking Strategic Environmental Assessment for policies, plans and programmes.
	Environmental Impact Assessment	Undertaking Environmental Impact Assessment for development projects. Preparing Environmental Statements.
	Ecological Impact Assessment	Undertaking the ecological aspects of an Environmental Impact Assessment.
	Habitat Regulations Assessment. Appropriate Assessment/Natura Impact Assessment	Undertaking Habitat Regulations Assessment or Appropriate Assessment, Production of a Natura Impact Statement (NIS).
	Regulatory aspects of environmental assessment	Specifying environmental assessment requirements for plans or projects. Reviewing environmental assessment submissions on behalf of a competent authority or decision-making body.
Environmental governance, legislation and policy	Formulation	Development and review of legislation, policy and guidance relating to ecological and environmental management
	Understanding and application	Understanding and applying relevant legislation, policy and best practice.
	Compliance and enforcement	Determining whether actions by third parties are compliant and understanding enforcement routes and penalties for non-compliance. Managing casework.
Scientific method	Design	Setting appropriate scientific questions/hypotheses and designing methodologies to answer/test these.
	Implementation	Taking a methodology and implementing it appropriately, with a suitable programme and resources.
	Analysis	Carrying out appropriate analysis of results and information that is fit for purpose (statistical or otherwise).
	Interpretation and reporting	Interpreting outcomes and drawing valid conclusions. Presenting findings clearly and appropriately to a range of audiences.
Formal facilitation, consultation, engagement and partnering	Formal facilitation, consultation, engagement and partnering	Engaging with stakeholders and statutory consultees. Designing and implementing consultation projects. Partnership building.
Public awareness and education	Formal ecological teaching and training	Planning, delivering and evaluating teaching and/or training in ecological and/or environmental topics.
	Raising environmental awareness	Designing and implementing activities to raise environmental awareness and understanding, using a range of media.

Professional conduct	Professional conduct	Commitment to high standards of professional practice, recognition of ethical considerations and obligations to the environment, to customers and to society.
Business management	Managing quality	Developing and delivering quality services and products. Compliance with quality management systems (internal and/or external) and recognised standards. Quality management auditing.
	Environmental resource efficiency	Developing and achieving environmental resource efficiency targets. Raising awareness of resource efficiency and impact monitoring.
	Business planning	Strategic planning including use of strategic planning tools. Stakeholder engagement in business planning.
	Managing business	Financial, change and risk management. Operational management.
	Customer care	Commitment to, and practice of, high standards of customer care policy and practice.
Project management	Managing projects	Developing and implementing processes and systems to manage projects effectively. Stakeholder management.
	Evaluating projects	Project evaluation.
Information management	Data and document management	Establishing, promoting and using organisational processes to ensure effective data and document management. Compliance with recognised internal and external data management protocols and legislation including data protection.
	Numeracy	Using a range of numerical techniques. Modelling.
	Report writing	Producing clear, concise, factual and accurate written communications.
People management	Recruitment and selection	Recruiting staff and/or volunteers following equal opportunities and organisational policies in accordance with best practice guidelines.
	Developing people	Managing the performance of staff and volunteers. Developing capabilities to enable others to achieve their full potential.
	Team working	Working collaboratively and cooperatively. Managing teams.
	Leadership	Motivating people to act towards achieving a common goal, through direction, inspiration and effective communication.
Self management	Task management	Organising and prioritising work effectively to achieve desired goals. Being task-orientated. Delegating effectively. Achieving an appropriate work-life balance.
	Communicate effectively	Communicating accurately and clearly. Sharing knowledge effectively. Presentation skills. Negotiating and influencing skills.
	Learning and development	Recognising areas for personal development and seeking opportunities to develop knowledge, understanding and skills.
Health and safety	Occupational Health and Safety	Compliance with personal, organisational and statutory health and safety legislation, and organisational policy and protocols. Risk management. Health and safety auditing.

Box 3. Species Management

Identify what species management techniques are available, what they involve and how effective they are.
Demonstrate an awareness of current research relating to conservation policy and practice of species management.
Design best-practice guidelines for species management programmes.
Assess the need for a species/livestock management programme.
Set appropriate objectives/desired outcomes for species/livestock management, identifying which techniques (e.g. captive breeding, translocation, reintroduction, grazing levels) are most appropriate to achieve these.
Undertake practical species/livestock management.
Write and manage a species/livestock management programme.
Evaluate whether a species management programme has been successful.

About the Author
Steve Pullan works for Natural England as a Lead Advisor in the Northumberland Land Management Team.

Contact Steve at:
Steve.Pullan@naturalengland.org.uk

NEW PROFESSIONAL DEVELOPMENT COURSES

The Institute's 2013 Professional Development Programme includes the following highlighted new courses including masterclasses and seminars.

Ecological Clerk of Works

6 February 2013, Glasgow

This course gives participants an overview of the role of the Ecological Clerk of Works, exploring how these functions should be performed effectively. The course content will include understanding the role of an ECoW on a construction site - including monitoring, auditing and incident reporting. The identification of construction site constraints and survey methods will be discussed, along with general mitigation measures to protect, enhance and restore ecological receptors. There will also be a session on communication skills including on-site behaviour, site induction, client and stakeholder liaison and record-keeping.

Trainer
Rob Tyrrell MSc

Cost
IEEM members: £150
Non-IEEM members: £195

Environmental Advisor for Construction Sites

7 February 2013, Glasgow

Participants will gain a thorough understanding of what it means to be an Environmental Advisor for Construction Sites and how to discharge this role effectively. The course will examine environmental constraints faced during construction such as contaminated land, light, water, noise and dust pollution and explore general mitigation measures for pollution control and emergency response. Risk assessment and method statements will be discussed as well as the use of impacts registers.

Trainer
Rob Tyrrell MSc

Cost
IEEM members: £150
Non-IEEM members: £195

Water Environment: The Legal Framework

8 February 2013, Sheffield & 14 March 2013, London

Covering key aspects of European and national Water Law, the seminar will provide professional knowledge of the Water White Paper and the implications of the Water Framework Directive. Topics will include Abstraction and Impoundment; Pollution of Controlled Waters; Structures and Obstructions in Watercourses; Permits and consents. The course is intended for professional ecologists working with the water environment as well as land managers and developers, operators and consultants working on land-based activities.

Trainer
Penny Simpson - Environmental Lawyer, English & Welsh Qualified

Cost
IEEM members: £195
Non-IEEM members: £225

Ecological Impact Assessment (Beginner, Intermediate, Advanced)

15 January 2013 (Beginner), 16-17 January 2013 (Intermediate), Crewe

29 January 2013 (Beginner), 30-31 January 2013 (Intermediate), 5 March 2013 (Advanced), London

6 February 2013 (Beginner), 21-22 February 2013 (Intermediate), Bristol

27 February 2013 (Advanced) Birmingham

18 March 2013 (Beginner), 19-20 March 2013 (Intermediate), 21 March 2013 (Advanced), Leeds

These courses are for environmental professionals at all levels who want to develop their knowledge and skills in undertaking Ecological Impact Assessments (EcIA). They are designed for different career stages and levels of experience of the EcIA process. Worked case study examples will be used to guide participants through the EcIA process. The beginner course caters for those with little practical experience of EcIA, providing a grounding in key areas of undertaking. The intermediate course is designed to give participants with some experience a deeper understanding through more complex case studies, and the development of skills such as presenting the outcomes of EcIA reports. The advanced level is aimed at more senior professionals and includes complex examples as well as training to identify important ecological resources.

Trainer
Trainer Mike Dean BSc MSc CEnv MIEEM

Cost (1 day courses) IEEM Members: £195
Non-members: £245

Cost (2 day courses) IEEM Members: £375
Non-members: £425

For more information and to book visit www.ieem.net/events

IEEM Survey of Working Practices

Sally Hayns MIEEM
Chief Executive Officer, IEEM

Thank you to those members who responded to our survey on Working Practices earlier this year. Council had requested that a survey be undertaken because of concerns raised by reports of the working conditions that some members are required to work under. A survey was felt to be the best means of ascertaining

a) whether there is an issue, and

b) if so, what should the Institute's response be.

Over 750 of you responded to the survey, which illustrated that it clearly touched an area that is important to you. Just under 12% of Graduate members responded to the survey, 14.5% of Associate members took part, 22% of Full members and 50% of Fellows. Just under half of the respondents had been in their current post for more than 5 years. Over 80% were full-time workers. Almost three quarters were employees with the remaining 25% being self-employed. The spread of employers (including self-employed) is shown in Figure 1.

