Number 62 • December 2008

In Practice

Bulletin of the Institute of Ecology and Environmental Management

Mitigation

In Practice No. 62, Dec 2008. ISSN 1754-4882

Editor: Jason Reeves (jasonreeves@ieem.net)

In Practice is published quarterly by the Institute of Ecology and Environmental Management. It is supplied to all members of IEEM and is also available by subscription (£30 per year in UK, £40 overseas).

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In Practice is printed on Revive Silk, a 100% recycled paper (100% post consumer waste).

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IEEM Office

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

Tel: 01962 868626 | Fax: 01962 868625

E-mail: enquiries@ieem.net | Website: www.ieem.net

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British Ecological Society

Editorial

By the time you read this editorial the Institute will have had a thorough discussion about mitigation at its annual conference in Glasgow. This issue of *In Practice* concentrates on the subject, which should be at the heart of our work as ecologists and environmental managers. The conference will have had the benefit of reviewing a number of case studies, and discussing their outcomes. I have to anticipate what the outcomes may be, as I write this editorial, the day before the Conference starts.

I think we may hear calls for change in the way we go about mitigation and the way that decision makers and project managers alike rely on mitigation. I use 'mitigation' here in the broader sense, commonly used in environmental assessment, to cover avoidance, cancellation and reduction measures, rather than the narrower meaning of 'mitigation', only as the action of reducing the severity or seriousness of something. I argue that we should take these measures into account at every stage of the decision making process. However, we should distinguish between them and 'compensatory measures', which should be considered only after the decision in principle has been taken to proceed with a damaging change.

I am advocating a more structured approach to mitigation and compensatory actions, following a sequence, down a ladder of counter-acting measures; where we give priority to avoidance, then cancellation, then reduction measures, before considering seven types of compensatory measures. These are, again in the order I suggest they should normally be prioritised: in situ repair; like-for-like habitat or species restoration; like-for-like habitat creation; alternative habitat or species restoration; alternative habitat creation; new protection measures and translocation. All of the measures are not, of course, available in every case, and are not mutually exclusive. They should be used individually or in various permutations to deliver the most reliable and most complete recompense for the adverse effects in the longest term.

Requiring mitigation is routine, but compensatory measures are more difficult to secure in most regulatory regimes. Furthermore, although government policy (*e.g.* PPS9) urges the spatial planning system to conserve and enhance biodiversity resources, development management and other regulatory processes are not well designed to deliver net benefits. There is scope for a bigger contribution, through regional and local spatial planning, to the planning and delivery of both compensatory measures and net benefits, at greater-than-project- level scale. I also think that there is a positive role for 'habitat banking' as a form of mitigation, or more often, a compensatory measure, when done with care and integrity and when properly accounted for.

I think we should also place more weight on the need for, and value of, monitoring. All too often projects offer mitigation or compensation measures, decision makers accept them, or impose alternative measures, the project is implemented and we all assume the measures were properly applied and fully effective. There are some good examples of diligent monitoring and adjustment of measures in response to actual, as opposed to predicted, effects. These should become the norm not the exception. A monitoring and review procedure should be imposed as a requirement (by way of enforceable conditions) in every case where EIA has been undertaken, and potential harm identified.

David Tyldesley MIEEM
Principal, David Tyldesley and Associates

Correction

In the *EcIA Questions and Answers* article, in *In Practice* 61, the third last paragragh on page 27 should make reference to the 'NERC Act Section 41 list' rather than to the 'CRoW Act Section 74 list'. This correction was made by the author, but unfortunately was not included in the final print version. IEEM would like to apologise for any inconvenience caused.

Merry Christmas and Happy New Year!

Everyone here at IEEM would like to wish you a wonderful Christmas and a prosperous New Year!

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Cover image: Professor Charles Gimingham (right) receives the IEEM Medal from Mr Michael Russell MSP, Environment Minister, Scottish Government

Artwork on the cover will normally illustrate an article in, or the theme of, the current issue. The Editor would be pleased to consider any such material from authors.

Mitigation Banking: Securing No Net Loss for Biodiversity?

*William Latimer CEnv MIEEM and David Hill CEnv FIEEM***
** Associate Director, Faber Maunsell*
*** Chairman, The Environment Bank Ltd*

Introduction

Environmental advisors and planners are frequently confronted with uncertainties over ecological mitigation, whether the proposed compensation is adequate and how it will function over time. The advantages of acquiring and retaining land in advance for ecological mitigation required by subsequent development has been demonstrated primarily in the USA where such Mitigation Banking (or Biodiversity Offsets, ten Kate, Bishop and Bayon 2004), pioneered for the conservation of wetlands over 20 years ago (Crooks and Ledoux 2000), is now established in the regulatory framework.

Essentially, the mitigation bank is established by acquiring land for the creation, or enhancement and management, of habitats or ecosystems for a particular wildlife or environmental resource. The asset is valued in terms of credits and the better the condition of the land in terms of its environmental objectives, the greater its value. Credits may be purchased, held, and traded in a process analogous to carbon trading.

Land may be acquired by financial institutions, businesses, land-owners or investors and managed to maximise its biodiversity or environmental capital. Credits may then be sold as the land comes into appropriate and stable condition for which the asset was purchased. The purchase of credits does not in any way obviate adherence to existing legislation regarding environmental protection, natural resource or wildlife conservation, but may be used where impacts are deemed to be unavoidable. Along with the reduction in ecological risk that comes to the developer with the acquisition of credits also comes a reduction in financial risk: credits for species or a functioning ecological system can be more accurately costed.

The monetary value of the credits is related to the costs of land acquisition, habitat creation and management. Credits for land set aside for mitigation banking can increase in value as the ecosystem develops or populations increase to a stable and self-sustaining level. In the USA, the scheme now encompasses broader habitat and species banks with around 150 institutions administering the banks or providing ecological and conservation expertise.

Mitigation banks have inverted conservation values: where wildlife conservation in the development context was formerly regarded as a financial drain and a liability, the mitigation banking system has transformed protected species and habitats into assets.

The results of mitigation banking from the US experience appear to be broadly positive as a large number of successful conservation schemes have been achieved. There have been some failures attributed principally to the lack of regulatory supervision, highlighting the need for effective enforcement and monitoring.

Mitigation Banking: its Application in the UK

The Legislative and Planning Framework

The Habitats Directive, enacted in the UK by the 1994 Conservation (Natural Habitats, &c.) Regulations (Habitats Regulations), requires the protection, at a 'favourable conservation status' of habitats and species deemed to be rare or vulnerable at an international level. This principle of no-net-loss applies certainly to the network of European protected sites but also to qualifying species that may obtain resources, at least occasionally, outside protected sites. Examples of the latter might include birds from a protected estuary or marshland that may also roost or graze outside a Special Protection Area (SPA) or bats from a Special Area of Conservation (SAC) that forage along adjacent hedgerows. Where developments outside protected sites may affect the interest within, the statutory regulator will require an 'appropriate assessment' to be undertaken and, if needed, mitigation to ensure no net loss.