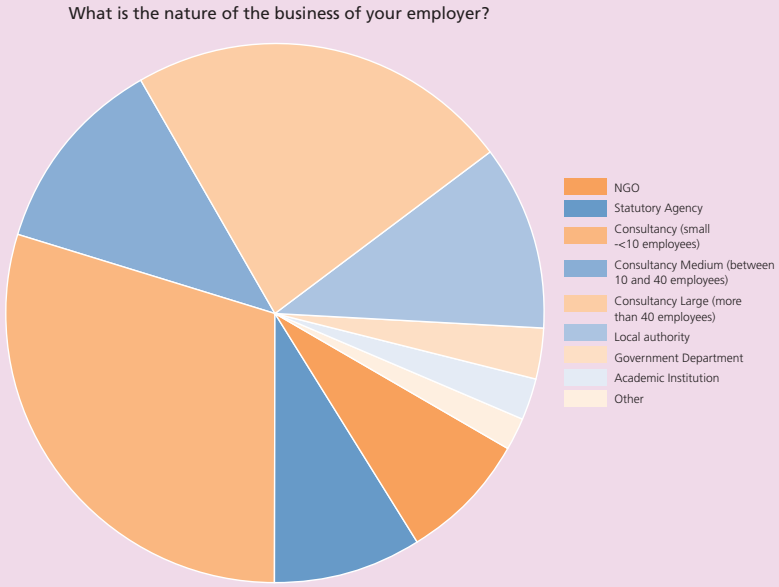


Figure 1. Pie chart of employer sector breakdown (Q5)

The most common category of contracted hours was 35-40 hours per week. The majority of part-time workers are contracted for more than 20 hours a week but less than 35. Over three quarters of respondents said that their actual working hours vary at different times of year with the majority citing the pressures of the ecological survey season as being the main cause, followed by events organisation, habitat/species management activities and policy consultation deadlines. About 15% of employees get paid overtime. Self-employed respondents do not! Time Off in Lieu (TOIL) or some other system of compensation for extra hours worked is available to just over 70% of employees.

For those involved in ecological survey work the average weekly hours worked rises significantly (see Figure 2). Over a third of those affected work an average of more than 50 hours a week during this period. This compares with 3% of the same group during the non-survey season.

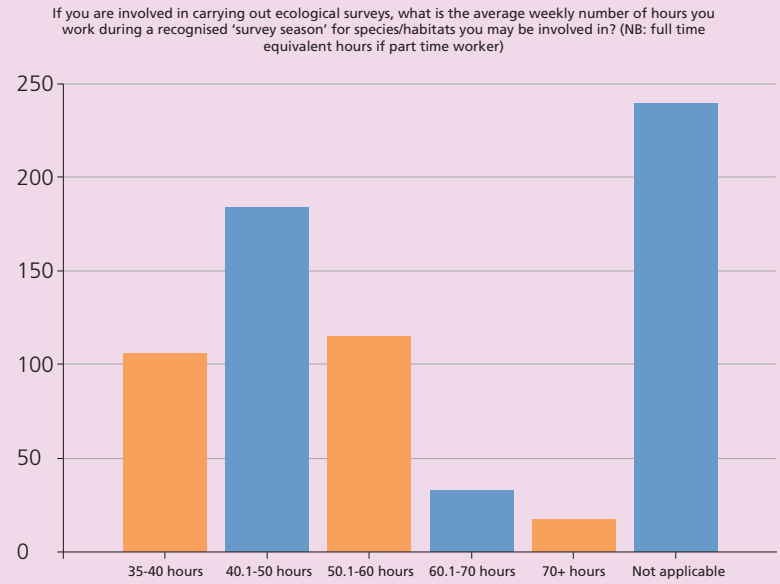


Figure 2. Average weekly hours worked during the survey season (Q13)

Almost three quarters of those responding are required or expected to take regular rest breaks in accordance with European

legislation – but that means just over a quarter are not. Just less than two thirds get an allowance or are able to claim back the cost of lunch whilst working away from home. For those working unsocial hours (at weekends or in the evenings) just under 60% have a food allowance (e.g. for dinner or breakfast), although for 2% of this group it is less than £5 per meal.

One third of respondents said that their travel time (to sites or meetings) is not recognised by their employer in their 'hours worked' or only have a proportion of the time recognised. Seventy percent of respondents do have access to a company vehicle or paid-for public transport when travelling for work, although over half are also routinely expected to use their own vehicle. Just over 17% of respondents drive, on average, over 1,000 miles per month for their work. For those members that do use their own cars almost all are reimbursed for their mileage with the majority getting the HMRC-recommended 45p per mile. Twenty-six respondents get less than 20p per mile and three get less than 10p per mile!

Three quarters of those using motorcycles and half of those using bicycles also get reimbursed, generally in accordance with the HMRC guidelines. It is disappointing that the response for reimbursement of bicycle use isn't higher.

Seventy percent of respondents regularly work unsocial hours but only 2.5% of those get any unsocial hours payment. The employers of 90% of respondents have a lone working policy but a third of respondents say that it is not strictly enforced or adhered to. Two fifths of those working unsocial hours are expected to work alone when required. Just over a third of those working beyond 10.00pm are provided with access to sleeping or rest accommodation, although when it is provided it is usually to an acceptable standard of facilities and privacy.

Over three quarters of the respondents do feel that their welfare at work is a high or very high priority for their employer with many providing additional means of demonstrating care and concern (see Figure 3). Other provisions listed by some include private healthcare, access to counselling, child care allowances, company discounts, employee assistance schemes, work scheduling to avoid fatigue and being open to feedback. A similar proportion feels that their employer's attitude to their employees' welfare has unchanged over the past three years whilst, encouragingly, almost 20% felt that it had improved.

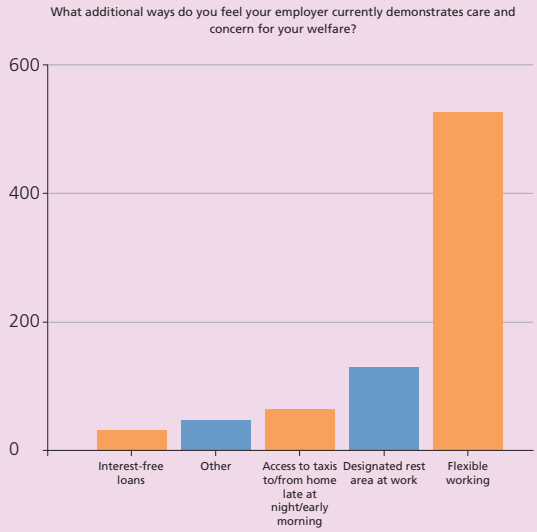


Figure 3. Employer provision for their employees' welfare (Q36)

For those who do not feel that their welfare is of sufficient concern, this is clearly an area of frustration. The most commonly cited suggestions for improving staff welfare were additional staff to share the workload, proper rest provision, restrictions on the number of very early starts/very late finishes per week, greater professional recognition, outdoor clothing allowance and a system which doesn't require the individual to pay too much upfront before being able to claim it back. By far the most common plea was for more staff/resources to help overloaded and stressed employees.

So those are the results. But what is not shown here are the much more detailed comments from many respondents which reveal a worrying depth of frustration at working practices including poor wages (especially for casual workers), long hours – not just for fieldworkers who may suffer prolonged sleep disruption but also for many others striving to meet unreasonable deadlines, the expectation of unpaid overtime, and a perception of having low status/being undervalued as a professional. This is not just about consultancies but in many other sectors there are also increasing stresses and strains to perform against a backdrop of continual change and performance management. A common theme from respondents was satisfaction that the Institute is looking into the issue of working practices because it is of such concern.

Finally, let us not forget the many employers and self-employed ecologists amongst our membership. The survey results indicate that whilst some respondents are able to manage their hours and the pressure that they put themselves under according to their circumstances, many are working extremely long hours in a very competitive market with a depressed income. And whilst they may make every effort to treat their employees or sub-contractors well, this will often not apply to themselves and their own working conditions.

Next Steps

The survey results will be considered by the Institute's Governing Board later this month which will take a view on what action, if any, IEEM should take. This could, for example, include providing guidance on good practice in this area and some reference points as to what a good employer should be aiming for (which hopefully self-employed members can also aim for). There are some other ideas and suggestions which we will be following up so look out for updates in future issues of *In Practice*.

About the Author
Jally Hayns has been CEO of IEEM since June 2010. Prior to joining the Institute she was Head of People and Wildlife at the Hampshire and Isle of Wight Wildlife Trust.

Contact Sally at:
sallyhayns@ieem.net

Renewable Energy and Biodiversity Impacts

IEEM Autumn Conference, 7-8 November 2012, Cardiff

In the UK today, 10% of our energy needs are supplied by renewable sources. Across the spectrum of provision available – wind, tidal, biomass, food waste, nuclear – the renewable sector and all those involved need to find ways to reduce their impacts and make genuinely sustainable renewable energy available. This was the joint message of key note speakers **Tony Juniper** and **Maf Smith**.

Bernice Roberts MIEEM and **Pete Etheridge MIEEM** raised questions about the pressures faced by ecologists and environmental managers working on renewable energy developments, and how to face the high demands to deliver robust technical analysis.

Stuart Clough outlined recent developments in surveying techniques for offshore renewable projects and in particular the use of remote sensing. He explained how the advent of new technology based methods has improved the quality of data being used for impact assessment, and has led to the development of advanced modelling methods for investigating change over time.

This year the Bat Conservation Trust has developed survey guidance for bat surveys of wind farms. **Matthew Hobbs MIEEM** explained how its use is aimed to help prevent inconsistency, close data gaps, assist in micro-siting turbines, and informing the assessment process and provision of appropriate mitigation.