Recent UK government guidance to planning authorities in its Planning Policy Statement No. 9 takes this principle further, stating (para. 1.vi) *'Where a planning decision would result in significant harm to biodiversity and geological interests which cannot be prevented or adequately mitigated against, appropriate compensation measures should be sought. If that significant harm cannot be prevented, adequately mitigated against, or compensated for, then planning permission should be refused'.*

The focus is therefore shifting from site-based conservation of habitats and species, to the maintenance of biodiversity and functioning ecosystems as emphasised in the Government's 2005 Sustainable Development Strategy (Ch. 5) which recognises the importance of biodiversity to self-maintaining natural systems and "ecosystem services". While the converging policies on biodiversity and sustainability might be considered fairly straightforward, there remain considerable risks to sustainable development under the current planning system.

Section 106 'Agreements' of the 1990 Town and Country Planning Act allow the applicant to enter into legally binding agreements to secure mechanisms to offset adverse environmental effects. While this adds power and flexibility to the planning process there are a number of notable disadvantages:

- agreements with the local authority usually predicate that the works or mitigation feature operate at a local level, often adjacent to the development, which may not be an optimal strategy;
- mitigation is often initiated at the same time or even after the development has taken place leading to a temporal loss of ecological resources;
- timescales for ecological succession leading to habitat stability are therefore often too short; and
- overarching mitigation for combined developments, which may be temporally as well as spatially separated is rarely sought, unless part of an appropriate assessment under Para. 48(1) of the Habitats Regulations.

In addition, there can be a substantial gap between what is promised by developers through planning obligations and what is delivered, due to the inadequacy of subsequent monitoring and enforcement.

Statutory Requirements and Ecological Principles

Like-for-Like Mitigation

The no-net-loss principle dictates that where mitigation is obtained by means of credits, these should have parity with the losses due to development, both in keeping with the scale of loss and the nature of the loss. The financial analogy would be that the credits are of the appropriate currency and monetary value. Thus a pond with protected great crested newts necessarily lost to development would require replacement habitats for that species, chalk grassland re-created in mitigation for losses to development should be of a similar plant community.

Critical Natural Capital or Non-Replaceable Habitats

Mitigation banks are limited to those habitats that can be created or manipulated to increase their conservation value in terms of their ecological function, habitats, or species. The system cannot deal with losses to habitats that are deemed, in realistic timescales, to be irreplaceable. Such critical natural capital (*e.g.* ancient woodlands and raised mires) cannot be traded, along with other habitats that may be very difficult to replicate because of environmental complexity (*e.g.* habitat mosaics on complex geology) or intricate relationships between physical and biological factors (*e.g.* hibernation caves for bats).

Spatial Relationships between Development Areas and Mitigation Sites

Size

The creation of large reserve areas for wildlife is often more successful in producing stable and self sustaining populations of the target species and habitats than small isolated sites, vulnerable to random catastrophic factors or the deleterious effects of inbreeding. Small sites can require a disproportionate effort of management in order to maintain their ecological interest, *e.g.* the control of invasive species on small heathland patches, and mitigation costs for separate developments can also be higher where administration and management are replicated both spatially and over time for the same target habitat or species.

There is therefore now considerable interest in developing large 'reserves' at a landscape scale, *e.g.* the various initiatives for the restoration of extensive reedbeds in the Fens, habitats or biotopes sized to support sustainable populations of key, 'flagship' species.

Location

It is often appropriate to re-create habitats in the same ecological area (*e.g.* English Nature's Natural Areas or Joint Character Areas) to obtain the best like-for-like replacement. It may also be necessary to make even finer discriminations based on microclimatic factors or soil types. Adjacent compensation for housing or employment developments provides a visible and accessible amenity and a public perception of replacement of valued natural resources.

However, in some cases, the success of mitigation may be compromised by siting the area in close proximity to the development. These would include mitigation areas for species that are sensitive to anthropogenic disturbances such as visual disturbance from walkers, noise, fires, disturbance or predation from domestic pets. The degradation of lowland heaths as an apparent result of proximate housing developments is well documented (Liley and Clarke 2002, Underhill-Day 2005) and has led to the development of local spatial planning policies (English Nature 2005). On-site or adjacent mitigation may also not be appropriate for busy transport corridors with high levels of noise, collision risk, or poor air quality. In such cases it would be necessary to seek alternative sites well beyond the range of expected impact. Climate change adds a challenging new dimension to this debate. The value of habitat banking is that it provides a mechanism for the delivery of this resource and this principle can be extended to the provision of the core sites and green corridors comprising ecological networks.

Timescales for Habitat Development and Ecological Succession

Where the mitigation bank can be created well in advance of its requirement in compensation for losses to development, the uncertainty as to the success of mitigation is reduced as the process of ecological succession, and management as needed, render the habitat better suited for its purpose. Timescales for habitat creation vary according to the type of habitat. Ponds may be available for colonisation by protected amphibian or aquatic insect populations within one or two years; species-rich grasslands may take 4-5 years, with appropriate management, to stabilise, while woodlands will clearly take many decades to mature. The principle that newly created habitats should be in place in appropriate condition for their compensatory purpose is noted in Paragraph 30 of the UK Government's Circular on Biodiversity and Geological Conservation, but this can be difficult to achieve under the current planning regime.

The important advantages in ensuring that habitats undergo the correct development period are therefore:

- the longer the period of development, the greater the likelihood that some measure of habitat stability is achieved, though this is often reliant on the correct management regime;
- with appropriate monitoring, and remedial action where needed, the risk of failure declines over time;
- the habitat is therefore better able to fulfil its intended biodiversity function; and
- the value of the credits for the habitat increase over time, in keeping with greater stability, habitat quality and the assurance that the habitat will fulfil its objectives.

The ability to produce mature and stable habitats is perhaps the key advantage of the mitigation banking system, as long as the bank is correctly regulated and monitored.

Mitigation for Habitats and Species without Statutory Protection

For habitats and species without direct statutory protection, there is an increasing emphasis on similar compensation being provided for any losses of biodiversity due to development (PPS9). Species and habitats requiring conservation action are listed under Section 74 of the 2000 CRoW Act (reinforced by Section 40 of the NERC Act) and are generally subjects of the UK Biodiversity Action Plans (BAP). In addition to BAP and Section 74 habitats and species, the Red and Amber lists of bird species (JNCC 2002) and Red Data books point to additional species for conservation action.

While mitigation banks could be developed to permit compensation for BAP species and habitats lost to development, it would clearly be inappropriate for gains within the banks to be counted as progress towards BAP targets for key habitats or species and the development of mitigation banks should not, in any way, reduce the effort to promote the favourable conservation status of these species. Nevertheless, in some cases the presence of core populations within the banks, developed to compensate for losses elsewhere, may make a temporal, local contribution to species recovery outside the banks where favourable habitats exist.

Development in Farmland, a Case in Point

With increasing development on greenfield sites, pressures continue on communities of the mosaic of farmland habitats, already much depleted by intensive farming. The concern over the loss of species characteristic of arable farmland is highlighted in plans within the UK BAPs

and summarized in chapter 4 of the Government's Biodiversity Strategy for England (Defra 2002a). In view of this, the statutory conservation agencies and planning authorities are likely, in accordance with the requirements of PPS 9, to seek appropriate mitigation for such losses due to development. The advance acquisition of biodiversity credits in species and habitats characteristic of farmland habitats appears to be increasingly tenable given current concerns over landscape conservation, intensive agriculture, food quality and the rural economy.

Whole Landscape Conservation

By supporting a farming system geared towards conserving declining animal and plant species of increasingly rare farming landscapes, other gains, in addition to enhanced biodiversity, may arise. There is some evidence that extensive and organic farming methods not only produce increasingly sought-after products with a high market value but also support a landscape that offers sustainable production (Bullock *et al.* 2007) with a higher biodiversity than modern conventional intensive farming (New Scientist 2004). Organic farming is now seen as a viable sector of the UK agriculture industry with acknowledged benefits for sustainability, biodiversity and the rural economy (Defra 2002b, 2004) though without farm diversification, the economics can, at present, be borderline.

Payments for biodiversity credits held by landowners who conserved ecological assets upon their land could assist in keeping land-owners or tenant farmers and their employees working on the land, thereby assisting the rural economy. Management for sustainable food production and biodiversity often requires a higher level of skilled application whether applied to the management of rotational farming, sound and sympathetic animal husbandry, or the management of habitats and ecosystems.

Landscapes farmed in part for biodiversity objectives have a higher visual appeal than those under intensive agriculture which often result in rather forbidding and constrained environments for ready public access. Bio-diverse landscapes would have an enhanced high value for public enjoyment and, linked to public goods and services, enhancements of ecological patches and networks on farmland, delivered through mitigation banking, could also provide more areas for people to visit, alleviating pressure on vulnerable protected sites, assisting in progress towards government targets for restoring the Sites of Special Scientific Interest (SSSI) network to favourable condition.

The Rural Strategy (Defra 2004) presents a government vision of a living, working, protected and vibrant countryside comprising sustainable rural communities where economic, social and environmental issues are all taken into account. Where compensation for the loss of farmland biodiversity is required, mitigation banking could transfer some of this commitment, currently funded from the public purse through piecemeal Environmental Stewardships, to the developer.

The system would benefit extensive landscape initiatives where progress and sustainable management may be limited by the uncertainties and unpredictability of piecemeal funding (Wall 2006). As noted above, such initiatives could also be spatially designed to deliver the ecological networks needed to enable the dispersion of species across the wider landscape, from local, through regional, even to national dimensions, providing one of the pre-requisites for mitigating the effects of climate change.

Delivery of the Mitigation Banking System

With no formal system in place for a nationwide approach to mitigation banking, the approach at present would rely on partnerships between financial institutions and land management or conservation agencies. There is, however, nothing to prevent developers from acquiring additional land and managing this in order to provide for future mitigation needs. However, we believe such acquisition, or establishment of land is more appropriately done through a third party working independently of the developer and relieving him from the specialist work of ecological mitigation design, construction and management.

Regulatory supervision, as with the carbon trading scheme administered by the Environment Agency, would be most properly undertaken by the appropriate statutory conservation agencies, though it is highly likely, and clearly desirable both for the regulators and the development industry, that these agencies would require that managers of mitigation banks and developer seeking credits should obtain the assistance of professional ecologists.

There is a real opportunity to obtain much greater gains for biodiversity and ecosystem function, at varying landscape scales through the implementation of a mechanism based on mitigation banking. The required investment in land and skills should find favour in the current economic climate and the re-visiting of Keynesian economics. We propose that such a mechanism is enshrined within the planning process in the UK.

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This article is based on *Mitigation Banking: Securing No Net Loss to Biodiversity? A UK Perspective* by William Latimer and David Hill in *Planning, Practice & Research*, Vol. 22, No. 2, pp. 155–175, May 2007.

Correspondence:
william.latimer@fabermaunsell.com
dhill@davidhillecology.com

Large Scale Mitigation: A Case Study Using Water Voles

Helen Markwell CEnv MIEEM
Senior Environmental Scientist, Halcrow Group Ltd

Summary

Large scale development projects can pose significant challenges when implementing protected species mitigation, but also provide opportunities for developing novel solutions and best practice methodologies. A prime example is the issue of water vole mitigation required for the Broadland Flood Alleviation Project (BFAP). Achievements to date have included the development of an effective mitigation technique, using water draw down as a displacement tool, and a rapid assessment survey methodology. Post works monitoring indicates mitigation is a success and Broadland continues to provide a UK stronghold for the species.

Project Background

The BFAP is a long-term project providing a range of flood defence improvements, maintenance and emergency response services within the tidal areas of the Rivers Yare, Bure, Waveney and their tributaries. The contract for the Public Private Partnership Programme was awarded in 2001, and the 20 year programme of works is being delivered on behalf of, and in partnership with, the Environment Agency (EA). The project is the first of its kind to provide flood defences on this scale; more than 240 km of floodbanks protect in excess of 21,000 hectares of Broadland.

Situated in East Anglia, Broadland is one of the finest areas of wetland in Britain. It includes open water, the Broads themselves, and the low-lying marshland surrounding the tidal river reaches. The rivers reach the sea at Great Yarmouth, and together with the Broads comprise a major inland navigation.

The Broads, a unique and environmentally sensitive area, has a status equivalent to a National Park, and is home to plants and animals found in few other places in Britain, many of which are protected under UK and European law. The Project area contains 28 Sites of Special Scientific Interest (SSSI), amounting to more than 7,000 hectares in total, the majority of which benefit from protection under European law either as Special Protection Areas (SPAs) or Special Areas of Conservation (SACs). Two Ramsar sites are also located within the Project boundary. Conservation bodies own or manage some of the sites, but most of Broadland is productive farmland and much of the land is now used for traditional summer livestock grazing. Many of the biodiversity features of the area rely on the protection afforded by the Project's flood defences.

Map of rivers in the BFAP project area

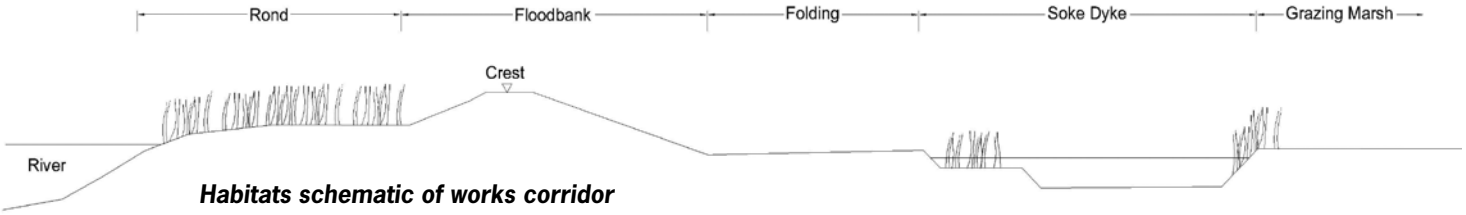
In order to deliver the works, a large team of civil engineers, environmental scientists, and project managers are employed by the client, design consultant and works contractor, operating from a single main office base. An extensive network of site personnel implement the construction works. All baseline ecological surveys are either undertaken in-house or are sub-contracted to relevant specialists. Impact assessments, mitigation prescription, on-site environmental (clerk of works) supervision and strategic post-works monitoring are all undertaken by members of the Project's Environment Team.