Kirsty Park discussed quantifying the effects of Small Wind Turbines on birds and bats, the results of which suggest that bats avoid operating SWTs but that this effect diminishes within 20m. Data was presented demonstrating that local planning processes can vary widely and that a strategic approach is needed at the national level to reduce the impacts on wildlife.

Mike Evans gave an overview of hydropower technologies and their associated ecological issues, making reference to the Environment Agency's recent good practice guidelines. He introduced the benefits of environmental sensitivity mapping and effective mitigation and enhancement techniques, particularly in relation to fish.

A potential barrier to the development of the Marine Renewable Energy (MRE) industry is the concern over the environmental impact that MRE devices may have on marine biodiversity. **Martin Attrill** reviewed the evidence for the operational impacts of offshore wind turbines, wave energy converters and tidal turbines on marine organisms.

Ross Hodson from the Marine Management Organisation discussed the consents regime for offshore renewables and the role and functions that this relatively new organisation has to play within the regulatory landscape.

'The Greatest Threat to Biodiversity is Climate Change - So let's build the Severn Barrage?' Styled along the lines of the BBC's Question Time, this lively session was chaired by **Steve Ormerod FIEEM** and featured four leading experts with particular interest in the Severn Barrage. The panellists included **Martin Harper** (RSPB); **Maggie Hill MIEEM** (Countryside Council for Wales); **Brian Morgan** (Cardiff Metropolitan University) and **Reza Ahmadian** (Cardiff Metropolitan University). Each panellist took to the stage to give their perspective on the proposal before delegates were able to question their stances from the floor.

A large onshore wind farm covers several square kilometres of land, less than 2% of which is actually occupied by the turbines, access tracks and other bits of infrastructure. **Hugh Watson CEnv MIEEM** considered the benefits this could present in providing a shift towards more sustainable land management and some of the reasons why this has not yet happened.

In the context of growing demand for offshore wind energy production in recent years, much effort has been made to determine the collision risk that offshore wind turbines pose to birds. Currently only limited data exists on species-specific migrating birds' avoidance rates and associated mortality at offshore wind farms. **John Allan** explained how a 4-year study using bird detection radar has monitored behavioural responses and flight changes of migrating pink-footed geese in relation to two offshore wind farms during and after construction. **Matthew Denny MIEEM** has explored the potential turbine displacement effect on breeding farmland birds and initial results show minimal displacement effects. **Richard Nairn CEnv FIEEM** continued the theme with water birds and impacts on their foraging ecology as a direct result of proximity to wind turbines. The foraging activity of two focal species, bar-tailed godwit and oystercatcher, were compared at wind farms and at nearby control sites.

Benedict Gove's presentation covered a selection of the wind farm research undertaken by RSPB over recent years, which has developed our understanding of the effects of wind farm construction or operation on bird populations. Benedict identified a number of species that have been affected in very different ways, pre- and post-construction.

Tom Dargie CEnv MIEEM reviewed the evidence for wind farm impact on peatland. The context was related to the planning process and drew on the consultancy experience. The role of habitat information in the EIA process was also reviewed, together with Habitat Management Plans offered as mitigation and compensation for wind farm development.

An update on The National Bats and Wind Turbine Project, which seeks to understand whether bats are affected by wind turbines in the UK, and develop methodologies for effective post-construction monitoring, was presented by **Fiona Mathews MIEEM** from Exeter University. The use of search dogs and acoustic monitoring at the nacelle was also discussed.

Adrian Lea highlighted the stages, work and information necessary to increase the chances of submitting a successful planning application. The presentation stressed the importance of community engagement and pre-application discussions and recognised the need to provide certainty and commitment, and how this translates into delivery on the ground.

The 'average' on-shore wind farm can take up to 10 years from site identification through to operation. Ecological constraints and opportunities are one of the first to be considered in the development programme. **Owen Saward** outlined the importance of early, meaningful dialogue between developers and statutory consultees and how this can form the basis of a successful project.

Steve Evison looked at some of the challenges we face in a world where science is perhaps no longer held as providing all the answers. For science to play a role, we need to address the challenges for consultation, engagement and dialogue. Steve elaborated on our thinking around this and suggested some potential ways for scientists and the public to work together effectively.

EIA survey data generally follow the same methodologies and potentially provide a valuable archive of ecological information. However, most of the information is scattered and there is a danger that the value of this data will never be realised. **Mick Green CEnv FIEEM** presented the efforts underway in Wales to pull all this information together and its future value to developers and regulators.

David Lewns MIEEM described the role of the Ecological Clerk of Works (ECoW) during construction of renewables projects. He outlined the need for good quality reliable surveys, the benefits of early involvement, an understanding of the constraints offered by the ecological aspects of the site, as well as an understanding of the environmental, engineering and physical constraints involved.

The Scottish Borders is a preferred area for onshore renewable developments and these complex developments have presented the planning authority with considerable challenges. **Andy Tharme** described how the Council has addressed this with the development and implementation of a biodiversity offsetting approach.

The last talk of the conference, by **Stewart Lowther CEnv MIEEM**, considered a future vision for renewables. He stated that renewable energy developments must make a significant and strategic contribution to the restoration and enhancement of biodiversity in the UK. He then elaborated on how to get developers to 'buy' into this vision and the role that ecologists and environmental managers have to play.

All of the presentations, speaker biographies, and abstracts are available at http://www.ieem.net/previous-conferences-2012-autumn-conference-318.

The conference was supported by:

Thoughts from a Member

I was very pleased to be able to attend the IEEM annual conference on *Renewable Energy and Biodiversity Impacts* in Cardiff recently. Some excellent speakers and a lively debate on many of the issues all topped off by the news that our petition for a Royal Charter has been accepted by the Privy Council and signed by Her Majesty the Queen. So how does our, soon to be Chartered, Institute and its members need to deal with renewable energy? Out of all of the statements made at the conference, two strike me as particularly pertinent: *"that you can't have energy, renewable or otherwise, without environmental impact"* and *"that ecologists and environmental managers need to start thinking bigger"*.

We live in a world with a growing population and an increasing standard of living, or at least some aspiration for a better life, and that requires a secure and constant supply of energy. Our population currently relies, in large part, on carbon sequestered in fossilised plants and animals accumulated over millions of years. While our technology has increased to exploit these resources so that we can still use them for a few decades more, we have come to suspect, believe or deny (depending on where you live and who funds your politicians) that the costs may be greater than the obvious huge holes in the ground, fouled birds, dead fish and incidence of respiratory diseases that come to our attention from time to time, in that the global environment may change sufficiently to make large parts of the world uninhabitable for us. Nuclear power offers us an alternative but clean, usable fusion energy is still said to be 30 years away, bearing in mind that 30 years ago it was also said to be 30 years away. Nuclear fission is around and is in use now, but it has many problems, some of which technology could solve but in the end it is reliant on digging up a finite amount of material. So that leaves us with the renewable option, energy from the sun and earth. Whatever the sustainability of the technology we have available, the sources themselves are sustainable for as long as the sun continues to shine and until the earth cools. Sometimes it helps to remember that many of these technologies are not new and scary, substitute wind turbines for windmills, hydropower for water wheels and biofuels for coppicing and you have essentially the same activities scaled up. I wonder if anybody restoring a windmill has been asked to investigate bird impacts or barotrauma yet?

Given that renewable energy has always been around, we will need more of it and here in the British Isles we have plenty of unexploited potential. So there will be many new projects which require input from IEEM members. Hence we need to consider biodiversity in two ways when advising: firstly, in the long-term, sustainable energy is likely to be more beneficial to biodiversity than unsustainable energy; and secondly, how can we minimise the impact and maximise the benefit to biodiversity of these schemes based on data and sound science without the collection and assessment effort costing enough to make the projects unviable?

Richard Graves CEnv FIEEM
Richard Graves Associates

IEEM-RES Conference 2012:

Techniques and Approaches for Assessing the Importance of nvertebrates in Environmental Impact Assessments (EIA)

Nick Jackson AIEEM
Marketing and Communication Systems Officer, IEEM

The second joint conference between IEEM and the Royal Entomological Society (www.royensoc.co.uk) took place on 10th October 2012 in Faversham, Kent. The meeting attracted 70 delegates and was again hosted by the Kent and Medway Biological Records Centre. The meeting aimed to compare techniques for assessing invertebrate species richness, protection of pollinator services, the importance of wetland, aquatic and ground dwelling invertebrate faunas, and how best to present the information on invertebrates to planning authorities.

Delegates were very pleased to welcome **Jon Webb MIEEM**, Senior Entomologist with Natural England, who gave an outline of the development of ISIS (Invertebrate Species-habitats Information System) which is a tool used for classifying invertebrate assemblages into habitats (like an NVC for invertebrates!). The system was developed to undertake Common Standards Monitoring which is the agency's method for determining the condition of SSSIs.

The next speaker was **Graham Hopkins CEnv MIEEM**, from The Ecology Consultancy, who explained 'how the experts do it' by presenting a review of Environmental Statements from Ecological Impact Assessments (EcIA) taking into consideration invertebrates. Sixty-one reports written by 23 surveyors over the last 10 years were analysed and survey effort was considered for each report. Preliminary analysis suggested that only 40-50% of the assessments were accurate in terms of enough survey effort to show rare/scarce invertebrate species; 20-35% had insufficient invertebrate information and in only 5-15% was there too much survey effort for the species identified.