Nature of Works

Under the BFAP contract the main flood defence improvement works are to be completed by 2012. As a result many tens of kilometres of floodbanks may be worked each year. The works are based on the use of sustainable techniques, and utilise locally sourced material for building new and strengthening/ crest raising existing floodbanks wherever possible.

The zones and habitats directly affected within the works corridor comprise the rond (area of reed/saltmarsh located between the main river and the floodbank); the floodbank itself; the folding (area of land between the floodbank and the soke dyke); and the soke dyke. The soke dyke runs parallel to the floodbank and is the traditional source of local material for building and maintaining the flood embankments.

The construction works involve removal of vegetation and large-



Habitats schematic of works corridor

Example of pre works soke dyke habitat

scale earthworks, including the need to in-fill sections of redundant dyke. Furthermore the timing of works (April to October to benefit from suitable ground conditions) means that impacts on habitat and associated plant and animal life can be considerable, indeed unacceptable, without appropriate mitigation being taken to avoid or reduce them.

Water Voles

The catastrophic decline of the UK water vole *Arvicola terrestris* population during the 1980s and 1990s is well documented (*e.g.* Strachan and Moorhouse 2006). Populations have suffered primarily as a result of habitat loss and fragmentation, and predation by feral American mink *Mustela vison*. Measures to address this decline culminated in April 2008 when the species was afforded full legal protection under the Wildlife and Countryside Act, 1981 (as amended). One of the main consequences for development works resulting from the update to the legislation is that trapping of animals as part of mitigation now requires a license from Natural England.

Within the UK East Anglia is considered a stronghold for water vole, and increased recording effort since 1999 indicates that they remain widespread in Norfolk, with density in the Broadland area being the highest or one of the highest in Britain (Henson 2001). Habitats in Broadland which support large, apparently robust populations include reedbeds, the extensive grazing marsh dyke systems, and in the upper stretches of tidal rivers reeded ronds. As part of the wider grazing marsh dyke system soke dykes often provide important water vole habitat.

Mitigation of Impacts

Whilst the improvement works require major earthworks, including the in-filling of lengths of soke dyke used by water voles, they are fundamentally important for the protection of the wildlife value of the wider marshes from inundation by river water that is brackish and/or eutrophic. The floodbank corridor habitat (including the soke dyke) is always re-instated as part of the works, and scheme implementation provides the opportunity to improve habitats otherwise undergoing succession.

As one of many protected species present within the Project area, water voles are a material consideration for design and construction. Whilst they have always been present within the BFAP since its commencement in 2001, the numbers found within the working corridor in 2006 and 2007 were exceptional, with more than 30 km of soke dyke subject to mitigation for water voles in those two years alone. Baseline surveys indicate this will continue to be the case for the remaining works.

The large scale and longevity of the Project, together with a Project dedicated Environment Team, affords opportunities with regard to research and development of survey and mitigation techniques. The main outcomes related to water voles are summarised below.

Displacement: Vegetation Cutting and Water Draw Down

Because of the extensive dyke system adjacent to the works corridor, mitigation for water voles mainly comprises the use of displacement techniques, whereby habitat in the working corridor is rendered 'unsuitable' for water voles, to encourage them to move to nearby alternatives. Prior to 2007, vegetation cutting comprised the main method of habitat manipulation used. Because of concerns about the effectiveness of vegetation cutting alone as a displacement technique (*e.g.* Dean 2003), trapping was used as an additional method to ensure animals had left the area subject to mitigation, whether fresh field signs were recorded in the area or not.

Due to the scale of the mitigation required, certain aspects of recommended 'best practice' (Strachan and Moorhouse 2006) are not routinely implemented as part of the BFAP:

- Individual burrow entrances are not marked. Capture of animals post cutting indicates burrow entrances are not generally blocked.
- Vegetation is neither strimmed off to bare earth nor raked and removed, but mainly cut using excavator mounted flails.
- 'Soft release' methods are not used for relocated animals.
- Fencing is not used due to cost, maintenance and waste issues.
- Mitigation is undertaken from spring through to early autumn.

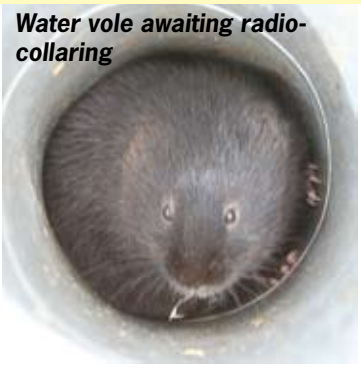
In 2006, the first year when large scale mitigation was required as part of the BFAP, more than 470 animals were captured from more than 13 km of soke dyke habitat despite vegetation cutting being implemented and maintained. Animals were relocated to alternative suitable nearby dyke habitats.

The significant number of animals caught during 2006 prompted an internal review of mitigation. Concerns included the effectiveness of vegetation removal alone in achieving displacement as part of large scale mitigation, and potential welfare implications for the high numbers of animals caught. The review resulted in a modification of the approach to mitigation, most notably a concerted effort was applied to achieve maintained water draw down in combination with vegetation removal. Draw down is achieved by bunding discrete sections of dyke and using diesel pumps to remove the water. This technique was applied to more than 16 km of dyke in 2007.

During 2007 an undergraduate research project used radio collars and Passive Integrated Transponder (PIT) tracking to monitor the reaction of individual water voles to mitigation implementation. Mitigation comprised vegetation cutting, repeated on an as required basis, and at least two weeks maintained water draw down. The project was undertaken by Ben Raybould, a student from the University of East Anglia, with assistance in the use of PIT tags and radio collars provided by Merryl Gelling, a WildCRU researcher from the University of Oxford. The research was funded by the Project and the EA, and was based on a SSSI owned and managed by the Royal Society for the Protection of Birds (RSPB) adjacent to the River Yare. The marshes of the site are subject to moderate intensity grazing, and have an extensive water vole population present across parts of the site. As such the site provides a comparable standard for much of the BFAP project area.

Although based on a small sample size, the research demonstrated that a proportion of the resident water vole population was displaced to nearby alternative habitat (Raybould 2008). Of the 30 PIT tagged animals

Water vole mitigation: vegetation removal and dewatering of soke dyke



Water vole awaiting radio-collaring

monitored along a 1700 m length of soke dyke, 10 of which were radio collared, nine animals were confirmed to have dispersed to nearby dykes through radio tracking and recaptures. Two animals were trapped and actively relocated to alternative nearby habitat within the marshes, one of which was subsequently recaptured at the release site a few months later. Two animals were known to have died prior to mitigation commencing, found by their radio collars. The fate of the remaining animals was unknown, although at least one radio collar was presumed to have been removed from the site by a predator, as its signal was lost entirely during the monitoring.

Animals recorded as dispersing generally moved only relatively short distances to nearby marsh dykes *i.e.* up to 300 m but mainly less than 150 m. More males than females were displaced, possibly reflecting population demographics, territoriality and/or seasonality factors. Males generally moved greater distances than females. Monitoring indicated that animals largely remained in situ when vegetation cutting alone was implemented and, only when subsequent water draw down, commenced and was maintained, did animals respond through permanent relocation.

At other sites worked during 2007, more than 14 km of soke dyke was subject to mitigation which included trapping as a final measure, after vegetation cutting and water draw down were maintained for at least two weeks. The exception was one small length of 330 m where asbestos removal resulted in the cutting short of water draw down. In total, 33 animals were caught. Seventeen of these were from the 330 m length where water draw down was not maintained for the full two week period.

Field observations indicated the density of animals present in 2007 was comparable to 2006. This allows comparison between years of the effectiveness of displacement based on vegetation cutting alone vs. vegetation cutting and water draw down, using the number of animals trapped as a measure of animal persistence:

Comparison of trapping numbers from water vole mitigation undertaken in 2006 and 2007

Year	Length of mitigation (m)	No. of animals caught	Animals per km equivalent
2006	17,280	476	27.55
2007	14,075	33	2.34
2007*	13,743	16	1.16

*(*excluding data from 330 m length where water draw down not maintained)*

The data indicate the number of animals caught is reduced by an order of magnitude when water drawn down is implemented in addition to vegetation cutting alone. When the 330 m length where water draw down was not fully implemented is removed from the assessment, a greater than 95% reduction in the number of animals caught over standardised lengths is apparent.

Whilst predation pressure will almost certainly be a factor affecting displaced voles, the data gained using the radio tracking study and results from animal trapping in 2007 indicate a proportion of resident water voles are successfully displaced from habitats subject to development works, to establish territories nearby. Such operations are likely to be considerably less stressful for animals than trapping and forced relocation.

Example of soke dyke habitat one year after works completion

Monitoring indicates that, in order to be considered successful, the mitigation methods must include:

- thorough vegetation cutting, repeated on an as required basis;
- maintained water draw down, in conjunction with vegetation removal, for a period of at least two weeks; and
- the presence/provision of suitable alternative habitat for animals within proximity of the works corridor.

Tool Box Talks, Mitigation Practice Notes, Environmental Issue Posters and the regular presence of environmental staff on site to monitor works are all approaches used to ensure mitigation is successfully implemented. As it is believed that the methods developed are the best available techniques suitable for use on the BFAP, trapping is no longer used as a routine method of water vole mitigation.

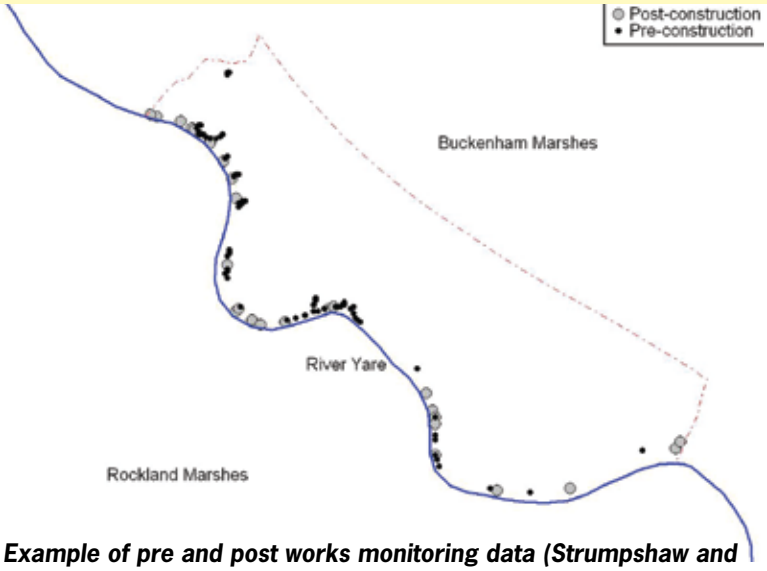
Water Vole Habitat Suitability Assessments

A Water Vole Habitat Suitability (WVHS) assessment was developed for use as a survey tool for the BFAP during 2007. The assessment is based on a method developed by Jane Harris of Kepwick Ecological Services, a local sub-consultant regularly employed by the Project. It is designed to enable a rapid assessment of habitat suitability over extensive lengths, which can then be validated using searches for field signs at a number of sub-locations.

The assessment considers eight separate site characteristics, based on cover, food source, burrow and nesting opportunities, and freedom from disturbance. Sites receive a score of 1 to 8, which relate to 'unsuitable', 'sub-optimal' and 'optimal' habitat types.

Example of works corridor one year after completion (new double soke dyke to left of photo)

The main benefit of the use of habitat assessments relates to the recognition that baseline surveys for field signs only provide a snapshot evaluation of animal presence at any one time, and can quickly (within a breeding season) become out of date. However, if a habitat is considered suitable for supporting water voles, it will generally remain suitable from one season to another *i.e.* a precautionary approach can be taken. Validation checks can then be used to confirm the presence of field signs. Where habitats are assessed as unsuitable, thorough checks for field signs are required prior to works commencement to confirm animals are absent. The method can also be used to assess habitat suitability of adjacent marsh dykes for displaced animals, and in post-works surveys to assess the success of habitat re-instatement.



Example of pre and post works monitoring data (Strumpshaw and Buckenham Marshes, River Yare)

Experience gained using the WVHS method in 2007 and 2008 indicates habitat assessed with a score 5 or better is routinely found to support water voles, based on validation checks for field signs. Furthermore, the method was applied to 423 sample points during the undergraduate research project (Raybould 2008). Logistic regression analysis demonstrated a significant positive relationship between habitat suitability scores and the probability of the presence of water vole ($P<0.0001$).

Post Works Habitat and Monitoring

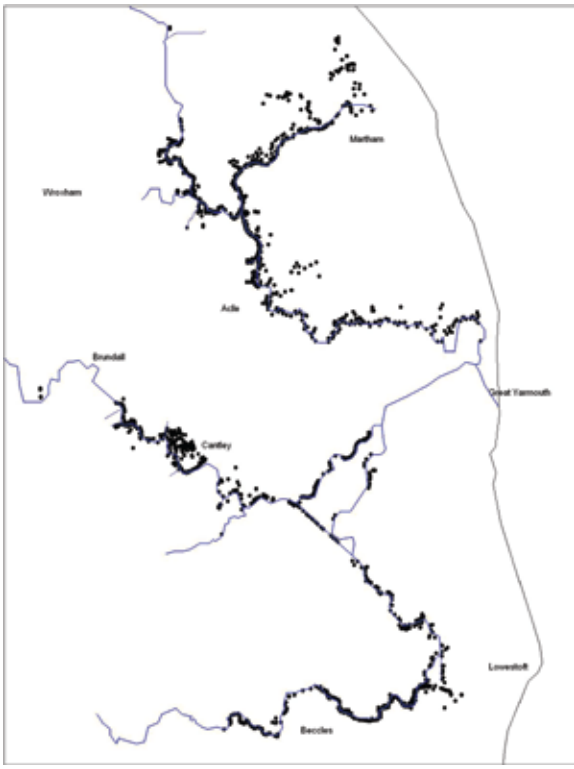
In order to ensure no long term impact upon water vole populations, re-instatement of good quality habitat is an important aspect of the works. Reed rhizomes and/or vegetation turves are routinely transferred from old soke dyke habitat being in-filled onto the new soke dyke edges. This is a standard procedure used within the BFAP, and is annotated on all construction drawings and included in environmental Tool Box Talks. Dependant on the nature of the ground conditions, habitat re-establishment can take between a few weeks and up to two years; peat substrates generally colonise quicker and, in the short term, more thoroughly than clays.