Colin Hawes, from Royal Holloway College, then spoke about planning application mitigation for the iconic (and only partially protected in the UK) stag beetle species. He explained techniques used in mitigation measures for the beetle, which spends up to 97% of its life cycle underground. Managing the land for stag beetles along with configuration of log piles were explained.

The next speaker, **Jon Davies CEnv MIEEM** from Cresswell Associates, gave a presentation from a consultant's perspective and outlined some of the pragmatic approaches used when assessing invertebrates. He explained the different approaches through a desk study and scoping phase of a project, through the habitat assessment and site appraisal, and then putting the data into context when valuing the site and assessing the impacts.

Alex Ramsay MIEEM spoke about a decision tree for informing EIA decisions on-site, which he had developed whilst working at Thomson Ecology. This decision tree was a step by step approach to ensure that the highest risk species of invertebrates are considered in turn. This tool could potentially be used to inform decisions for EIA at all stages of the EIA process.

The next speaker, **Stuart Connop** from the Sustainability Research Institute at the University of East London (UEL), spoke about the importance of brownfield sites and using appropriate landscaping methods to promote invertebrate conservation. Stuart highlighted different alternatives to green roofs and the materials used to build them. He cited three projects as examples – housing and green roof design at Barking Riverside, London Wildlife Trust's community garden, and UEL's 'beetle bump'.

Nikki Gammans from the Bumblebee Conservation Trust gave the next presentation and spoke about methods for surveying some of the rarer bumblebee species and how to create the perfect flower-rich habitats beneficial to the species.

The final talk of the conference was from **Stefanie Buell MIEEM** of Kent County Council, who gave a local authority perspective on planning for invertebrates. Stefanie covered the relevant planning policy and processes, the ecological requirements of a planning application, and looked at local authorities' understanding of invertebrates using a survey of ALGE (Association of Local Government Ecologists) members.

Following the conference there was an optional tour around Brogdale Farm (www.brogdalecollections.co.uk), home to the National Fruit Collection, which is the largest collection of fruit trees and horticultural plants in the world. My particular highlight was the 'knobby russet' apple which is somewhat of a rarity.

The presentations from this conference are now available on the IEEM website at www.ieem.net/2012-res-ieem-conference.

1. Knobby russet apple (background image)
2. Delegates at the conference
3. Tour of the National Fruit Collection at Brogdale Farm (All photos by Nick Jackson)

About the Author
Nick Jackson has been the IEEM Marketing and Communication Systems Officer since June 2011. Prior to this he was the Institute's Education and Professional Development Officer.

Contact Nick at
nickjackson@ieem.net

NEW PROFESSIONAL DEVELOPMENT COURSES

The Institute's 2013 Professional Development Programme includes the following highlighted new courses including masterclasses and seminars.

Habitats Regulations Assessment (HRA) training

14 January, 2013 'HRA of Projects for Project Proposers & Advisers', London

21 January, 2013 'HRA of Projects for Local & other Competent Authorities', Edinburgh

22 January, 2013 'HRA of Plans for Local Authorities & other plan-making bodies', Edinburgh

28 January, 2013 'HRA of Projects for Project Proposers & Advisers', Cardiff

4 February, 2013 'HRA of Projects for Project Proposers & Advisers', Leeds

14 February, 2013 'HRA of Projects for Local & other Competent Authorities', Birmingham

15 February, 2013 'HRA of Plans for Local Authorities & other plan-making bodies', Birmingham

25 February, 2013 'HRA of Projects for Project Proposers & Advisers', Edinburgh

A suite of courses tailored to professionals with specific responsibilities relating to the HRA. The training provides a thorough understanding of the overall purpose, process and methodology of the HRA of projects or plans (depending on the course) in England and Wales, or Scotland. Learning outcomes will incorporate an appreciation of the source legislation, practical application of the key stages, knowledge of case law and examples of good practice, with sources of advice and guidance provided. The training will provide helpful tips and hints on ensuring compliance and due process and the pitfalls to avoid, plus how to keep assessments fit for purpose. The courses are tailored separately for 1) those working in or acting for Local Authorities and Competent Authorities carrying out assessments; 2) professionals involved in project proposals and those whose job it is to provide information to competent authorities; 3) professionals working in or for plan making bodies

Trainer David Tyldesley FRTPI FIEEM FRSA and Dr Caroline Chapman

Cost IEEM Members: £225 Non-members: £275

Train the Trainers

12-13 February 2013, Birmingham

14-15 March 2013, Leeds

- Have you led a training day and wondered how to cope with the mix of abilities in your group?
- Want to know how to deliver effective learning sessions instead of lectures?
- Need tips to make teaching species ID fun and interactive?

These unique two-day courses are specially designed for ecologists and environmental professionals and cover field as well as classroom tuition. They are for anyone who wants to enhance their teaching and training skills. Included are designing sessions to cater for differences in the way people learn, tips on maximising information retention, and how to design learner-centred group activities. Participants will also develop a session for use on their own course.

Trainers Clare O'Reilly MSc PGCE (FE&HE) MIEEM MIfL and Paul Losse MSc MIEEM

Cost Existing IEEM Training Providers: £100 IEEM Members: £195 Non-members: £245

ROLO Health, Safety and Environmental Awareness for Ecologists

18 January 2013, Penarth

This one-day course has been designed specifically with ecologists in mind and will draw on case studies and examples from within the sector. The course promotes H&S in the land-based sector and aims to reduce the number of accidents caused by lack of awareness. It provides a recognised route for H&S training in the National Highways Sector Scheme 18 (NHSS) and is also an accredited route to the Land-based Industry Skills Scheme/Construction Skills Certification Scheme (LISS/CSCS). The aims of the ROLO scheme are to:

- Keep a record of those in the industry who have achieved a recognised level of competence and to provide a means of identification on site.
- Raise the standards of health and safety to reduce the risks and accidents.
- Encourage employers to use only ROLO card holders who have accredited health and safety training.

Trainer Jodie Read

Cost IEEM Members: £150.00 Non-members: £175.00

For more information and to book visit www.ieem.net/events

A Royal Charter at last!

Sally Hayns MIEEM
Chief Executive Officer, IEEM

Following the decision taken by members at the Extraordinary General Meeting (EGM) on 13th June 2012 to petition her Majesty the Queen for a Royal Charter, the Petition itself was signed by our President, Penny Anderson, at the House of Lords on 28th June. This followed extensive consultation with a wide range of interested parties, stakeholders, supporters and objectors and the submission of a Letter of Intent to the Privy Council. The Letter of Intent was circulated to a standing list of consultees and, as no objections were raised, the Institute was free to make its petition.

The Petition, draft Charter, and ByLaws were submitted in early July 2012 and notice of their submission was published the *London Gazette* inviting any representations. A list of consultees was also contacted by the Privy Council seeking further comments. Some minor changes were advised by the Privy Council's legal advisers and approved by IEEM's Council on 4th October 2012.

The Petition was heard by the Privy Council at their meeting of 7th November and the Order of Grant was signed by Her Majesty the Queen. So we will become a Chartered Institute in 2013. **We are not chartered yet** as the Charter does not come into effect until it has been drafted, signed and sealed with the Great Seal.This could take several months.

A New Register

Included within the Charter is a request for the power to establish a new Register of Chartered Ecologists. The Institute (or Chartered Institute) will be responsible for determining the competence criteria and assessment procedures for the award of Chartered Ecologist (CEcol). Council has recently approved the establishment of a shadow Registration Authority to consider such matters, continuing the preliminary work undertaken earlier this year.

Some Frequently Asked Questions

What does becoming a Chartered Institute mean for IEEM and its members?

The Institute will become the Chartered Institute of Ecology and Environmental Management (CIEEM). There will be a transfer of assets from the current company to the new body. The Charter and ByLaws become the governing instruments of the Chartered Institute, replacing the current Memorandum and Articles of Association. Our members will become members of the Chartered Institute.

The collective benefits are around enhancing the profile and perceived status of the profession. To quote the Privy Council website *"New grants of Royal Charters are these days reserved for eminent professional bodies or charities that have a solid record of achievement and are financially sound."*

When will this happen?

We now have to wait until the Charter is printed and the Great Seal applied. This could take some time. We can then choose a date on which to enact the Charter – i.e. to transfer from a limited liability company to a body incorporated by Royal Charter and, for practical reasons, this is usually done to tie in with a financial quarter.

We will certainly let you know!

Will I automatically become a chartered member?

No. You will become a member of the Chartered Institute. At the appropriate time (but not yet!) you would be required to update your post nominals-such that:

FIEEM	becomes FCIEEM
MIEEM	becomes MCIEEM
AIEEM	becomes ACIEEM
GradIEEM	becomes GradCIEEM

So how do I become chartered?

There will be two routes to Chartership.