An important component of the BFAP is the provision of three years post works environmental monitoring. Surveys in relation to water voles include the use of the WVHS method, validated with checks for field signs. Results indicate water voles are generally widespread throughout the compartments where works have been completed and habitat re-established, including in areas where animals were not previously recorded. Habitat suitability is generally improved relative to pre-works, as often soke dykes prior to works were heavily reeded and subject to little maintenance; therefore longevity of habitat availability is generally increased. Perhaps the most significant benefit of the works is the reduced risk of floodbank breach or overtopping, providing improved protection from flooding and inundation for water vole habitat present in the grazing marsh system.

Conclusion

It is the large scale nature of the BFAP, and its setting in a high quality wetland landscape, that poses some of the most difficult obstacles for successful mitigation design and implementation when approached from a conventional standpoint. Yet it is these factors that have enabled the development of novel solutions: the presence of widespread good quality habitat suitable for displaced water voles to use; a project dedicated team of environmental staff involved in all stages from baseline surveys through to post works monitoring; a committed management team who encouraged and supported the research undertaken to develop best practice, and a pro-active workforce who enabled the mitigation to be implemented successfully over a huge scale on the ground.

It is believed that the methods developed are the best available for implementation on the BFAP. The data indicate water draw down is an effective displacement tool and post works monitoring demonstrates no long term negative impacts upon water vole distribution at the Broadland scale. Indeed an increase in distribution is apparent in recent years. The works to date have generated a huge dataset of water vole records, which are managed through a project database and are regularly disseminated to the local Biological Record Centres and Environment Agency teams. The records will shortly be made available via the NBN Gateway http://data.nbn.org.uk.



All BFAP water vole records to date

It is hoped that reporting the methods developed for the BFAP will provide useful information for other relevant development schemes in the UK, such as coastal managed re-alignments and conservation based wetland enhancements.

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The BFAP (www.bfap.org) is being delivered by Broadland Environmental Services Ltd (BESL), a joint venture between BAM Nuttall Ltd and Halcrow Group Ltd.

Correspondence: markwellh@halcrow.com

Site Mitigation for Invertebrates

Alex Ramsay MIEEM
Senior Invertebrate Ecologist, RSK Carter Ecological

Which Invertebrates are Likely to Require Mitigation?

Over 30, 000 invertebrate species have been recorded from the UK and it is clear that not all species can be mitigated for during site development. Mitigation plans usually focus on species with statutory protection, currently 71 species. Biodiversity Action Plan (BAP) species are also now a material consideration in the planning process, currently 411 species (Anon 2007). Rare species identified in the *Red Data Books* (Shirt 1987, Bratton 1991) may also be considered (some of which are likely to also be protected or BAP species), particularly on sites where there is an assemblage of rare species that could be nationally significant.

Protected Species

Most protected invertebrates only occur at one or two sites and hence are rarely likely to feature in the planning process or be affected by development. However, a few species are extremely widespread but very rare and could occur wherever the habitat is suitable. This includes the fairy shrimp, mole cricket and marsh fritillary The former two species are found in flood plains, where a number of housing developments have been sited in recent years. For more mobile invertebrate species such as the marsh fritillary, mitigation needs to cover a larger area as the species is dependent on a series of habitat patches which can extend over several kilometres, and if the core habitat area is lost to a proposed development, this will have a significant bearing on whether the development actually goes ahead.

The mole cricket can potentially occur in floodplain development areas
Photo: Alex Ramsay

Floral diversity is key to retaining good bee faunas on mitigation sites
Photo: Alex Ramsay

UK BAP Species

The recent review of BAP species (Anon 2007) led to the inclusion of 411 species. Some of these are well-known and include charismatic species such as the stag beetle and a third of all British butterflies, to more obscure species such as the lacebug *Physatocheila smreczynskii*, which is found only in old orchards. Generally speaking, good invertebrate sites will include a number of BAP species and in such cases rare species are also likely to be present.

Rare Species

Defined as species which occur in less than fifteen 10 km squares in Great Britain (Shirt 1987), the criteria for such species are gradually being upgraded to IUCN threat categories which are based on level of threat to the species in Britain rather than simply on rarity. The advantage of this system is that it allows status to be assessed internationally. Recent status assessments of invertebrates which use the IUCN criteria include Foster (in press) for the water beetles and Falk and Chandler (2005) for Nematoceran flies.

What Form is the Mitigation Likely to Take?

This is largely dependent upon what is known about the ecology of the species or assemblage present. In some cases the ecology is extremely well-known, but in others very little is known. Where notable species are found, repeat site surveys to study the ecology of poorly-known species will certainly add to the known information. Background literature including *British Red Data Books* for Insects (Shirt 1987) and Invertebrates other than Insects (Bratton 1991), and the JNCC reviews of scarce and threatened species are an invaluable resource for the ecology and distribution of rare invertebrate species and can provide a useful starting point for developing a mitigation scheme. Kirby (2001) and Fry and Lonsdale (1991) provide habitat-based management principles which can be used in conjunction with specific ecology for target species.

A decision needs to be taken regarding best practice - ideally mitigation areas are retained within the development, but if this is not possible then suitable sites for translocation will need to be identified. However, it should be stressed that retention of habitat within the development is usually the best option. Mitigation for mammals and many other groups can require large areas, but for invertebrates small areas of habitat can support populations for many years, although the likelihood of success can be enhanced by connecting areas of suitable habitat within the site. For more mobile species, maintaining a series of habitat patches within the site may be a minimum requirement.

Mitigation Timing

Creation of new habitat for invertebrates is not an instant process, and ideally a mitigation site should be set up at least a year before animals are moved to maximise natural colonisation. Careful consideration should be given to the location of mitigation areas, particularly as aspect and levels of shading are crucial - there is little point in moving insect species from flower-rich grassland on a sunny, south-facing bank to a shaded north-facing bank because

Mitigation for stag beetles could require provision of partially buried logs for larvae
Photo: Alex Ramsay

inevitably they are unlikely to survive. Consideration should also be given to when the translocation is carried out and to the life-stage of the species being moved - in some cases eggs or larvae may be appropriate, in other cases the adult stages of the target species will be more appropriate. If adults are moved, this should ideally be early in their emergence period to ensure that eggs are laid in the mitigation site, although there are always exceptions - female stag beetles lay a single batch of eggs towards the end of the breeding season and so a later translocation may be more appropriate for this species. For certain species a mid-successional habitat is crucial and mitigation might involve creation of several habitat patches which will vegetate at different rates, thereby providing a continuity of future habitat.