One is the existing route of Chartered Environmentalist (CEnv). IEEM currently holds a licence to award CEnv accreditation and this licence would be transferred to the Chartered Institute. CEnv is an increasingly recognised standard of good environmental practice and the competence requirements are appropriate for many of our members. The Institute (or Chartered Institute as it will become) remains fully committed to working with other members of the Society for the Environment to continue to promote recognition of Chartered Environmentalist status.

Our new Charter will also give us the power to establish a new Register – that of Chartered Ecologists. CIEEM would have responsibility for maintaining this Register, establishing the competence requirements, assessing and admitting registrants. Registrants will have the authority to describe themselves as a Chartered Ecologist and use the additional post-nominals of CEcol.

Can I just transfer across from CEnv to CEcol?

No. The Chartered Ecologist award recognises a different assemblage of competencies to that of Chartered Environmentalist (otherwise there would be no need for the new Register) so you cannot just transfer across. You have been assessed as meeting the CEnv competency requirements but that does not necessarily mean that you will meet the CEcol assessment competency requirements. Similarly future CEcols will not necessarily meet the CEnv competencies. They are not interchangeable, although of course some members may be able to demonstrate competence in both sets of criteria and may decide to have both awards.

Can only IEEM members become Chartered Ecologists?

No. It would be inappropriate (and not permitted) to create a Register that is exclusive to our members. Any member of a professional body with CPD requirements and operating a code of conduct can apply for registration as a Chartered Ecologist provided they meet the competence requirements. However, IEEM will set the requirements and the assessment process to ensure that it is an appropriate standard of competence and it is likely that IEEM assessors will undertake all of the assessments to ensure consistency.

I have heard that I would need to be re-assessed but my CEnv status is not reassessed. Why is that?

It is true that IEEM's Charter makes provision for a requirement for re-assessment of CEcol status at undefined intervals. This follows discussions with the Privy Council regarding maintaining CEcol as a standard of high competence (bearing in mind that the assessment can only assess competence over a relatively short time period) which the Institute is very keen to do. In most of the recently established registers the Privy Council has required a re-assessment provision but this was not the case when the Chartered Environmentalist Register was established.

The interval between re-assessments will be decided by the Governing Board on the advice of the Registration Authority.

How much will CEcol accreditation cost?

The costs will be decided by IEEM's Governing Board and will depend on factors such as the assessment process and administrative costs.

When might the Register be open?

The timescales is partly dependent on when the Charter is sealed and that may not be for several months. There is a considerable amount of work to be done to define and approve the criteria, the application and assessment process, put all the necessary forms together, recruit and train assessors and establish the necessary 'back office' systems. This cannot happen overnight but will clearly be a high priority which is dependent on the goodwill and effort of a very significant number of volunteers. A shadow Registration Authority consisting of some senior members of the Institute and representatives of external bodies has now been established to undertake this work.

We will continue to issue regular updates via our website, *In Practice* and the E-Newsletter.

About the Author
Sally Hayns has been CEO of IEEM since June 2010. Prior to joining the Institute she was Head of People and Wildlife at the Hampshire and Isle of Wight Wildlife Trust.

Contact Sally at:
sallyhayns@ieem.net

Assessors Wanted

In early 2013, IEEM will be launching its new scheme for accrediting higher education undergraduate and postgraduate degrees that produce graduates with the knowledge and practical skills that employers in our field are looking for.

We are now looking to recruit a pool of assessors to undertake the desk-based assessment and site visit required for each applicant degree programme. Assessors will:

- be experienced members of the Institute, ideally with a good understanding of the knowledge and skills requirements of graduates across a range of employment sectors, and/or
- have a good understanding of higher education practice.

Assessors will work in pairs, will receive training and support, and will each receive an honorarium of £500 per assessment undertaken.

If you are interested please register to receive further information by contacting enquiries@ieem.net.

The Society for Biology is also looking for assessors for their higher education degree accreditation scheme which will focus on the accreditation of research-focused courses. Further information can be found at www.societyofbiology.org/education/hei/accreditation or by emailing natashaneill@societyofbiology.org.

Best Practice Awards 2012

The IEEM Best Practice Awards are presented to projects that demonstrate best practice in one or more of the below award categories, which have been revised for 2012. Entries were invited from all sectors of the ecology profession including the public, voluntary and consultancy sectors.

The award categories are:

1. Outstanding Achievement in Practical Nature Conservation

- Enhances biodiversity and/or ecosystem functioning (e.g. projects that deliver significant enhancement or creation of biodiversity assets by going 'above and beyond' what is required).
- This category is judged against objectives 1 and 2.

2. Outstanding Innovation

- Advances the profession of ecology and environmental management (e.g. projects that advance the profession through innovative concepts, design, delivery or practical application).
- This category is judged against objectives 1 and 3.

3. Outstanding Knowledge Exchange and Promoting Best Practice

- Furthers the knowledge-base of the profession of ecology and environmental management (e.g. projects that improve evidence and ways of working through the production, storage and dissemination of policy, guidance, advice and practical tools (GIS, databases, toolkits, etc.)).
- This category is judged against objectives 1 and 4.

The objectives against which the above categories are judged are:

1. Displays high standards of professionalism.
2. Enhances biodiversity, ecosystem functioning and sustainable development.
3. Contributes to the profession of ecology and environmental management.
4. Contributes to knowledge exchange, training and education within ecology and environmental management.

An additional award is also available, the Tony Bradshaw Award, which recognises an exceptional project that is judged to be outstanding in two or more of the above categories and sets an impressively high standard. The winner of each award category is automatically considered for the Tony Bradshaw Award. The Tony Bradshaw Award is at the judges' discretion and will not necessarily be presented each year. This award is named in honour of the late Professor Tony Bradshaw FRS FIEEM, who was IEEM's first President.

Penny Anderson presents Roland Randall with the Best Practice Award for Outstanding Knowledge Exchange and Promoting Best Practice

In 2012, only one award was presented. This was in the 'Outstanding Knowledge Exchange and Promoting Best Practice' category and was awarded to 'Coastal Vegetated Shingle of Great Britain: 25 years of research and application' and was accepted by Dr Roland Randall CEnv FIEEM at the IEEM Autumn Conference in Cardiff.

The 'Coastal Vegetated Shingle of Great Britain' project is a pioneering classification and baseline survey over 25 years that has enabled sites to be revisited to provide consistent re-survey that delivers BAP Priority habitat and Annex 1 coastal vegetated shingle habitat extents and enhanced knowledge of the ecosystem.

Collaboration between Universities and statutory agencies has fostered a substantial body of academic research with feedback to the understanding of the habitat and human impacts; with integration into management advice, practical protection guidance and conservation actions.

Adoption of new technologies, remote-sensing and geospatial analysis now provide robust methods and a framework for repeat survey, monitoring and reporting. This foundation, built on past work combined with innovation provides an important lesson for survey standards and the value of habitat survey and continuity of monitoring.

The work was originally commissioned from Girton College, Cambridge, by the Coastal Ecology Branch of the Nature Conservancy Council's Chief Scientist Directorate in 1987 as part of an attempt to describe the size, location and quality of the main coastal habitats of Great Britain. The collection of basic data was an important first step in identifying the most significant sites, and for establishing a basis for monitoring and understanding the impact of monitoring operations and major development projects. These data were then used to develop a classification of the main shingle plant communities found in Great Britain.

The judges considered this project to be good, sound science, and a genuine example of 'best practice', which was hard to fault. It developed, over a considerable period of time, a well-managed project producing a high quality evidence base for the vegetated shingle habitat. The project has demonstrated an outstanding contribution to knowledge exchange, training and education by not only communicating with stakeholders and a wider audience but by influencing policy and providing new opportunities for education and training.

For more information see: www.ieem.net/awards

IEEM 2013 AWARDS

The Institute of Ecology and Environmental Management will be presenting the following awards in 2013:

BEST PRACTICE AWARDS

Awarded to projects that demonstrate best practice in one or more of the award categories, whilst contributing to the four objectives set out below. Entries are invited from all sectors of the ecology profession including the public, voluntary and consultancy sectors. The award categories are:

AWARD FOR OUTSTANDING ACHIEVEMENT IN PRACTICAL NATURE CONSERVATION

Enhances biodiversity and/or ecosystem functioning e.g. projects that deliver significant enhancement or creation of biodiversity assets by going 'above and beyond' what is required.

AWARD FOR OUTSTANDING INNOVATION

Advances the profession of ecology and environmental management e.g. projects that advance the profession through innovative concepts, design, delivery or practical application.

AWARD FOR OUTSTANDING KNOWLEDGE EXCHANGE AND PROMOTING BEST PRACTICE

Furthers the knowledge-base of the profession of ecology and environmental management e.g. projects that improve evidence and ways of working through the production, storage and dissemination of policy, guidance, advice and practical tools (i.e. GIS, databases, toolkits, etc.).

THE TONY BRADSHAW AWARD

An additional award is also available, which recognises an exceptional project that is judged to be outstanding in two or more of the above categories and sets an impressively high standard. The winner of each award category is automatically considered for the Tony Bradshaw Award. The Tony Bradshaw Award is at the judges' discretion and will not necessarily be presented each year.

NEW FOR 2013 - PEOPLE AWARDS

Awarded to individual members who demonstrate excellence through their achievements, knowledge, skills, leadership, passion and commitment and inspire others in ecology and/or environmental management.