Moving Entire Assemblages

This will usually involve a more broad-brush approach so that any newly-created habitat will be suitable for the widest range of species possible. Specific host plants may be selectively planted, and if swards can be moved then careful removal and replacement will provide a seed bank of hostplants and may contain eggs and larvae of invertebrates. Particular care should be taken to ensure that the sward is not inverted during removal and replacement on the mitigation site, as this would bury eggs and prevent development.

Short-Term Mitigation

This usually involves careful selection of key areas for invertebrates which can be retained during development. They must be adequately protected from construction processes including night lighting (a particular problem for moths), excessive dust (which can kill insect host plants) and soil compaction (which can kill subterranean insect larvae). Ideally, such areas should be monitored post-construction to assess the species present. If compensatory habitat is created, then it can be prepared at this stage which would maximise the chances of colonisation before existing habitat is lost. This is most likely to be successful if mitigation areas are immediately adjacent to the proposed development area so that species loss is minimised. If this is not possible then steps should be taken to ensure that plants and soil present on the proposed development site are carefully removed to the mitigation site prior to construction.

Medium-Term Mitigation

It is crucial that appropriate management is implemented for the mitigation site to ensure the translocated species continue to thrive. Such measures could include phased planting of host plants for plant-feeding species, or nectar plants for bees and wasps. Soil disturbance in some areas would provide basking and hunting sites for a variety of species and ensures that parts of the sward are open to provide potential future breeding habitat through natural succession. The implementation of appropriate management is necessary to maintain and enhance invertebrate populations on the mitigation site. Early successional habitats such as grassland may benefit from occasional surface soil disturbance to maintain optimum habitat conditions. Late successional habitats such as woodland may benefit from enhancement of the dead-wood resource by provision of log piles.

Long-Term Mitigation

Veteran parkland trees retained in a development are of particular importance for saproxylic beetles and flies. Long-term mitigation for these species is crucial to maintaining the fauna, and this will involve an assessment of the local age structure of trees present and identifying gaps in recruitment ages of the trees. Where these are identified then further planting of trees to fill identified gaps will help to ensure long term survival of the saproxylic fauna present.

A potential mitigation mechanism which has been only rarely applied in the UK context (although in widespread use in the USA) is the concept of buying areas of pristine invertebrate habitat and donating it to a conservation body to preserve a similar assemblage off site. Ideally this should include a sum for future upkeep of the site.

Monitoring

Almost always regarded as an afterthought, the post-construction monitoring of any invertebrate mitigation is crucial to determining the success of the mitigation technique used, be that retention of key breeding areas for rare invertebrates or colonisation success of re-created habitat. There is unfortunately very little published or readily accessible material on success (or otherwise) of invertebrate mitigation schemes due to lack of adequate post-mitigation monitoring. This is a situation that needs to be urgently addressed so that future schemes can be improved or refined. At the very least a post-construction survey would enable the target species to be identified as still present, and allow for slight changes in management if these are required to boost populations.

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Correspondence:
ARamsay@rskcarterecological.co.uk

Mitigating Urban Pressures on Natura 2000 Heathlands in Dorset

Heather Tidball MIEEM and Phil Sterling***
**Partnership Manager, Urban Heaths Partnership*
***Natural Environment Manager, Dorset County Council*

The Dorset heaths cover some 7,000 ha of South East Dorset. They are all Sites of Special Scientific Interest (SSSI) and are included within the Dorset Heathlands Special Protection Area (SPA) and Ramsar site, and the Dorset Heaths Special Area of Conservation (SAC). These European sites are protected by the Habitats Regulations 1994 which place particular responsibilities on a local authority considering planning applications affecting such sites. There are considerable difficulties in mitigating the indirect effects of many small scale housing developments on the heaths. However, an area-wide planning mechanism is now in place to enable permissions to be granted along with contributions towards a range of mitigation projects.

Housing development alongside the Dorset heaths in the twentieth century was associated with decline of protected species
Photo: The Urban Heaths Partnership

Urban Pressures

Research (Kirby and Tantram 1999, Underhill-Day 2005) has demonstrated links between quality and condition of the heathland habitats and species and the proximity of residential development. The diverse effects that people and urban living have on the heaths have become known as 'urban pressures'. Effects that can, either directly or indirectly, adversely affect the wildlife value of the heathlands are:

- increased incidence of arson (especially damaging during summer when the habitats and wildlife are most vulnerable);
- increased use by dog walkers leading to disturbance of ground nesting birds (particularly nightjar and woodlark) with consequent effects on their distribution, abundance and breeding success;
- increased number of urban adapted predators (*e.g.* foxes, crows) affecting breeding success of ground nesting birds;
- increased use of heathland for off road cycling and motorcycling, causing soil erosion, disturbance and damage to heath habitats. Similar disturbance and erosion of sandy tracks is caused by horse riders. Sand lizard and invertebrate breeding sites are particularly at risk;
- predation by domestic cats on birds (especially Dartford warbler) and reptiles;
- disruption to the hydrology of heathland wetland through drainage interception and enriched urban water discharges;
- presence of more people leading to more difficulties and substantially increased costs in managing the heaths effectively (*e.g.* from enhanced requirements for recreation and general vandalism);
- increased problems with the introduction of essential management measures (*e.g.* free roaming livestock for habitat management, removal of tree and scrub invasion and access controls);
- increased degradation of the heathland habitats due to the dumping of garden waste by nearby property owners, physically smothering the heath vegetation and enriching the soil. Soil enrichment and habitat change through enrichment by dog faeces; and
- loss or degradation of key habitats used by nightjar for foraging (nightjar travel away from the heaths to forage).

The Urban Heaths Partnership

The Urban Heaths Partnership (UHP) was formed in 2001 to carry out the Urban Heaths LIFE Project (UHLP) combating the urban effects on the Dorset heaths in and around the Bournemouth/Poole conurbation. There were 10 partners including local authorities, wildlife organisations and Dorset Police and Dorset Fire and Rescue Service (DFRS). The main aims of the project were to improve public perception by discouraging misuse of the heaths and, by raising awareness of the nature and importance of the heaths and their wildlife, to encourage people to help look after the heaths.

UHLP came to an end in June 2005 having developed and implemented a joint wardening strategy for the heaths and an extensive programme of community education. DFRS had trialled and purchased new equipment for heathland fire fighting and a range of fire management and access control measures had been carried out on the heaths. From 2001 to the present day Dorset Police take anti-social behaviour on heaths very seriously.

One of the most important products of the project was the partnership itself and before the end of UHLP the partners agreed that they wished the work of the partnership to continue. Effective collaborative working between partners and with the project team had resulted in an average 60% reduction in the number of fires and those fires which did occur were being brought under control more quickly, so caused less damage. Although large, this reduction is not statistically significant, but certainly indicates a positive trend. There had also been a reduction in illegal motor cycling on the heaths.