AWARD FOR OUTSTANDING INDIVIDUAL

Excellence in individuals working in the field of ecology and/or environmental management. Open to all grades of IEEM membership.

AWARD FOR NEW PROFESSIONAL

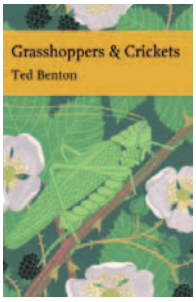
Excellence in individuals just starting their career in ecology and/or environmental management. Open to Graduate and Associate members of IEEM only.

Further details about the 2013 awards will shortly be available:

www.ieem.net/awards

The deadline for all submissions is 15 February 2013.

New Publications



New Naturalist: Grasshoppers and Crickets

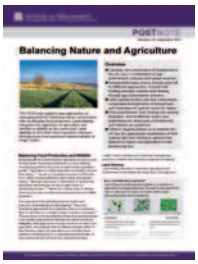
Author: Ted Benton

ISBN-13: 9780007277247

Available from: *www.nhbs.com*

Price: £29.99

A detailed and up-to-date account of the behaviour and ecology of grasshoppers and crickets. In this latest New Naturalist volume, Ted Benton offers a comprehensive account of the appearance, variations, behaviour, habitat, life-cycles and distribution of all the native British species of bush-crickets, crickets, groundhoppers and grasshoppers. Many details from direct field observation are included, which are published here for the first time. With up-to-date information on newly arrived and recently established species, as well as long-established non-native species (such as the house cricket and greenhouse camel cricket) Benton pays special attention to a key area of evolutionary thought that has stimulated an international research focus on grasshoppers and crickets. Recent approaches to mating and reproduction emphasise differences and even conflicts of interest between males and females. The sexually selected adaptations and counter-adaptations to such conflicts of reproductive interest are used to explain the astonishing diversity of reproductive behaviour exhibited by grasshoppers and crickets: male territorial behaviour, coercive mating, complex songs, elaborate courtship performances, the donation of edible 'nuptial gifts', the reversal of sex-roles, mate-guarding, keeping of 'harems' and, in a few species, parental care of the offspring. These chapters provide an introduction to the theoretical issues and an overview of many case studies drawn from research on orthopterans from across the world (but including British species where relevant). A unique, region-free DVD features many aspects of the behaviour of nearly all British species, including song, conflict, courtship behaviour, sex-role reversal and egg laying. The book is well illustrated with colour photographs and line drawings, covering all the British species (including immature stages in most cases), key habitats and many aspects of behaviour.



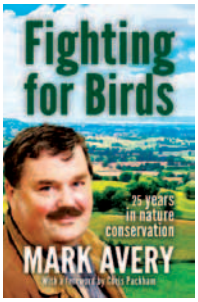
Balancing Nature and Agriculture

Author: Parliamentary Office of Science and Technology

Available from: *bitly.com/VHzE0E*

Price: Free download

The Parliamentary Office of Science and Technology has published a research note on *Balancing Nature and Agriculture*. The note explores two approaches to managing land for balancing nature conservation with sustainable food production: 'land sharing' (the integration of agricultural objectives and wildlife benefits on the same land), and 'land sparing' (the separation of intensive farming areas from protected natural habitats at larger scales).



Fighting for Birds: 25 Years in Nature Conservation

Author: Mark Avery

ISBN-13: 9781907807299

Available from: *www.nhbs.com*

Price: £10.99

Devoted to birds and wildlife since childhood, Mark's early scientific research at Oxford, Aberdeen and the RSPB provided a solid background for his management, ambassadorial, and political lobbying activities which were to follow – and his larger than life, yet quietly humane personality has provided the final tools in his own, unique, nature conservationists' toolbox. In *Fighting for Birds*, Mark mixes a great many stories from his professional life at the RSPB with personal anecdotes and passionate arguments on past and present issues in bird and nature conservation. He shows us something of the many scientists whose work paves the way for conservation action, places domestic conservation into an international context, takes us behind the scenes to glimpse the politicians who have worked with him, or against him, along the way. Mark leaves us armed with practical tips and a guiding philosophy to take wildlife conservation though the troubled years that lie ahead. A personal, philosophical and political history of 25 years of bird conservation, *Fighting for Birds* provides an instructive and amusing read for all those who would like a glimpse into the birds and wildlife conservation world – what the issues are, what must be done, how it can be done, and the challenges, highs and lows involved.

Environmental Funding Streams

Author: Institution of Environmental Sciences

Available from: *bitly.com/TGpbqO*

Price: Free download

The Institution of Environmental Sciences (IES) have published a report bringing together a list of available funding streams for research, careers or projects in the environmental sciences. The major sources of funding listed are for UK businesses, charities, academic institutions or individuals seeking financial support for environmental projects of all varieties.

Exploiting avian vision with aircraft lighting to reduce bird strikes

Blackwell, B.F. *et al*.

Journal of Applied Ecology 2012, 49: 758–766

The authors assessed whether use of aircraft lighting might enhance detection of and reaction to the approach of an aircraft in flight by Canada geese *Branta canadensis*, a species responsible for a high rate of damaging bird strikes. They used a novel approach by estimating the visibility to the goose visual system of a standard radio-controlled (RC) aircraft exhibiting either a 2Hz alternating pulse of two lights, or lights off; and another RC aircraft designed to mimic a raptor (predator model). The authors then exposed wing-clipped Canada geese to the approach of each aircraft and quantified behavioural responses to respective treatments. Estimates of chromatic and achromatic contrasts indicated that the standard aircraft with lights on was more salient to the visual system of the Canada goose than with lights off or the predator model. At individual and group levels, quicker alert responses were observed to the standard aircraft with lights compared with the lights off and predator model. Goose groups showed similar responses to approaches by the standard aircraft and the predator model, suggesting use of anti-predator behaviour to avoid the aircraft.

Correspondence: bradley.f.blackwell@aphis.usda.gov

Effects of the proportion and spatial arrangement of un-cropped land on breeding bird abundance in arable rotations

Henderson, I.G. *et al*.

Journal of Applied Ecology 2012, 49: 883–8916

In this study, bird abundance was examined at a scale consistent with many national monitoring schemes. Birds were counted on 28 farm sites of c.100ha, representing cereal-based and organic rotations. Sites were surveyed in summer, from 2007 to 2010, to assess the effect of the percentage cover and spatial arrangement of uncropped land (i.e. land that could be cultivated, such as fallows, grass–flower or wild bird areas) on bird abundance, with data analysed at the whole-farm (not patch) scale. Uncropped land area had significant effects on the abundance of key species (those with a high dependency on farmland) when controlling for effects of semi-natural habitats and management. On farms with <3% of their total area as uncropped land, the densities of birds were significantly lower than on farms with >10% area of uncropped land. Positive, significant effects of the percentage area of uncropped land were detected for lapwing, skylark, linnet and yellowhammer and for all highly farmland-dependent species combined. The relationship between uncropped land and bird abundance was stronger on conventional compared with organic farms, suggesting a greater importance of uncropped land on conventional farms. Uncropped land patch arrangement was significant for skylark and linnet abundance but generally weak amongst species compared with the availability of uncropped land. Skylarks were positively associated with a larger relative edge effect amongst patches, whereas linnets were more associated with larger blocks of contiguous habitat.

Correspondence: ian.henderson@bto.org

Landscape-scale responses of birds to agri-environment management: a test of the English Environmental Stewardship scheme

Baker, D.J. *et al*.

Journal of Animal Ecology 2012, 49: 871–882

Agri-environment schemes (AES) are used extensively across Europe to address biodiversity declines in farmland. In England, Environmental Stewardship (ES) was introduced in 2005 to address the shortcomings of previous schemes, but as for schemes in other countries, assessments to date have revealed little evidence for national-scale biodiversity benefits. Here the authors assess the efficacy of ES in driving changes in national farmland bird populations over the period 2002–2010, using BTO/JNCC/RSPB Breeding Bird Survey data. They tested for associations between ES management options, grouped into categories reflecting intended biological effects (e.g. stubble), and species' population growth rates, wherever benefits of management might be expected to occur. They found strong evidence for positive effects of management that provides winter food resources (i.e. ES stubble and wild bird seed (WBS) crops) on population growth rates across multiple granivorous species, at three landscape scales. The results for management aiming to provide breeding season benefits (i.e. grassland, field margin and boundary management) showed mixed patterns of positive and negative associations.

The results for stubble and WBS provide the first evidence for landscape-scale responses of biodiversity to AES management. The negative relationships identified may also show the importance of management context driving unforeseen predation or competition effects.

Correspondence: gavin.siriwardena@bto.org

Radar monitoring of migrating pink-footed geese: behavioural responses to offshore wind farm development

Plonczkier, P. and Simms, I.C.

Journal of Applied Ecology 2012, 49: 1187–1194

During a 4-year study, bird detection radar was used to monitor behavioural responses and flight changes of migrating pink-footed geese in relation to two offshore wind farms during and after construction. Radar recorded a total of 979 goose flocks migrating through the whole study area, of which 571 were visually confirmed as 39,957 pink-footed geese *Anser brachyrhynchus*. Overall, the authors calculated that 97.25% of all flocks recorded by radar, in 2009 and 2010 combined, migrated without any risk of additional mortality associated with the constructed wind farms. They identified a growing tendency of geese to avoid the wind farms and calculated that, for 2009 and 2010 combined, avoidance was exhibited by 94.46% of the original 292 flocks predicted to enter the wind farms. Migratory geese responded to offshore wind farms by adopting strong horizontal and vertical avoidance behaviour.

Correspondence: ian.simms@fera.gsi.gov.uk

Plant diversity and generation of ecosystem services at the landscape scale: expert knowledge assessment

Quijas, S. *et al.*

Journal of Applied Ecology 2012, 49: 929–940

In spite of the increasing amount of experimental evidence on the importance of plant species richness for ecosystem functioning at local scales, its role on the generation of ecosystem services at scales relevant for management is still largely unknown. The authors assessed expert knowledge on the role of plant diversity in the generation of services at the landscape scale. They developed a survey that included three levels of organisation and seven components of plant diversity; four provisioning, six regulating and four cultural services; as well as three resources and three conditions among key abiotic factors that are likely to provide a contribution to service generation equalling that of plant diversity. Eighty experts in areas of biodiversity, ecosystem functioning and services answered the survey. The experts identified species diversity within a community and diversity of communities within the landscape as the most important levels of organisation for service generation, both with positive effects. Composition and number of species were considered to be the most relevant components of plant diversity, the latter with a positive effect on services. Water availability was identified as the most important abiotic resource. The results suggest different approaches to management for sustaining the generation of services at the landscape scale. Provisioning services were perceived as largely influenced by abiotic resources and less so (although positively) by plant diversity. Regulating services were expected to strongly depend on both plant diversity and abiotic factors. A particularly strong positive effect of plant diversity was expected for the generation of cultural services. Some variation in answers could be attributed to expert background.

Correspondence: mdh@soton.ac.uk

A continental-scale tool for acoustic identification of European bats

Walters, C.L. *et al.*

Journal of Applied Ecology 2012, 49: 1064–1074

The authors developed a continental-scale classifier for acoustic identification of bats, which can be used throughout Europe to ensure objective, consistent and comparable species identifications. They selected 1,350 full-spectrum reference calls from a set of 15,858 calls of 34 European species, from EchoBank, a global echolocation call library. They assessed 24 call parameters to evaluate how well they distinguish between species and used the 12 most useful to train a hierarchy of ensembles of artificial neural networks to distinguish the echolocation calls of these bat species. Calls are first classified to one of five call-type groups, with a median accuracy of 97.6%. The median species-level classification accuracy is 83.7%, providing robust classification for most European species, and an estimate of classification error for each species. These classifiers were packaged into an online tool, iBatsID, which is freely available, enabling anyone to classify European calls in an objective and consistent way, allowing standardised acoustic identification across the continent.

Correspondence: charlotte.walters@ioz.ac.uk

Aerial surveys of seabirds: the advent of digital methods

Buckland, S.T. *et al.*

Journal of Applied Ecology 2012, 49: 960–967

Aerial seabird surveys are often conducted so that changes in abundance may be monitored. For example, large-scale offshore wind farms are proposed for UK waters, and surveys are currently being conducted to quantify numbers and distribution ahead of construction. Technological advances mean that strip transect surveys may now be conducted, using digital methods. The authors address survey design and data analysis issues for such digital surveys, contrasting them with visual aerial line transect surveys. The authors also explore the relative performances of the methods for estimating the size of a large aggregation of common scoters in Carmarthen Bay, Wales. They found that abundance estimates from two digital methods were closely comparable, while estimates from visual aerial surveys were appreciably lower. Efficient survey methods to quantify abundance and distribution of seabirds are needed, to assess change arising from climate change, or developments such as the construction of large-scale offshore wind farms. The traditional survey methods are visual surveys conducted along transects from ships or aircraft. Digital video and stills surveys can be conducted from aircraft flying sufficiently high to avoid disturbance, while still being able to detect and identify seabirds. Given the rapid technological developments, the authors expect digital surveys largely to replace visual surveys for seabirds in offshore regions.

Correspondence: steve@st-andrews.ac.uk

The biodiversity audit approach challenges regional priorities and identifies a mismatch in conservation

Dolman, P.M., Panter, C.J. and Mossman, H.L.

Journal of Applied Ecology 2012, 49: 986–997

The authors present a methodology for biodiversity auditing. They quantified regional biodiversity by systematically collating available species records, allowing objective prioritisation and collated autecological information to integrate multiple species into management guilds with shared requirements, providing evidence-based guidance for regional conservation. For two regions of Eastern England, Breckland (2,300km^2) and The Broads (2,000km^2), they collated 0.83- and 1.5-million records, respectively. Numbers of species (12,845 and 11,067) and priority species (rare, threatened, designated or regionally restricted: 2,097 and 1,519, respectively) were orders of magnitude greater than previously recognised. Regional specialists, with a UK range largely or entirely restricted to the region, were poorly recognised posing a risk of regional homogenisation. A large body of autecological information existed for priority species and collating this allowed the authors to define cross-taxa management guilds. Numbers of priority species requiring different combinations of ecological processes and conditions were not matched by current conservation practice in Breckland. For example, the current agri-environment agreements for designated grass heaths potentially catered for only 15% of the 542 priority species and 21% of 47 regional specialists that could potentially benefit from evidence-based management. A focus on vegetation composition rather than the ecological requirements of priority species underpinned this failure.

Correspondence: p.dolman@uea.ac.uk

Local-scale factors structure wild bee communities in protected areas

Murray, T.E. *et al*.

Journal of Applied Ecology 2012, 49: 998–1008

The authors analysed bee community data collected from 40 Special Areas of Conservation representing five distinct European Natura 2000 priority habitats in Ireland, quantifying local habitat features within each site and surrounding land-use. Species data were collected in a nested sampling design composed of three hierarchical levels such as 'site', 'habitat' and 'region' and analysed using diversity partitioning. The species–environment relationship was also decomposed into regional-, landscape- and local-scales by variance partitioning using partial canonical correspondence analysis. Wild bee species richness and abundance were highly dependent on habitat type, but the majority of regional diversity was contained within sites, as opposed to species turnover across sites and regions. Bee communities were primarily structured by local-scale factors associated with nesting resources and grazing regime, with non-*Bombus* taxa being more sensitive to landscape-scale differences in adjacent habitats than *Bombus* taxa. Regional-scale processes, such as species sorting along longitudinal gradients, were of minor importance in structuring bee communities in this system. Within habitats, local species richness, rather than species turnover at higher spatial scales, accounted for the majority of regional bee diversity. Local environmental factors were powerful determinants of community composition. Therefore, management effort prioritising the maintenance of a diversity of high-quality habitats within a broad network of protected areas best facilitates bee conservation in this system. At a regional level, schemes for conserving and restoring important bee habitats must be habitat- and taxon-specific, as the impact of individual local-scale factors and surrounding land-use on community composition is highly habitat- and taxon-dependent.

Correspondence: tomas.murray@zoologie.uni-halle.de

Large carabid beetle declines in a United Kingdom monitoring network increases evidence for a widespread loss in insect biodiversity

Brooks, D.R. *et al*.

Journal of Applied Ecology 2012, 49: 1009–1019

The authors used multivariate and mixed models to assess temporal trends over a 15-year period, across 11 sites in the UK Environmental Change Network. Sites covered pasture, field margins, chalk downland, woodland and hedgerows in the lowlands, moorland and pasture in the uplands, and grassland, heaths and bogs in montane locations. The authors found substantial overall declines in carabid biodiversity. Three-quarters of the species studied declined, half of which were estimated to be undergoing population reductions of >30%, when averaged over 10-year periods. Declines of this magnitude are recognised to be of conservation concern. They are comparable to those reported for butterflies and moths and increase the evidence base showing that insects are undergoing serious and widespread biodiversity losses. Overall trends masked differences between regions and habitats. Carabid population declines (10-year trend, averaged across species) were estimated to be 52% in montane sites, 31% in northern moorland sites and 28% in western pasture sites (with at least 80% of species declining in each case). Conversely, populations in the southern downland site had 10-year increases of 48% on average. Overall, biodiversity was maintained in upland pasture, and populations were mostly stable in woodland and hedgerow sites. The results highlight the need to assess trends for carabids, and probably other widespread and ubiquitous taxa, across regions and habitats to fully understand losses in biodiversity.

Correspondence: david.brooks@rothamsted.ac.uk

Variation in phenotypic plasticity and selection patterns in blue tit breeding time: between- and within-population comparisons

Porlier, M. *et al*.

Journal of Animal Ecology 2012, 81: 1041–1051

The authors studied between- and within-population variation in breeding time, phenotypic plasticity and selection patterns for this trait in four Mediterranean populations of blue tits *Cyanistes caeruleus* breeding in habitats varying in structure and quality. Although there was no significant warming over the course of the study, they found evidence for earlier onset of breeding in warmer years in all populations, with reduced plasticity in the less predictable environment. In two of four populations, there was significant inter-individual variation in plasticity for laying date. Interestingly, selection for earlier laying date was significant only in populations where there was no inter-individual differences in plasticity. The results show that generalisation of plasticity patterns among populations of the same species might be challenging even at a small spatial scale and that the amount of within-individual variation in phenotypic plasticity may be linked to selective pressures acting on these phenotypic traits.

Correspondence: melody.porlier@usherbrooke.ca

Biological Flora of the British Isles: Gymnadenia conopsea s.l.

Meekers, T. *et al*.

Journal of Ecology 2012, 100: 1269–1288

This account presents information on all aspects of the biology of *Gymnadenia conopsea* (L.) R. Brown s.l. (Fragrant Orchid) that are relevant to understanding its ecological characteristics and behaviour. The main topics are presented within the framework of the *Biological Flora of the British Isles*: distribution, habitat, communities, responses to biotic factors, responses to environment, structure and physiology, phenology, floral and seed characteristics, herbivores and disease, history and conservation.

Correspondence: tine.meekers@bio.kuleuven.be

Forthcoming Events

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

Conferences		
Date	Title	Location
Spring/Summer 2013	Spring/Summer Conference: Green Infrastructure	TBC
November 2013	Autumn Conference: Freshwater Ecology	TBC

Training Courses		
14 January 2013	HRA of Projects for Project Proposers & Advisers	London
15 January 2013	Ecological Impact Assessment (Beginner)	Crewe
16-17 January 2013	Ecological Impact Assessment (Intermediate)	Crewe
18 January 2013	ROLO Health, Safety and Environmental Awareness for Ecologists	Penarth
21 January 2013	HRA of Projects for Local & other Competent Authorities	Edinburgh
22 January 2013	HRA of Plans for Local Authorities & other plan-making bodies	Edinburgh
28 January 2013	HRA of Projects for Project Proposers & Advisers	Cardiff
29 January 2013	Ecological Impact Assessment (Beginner)	London
30-31 January 2013	Ecological Impact Assessment (Intermediate)	London
4 February 2013	HRA of Projects for Project Proposers & Advisers	Leeds
6 February 2013	Ecological Impact Assessment (Beginner)	Bristol
6 February 2013	Ecological Clerk of Works	Glasgow
7 February 2013	Surveying for Bats and Development - The Consultant's Approach	London
7 February 2013	Environmental Advisor for Construction Sites	Glasgow
8 February 2013	Water Environment: The Legal Framework	Sheffield
12-13 February 2013	Train the Trainers	Birmingham
14 February 2013	HRA of Projects for Local & other Competent Authorities	Birmingham
15 February 2013	HRA of Plans for Local Authorities & other plan-making bodies	Birmingham
18 February 2013	Introduction to BS 5837 - trees in relation to demolition and construction	Dorking
19 February 2012	Trees and Bats	Dorking
21-22 February 2013	Ecological Impact Assessment (Intermediate)	Bristol
25 February 2013	HRA of Projects for Project Proposers & Advisers	Edinburgh
27 February 2013	Ecological Impact Assessment (Advanced)	Birmingham
28 February 2013	Invasive Non-Native Species – Legislation and Policy	London
1 March 2013	Introduction to Wildlife Law	Birmingham
4 March 2013	Introduction to Biodiversity Offsetting	London
5 March 2013	Ecological Impact Assessment (Advanced)	London
7-8 March 2013	Pine Marten and Wildcat ecology and surveying	Perthshire
14 March 2013	Water Environment: The Legal Framework	London
14-15 March 2013	Train the Trainers	Leeds
18 March 2013	Ecological Impact Assessment (Beginner)	Leeds
19-20 March 2013	Ecological Impact Assessment (Intermediate)	Leeds
21 March 2013	Ecological Impact Assessment (Advanced)	Leeds
26 March 2013	Water vole ecology	Devon
27 March 2013	Water vole mitigation options for development	Devon

Geographic Section Events		
16 January 2013 (6.30-8.30pm)	East Midlands Section Discussion Workshop – Bat Surveys: Sharing Best Practice Approaches for Surveys in Trees	Nottingham

BLACKDOWN ENVIRONMENTAL

Working with our Countryside

Two Ecologists Required

Blackdown Environmental are looking for an ecologist...
IT COULD BE YOU!

If you are enthusiastic and passionate about ecology and are ready for a new challenge why not join us at Blackdown? One applicant is required for our Devon/Somerset office and the other for our Cornwall office.

Basic Role

We are looking to recruit two experienced Ecologists or Senior Ecologists who are able to work effectively across a wide range of disciplines and help to manage and develop our expanding client base. This position also allows applicants the opportunity to undertake a broad range of ecological projects and, due to the nature of the company, employees are actively encouraged to continue to develop their own niche areas of interest.

We are pleased to offer this opportunity for motivated, ambitious and enthusiastic ecologists to enhance our team. Applicants should hold a degree in an ecology-related subject and preferably be a full member of the Institute of Ecology and Environmental Management (IEEM), or other equivalent organisations.

The successful applicant will be required to manage and complete work comprising of habitat and protected species surveys, report writing, mitigation, license applications, marketing, public relations and project management.

Salary dependent on experience

For further details and information on how to apply for this position please visit our website:

www.blackdownenvironmental.co.uk/vacancies

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opportunity to make a positive impact

bird ecologist

£22,000-30,000 + benefits

Experienced and professional bird ecologist required with a proven background in bird survey and impact assessment. A degree in ecology or a related discipline is essential. Extended Phase 1 habitat survey and excellent analytical, communication and reporting skills are also required. Survey licences for protected species, full membership of IEEM and a post-graduate qualification would be advantageous.

innovative ecological consulting for planning, design and management

EAD is a successful and dynamic ecological consultancy that provides a full range of specialist services to developers, planners, local government and statutory agencies. We are looking to recruit an experienced bird ecologist to work from our riverside office in Exeter. We have an exciting portfolio of projects based predominantly in the South West and offer first-class training and promotion prospects.

If you would like a challenging role in a fantastic part of the country, please forward your CV to info@eadconsult.co.uk. To discuss this opportunity further, please contact either Matt Jones or Matt Cowley on 01392 260420. Full company information and contact details can be seen at www.eadconsult.co.uk

The closing date for applications is Friday 11 January 2013.

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- Temp. and humidity
- Runs for >1 year
- Download onto PC with free software

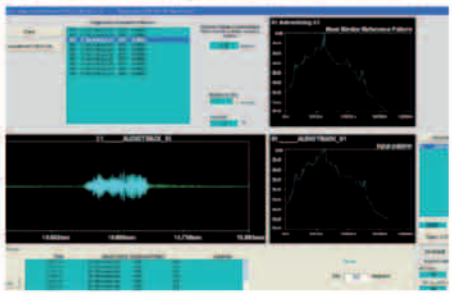
This standalone data logger measures temperature, humidity and dew point and allows the user to easily download the stored data via a USB port. Temperatures can be logged between -35 and +80°C (-31 and +176°F) and relative humidity between 0 and 100%RH. Supplied with a long-life replaceable lithium battery, the logger will typically run for over a year and will store 16,382 temperature readings and 16,382 humidity readings. Protected from water and dust to IP67 standard when cap is fitted correctly. Supplied with a micro USB cable.

- View results in the field
- Collect data from up to 500 loggers
- 8 hour battery life

This handheld programmer and data collector works in combination with the Easylog range of data loggers and will collect and store data from at least 500 loggers. The DataPad can also be used to configure units and view results on-the-spot without having to remove loggers from their location.

Luanne Wilkes
Wildlife Equipment Specialist

Sound ID automated sound analysis software



A new PC based sound recognition system which is ideally suited to bioacoustic applications such as bat surveys. It works by using new algorithms to compare sounds from a recording or series of recordings with those in a reference library. These reference calls are collated from samples of original calls which can be cut from .wav files using any sound editing software or by the sound editor that comes with SoundID. Calls are then made into a library where they are processed in preparation for the sound comparison algorithms to do their work. Once your reference library is created then you are ready to start analysing your recordings (it is recommended that reference files contain at least 10 examples of each call type).

£129.50 inc. VAT

Steve Hazell
Wildlife Equipment Manager

Bat Access Tile

£44.99 inc. VAT

Available in five traditional roof tile colours, or in Natural Clay (without sand face), the Bat Access Set presents a bat optimized entrance to the under-felt, or to the loft when the under-felt is opened. Each set comprises three roof tiles. The top `tunnel' tile offers the bat an 18mm high x 165mm long (approx.) tunnel to an entrance hole in the undertiles. This allows the bat to crawl into the roost area. The two tiles beneath the `tunnel' tile have small cutaway sections to facilitate access for the bat. An advantage of the tiles large double camber is that it provides the maximum amount of natural air flow under the tiles. The carefully designed access, along with this air flow between the tiles and the under-felt, aims to provide conditions where the bats are protected from any extremes of heat.

Aquascope

£44.99 inc. VAT

Great for conducting survey work, observing reefs and viewing secchi disks. It is also a great educational tool giving children and adults alike a glimpse into the fascinating plants, creatures and habitats that lie beneath the surface of our seas, lakes and rivers.