In December 2004 many of the Natura 2000 heaths were declared open access under the Countryside and Rights of Way Act 2000 and there was concern that this would encourage more people to visit the heaths and/or to stray off the paths resulting in an increase in recreational pressure. In response to this possible conflict UHP undertook the Open Access Project which aimed to encourage responsible access to the heaths using the collaborative working model developed in UHLP. The Open Access Project additionally covered the Purbeck Heaths. The Open Access Project ran from 2005 – 2007.

The Dorset Heathlands Interim Planning Framework

The Poole/Bournemouth conurbation is one of the largest urban areas in south west England and as the Principal Urban Area in Dorset is the focus for much of the housing development planned in Dorset in the next 20 years. Many of the Natura 2000 heaths are embedded in or immediately adjacent to the urban areas. Regulation 48 of the Habitats Regulations restricts the granting of planning permission for development that is likely to significantly affect a European site by requiring that an appropriate assessment is carried out of the implications of the development for the site's conservation objectives. The planning authority must ascertain that the plan or project will not have an adverse effect on the integrity of the site, alone or in combination with other plans or projects, either directly or indirectly, taking account of any conditions or restrictions that would help ensure no adverse effect, before granting permission. The Regulation thus enshrines the precautionary principle in law, preventing consent, other than in closely-defined circumstances, unless the authority is certain of no adverse effect.

Natural England considers that where development would result in an increase in residential units within 5 km of the SPA/SAC, it would have a likely significant effect upon the designated area, either alone or in combination with other developments, as a result of the potential impact of additional recreational use of the heathland or other urban effects.

Within 400 m of the designated site boundary Natural England considers that it is not possible for the planning authority, in undertaking its appropriate assessment under the Habitats Regulations, to be certain that any adverse effects could be avoided or alleviated, and development resulting in increased numbers of residential units or residential occupancy have been prevented within this zone, save in exceptional circumstances, since 2006. Beyond the 400 m zone and up to 5 km, Natural England considers that such development would be permissible subject to the implementation of a comprehensive package to mitigate urban pressures.

It was in response to the need for this package of measures that the Dorset Heathlands Interim Planning Framework (IPF) was agreed by local planning authorities in south east Dorset in January 2007. Without this agreement there would effectively have been an embargo on housing development in the area. The IPF provides a mechanism for planning obligations to be collected and disbursed in order to:

- continue the positive benefits accrued from the work of the Urban Heaths Partnership since 2001 by employing a Core Team;
- implement measures that would divert recreational pressure away from the heaths, including the provision of new or better managed existing greenspace to attract people to alternative locations; and
- implement access management measures which would limit the increased level of damage likely to result from increased visitor pressure on the designated heathlands.

In the longer term a joint Development Plan Document to deal with the housing and heathland issue is being brought forward, but in the meantime the IPF, with Natural England's support, has provided a pragmatic mechanism to enable housing development to continue.

A joint approach was considered essential as the problems are common to all the heaths. Many of the heaths are in multiple ownership and in some cases heaths are either in more than one local planning authority or are very close to the boundary and users are likely to come from the adjacent authority. Clarke *et al.* (2006) found that half of the visitors arriving by car lived an estimated 3.7 km or more away. The solutions, in terms of finding alternative greenspace, are not evenly distributed within administrative boundaries either. Opportunities to provide large new areas of greenspace for people to visit in the more built up parts of Poole and Bournemouth are very limited and mean that there is a need to work across boundaries to provide such areas in neighbouring areas of Purbeck, East Dorset and Christchurch.

Learning about the Dorset heaths Photo: The Urban Heaths Partnership

The vast majority of housing development has been, and is likely to continue to be, small scale infill development. It is not possible for individual developments to provide suitable mitigation measures on site and these developers make a monetary contribution to the mitigation fund. Anyone can submit an application for a proposal for a mitigation project.

Mitigation Measures

In practice, currently, projects funded through the IPF are being delivered by partners of the UHP (now expanded to 14 organisations), groups of partners, the UHP Core Team and combinations of these as appropriate. Work by UHP to deliver the IPF is divided into six strands:

- Wardening and Policing

- Education and Awareness Raising
- Fire Risk Assessment and Management
- Projects to divert recreational pressures away from the heaths
- Access management projects
- Recording and monitoring

Wardening and Policing

Extra wardening is provided on the heaths, above the background level supplied by partner organisations, to discourage unwanted and illegal activities and to engage with visitors to help them understand the importance of the heaths for nature conservation and the need for management. The wardens patrol the heaths particularly at high risk times of the day and year, and are able to be demand-responsive to local spates of undesirable activities. The wardens work closely with local police officers within the Dorset Police under the long-standing operational order 'Operation Heathland', co-ordinated by the Force Wildlife and Heathland Protection Officer.

Education and Awareness Raising

The extensive life long education strategy devised in UHLP and extended by the Open Access Project continues to be implemented to improve knowledge, understanding and appreciation of the heaths and their management. Education resources devised by the partnership's teaching staff have been provided, free of charge, to every school. These resources tie directly into the National Curriculum, contributing mostly to the Personal, Social and Health Education, Citizenship, Science and Geography strands at Key Stages 1-3. Visits to whole school assemblies by police and other partnership staff following a serious local incident such as a major fire have proved to provide an important and direct approach to educating a key part of the local community. Walks and activities are arranged at heaths so that visitors can learn more about the heaths and their wildlife. A mobile classroom/exhibition trailer provides a focus for awareness raising at community events away from the heaths in order to reach people who might not be attracted to a heath themed event.

Fire Risk Assessment and Management

UHLP developed a guide for fire risk assessment and management for the urban heaths which is now being extended to all the Dorset heaths so that each heath will have a fire plan that has been drawn up to a standard template by the heath manager and a local fire crew. These are distributed to all fire appliances in Dorset as in the event of a fire it is not always the local crew who attend, and larger fires will be fought by crews from across the county.

UHP wardens and partner wardens work with DFRS when there is a fire to co-ordinate access and direct the public away from the fire allowing the fire crews to concentrate on fire fighting. A system of communication for fires on the urban heaths developed during UHLP now extends to all Dorset's heaths. In the event of a heath fire the DFRS control room sends a pager message to a group of people made up of partner site managers and wardens and the UHP wardens. All members of the group receive the same message on the location of the fire and it is up to the recipients to decide whether or not they need to attend rather than the control room staff having to determine who they should send the message to. Staff with pagers then alert anyone else they think should attend.

Since 2001 certain infrastructure and equipment, such as fire hydrants and dedicated fire-fighting equipment to tackle heath fires has been provided to limit fire damage. Management works to remove particularly combustible vegetation, particularly dense banks of gorse, to reduce fuel loading and to provide fire defensible lines (fire breaks) were also carried out. Further works of this nature are being planned.

The most dangerous and damaging urban pressure is arson Photo: Dorset Fire and Rescue Service

Projects to Divert Recreational Pressures Away from the Heaths

A range of projects to provide suitable alternative recreational opportunities are being designed and implemented. These include new greenspace developments and works to improve existing areas to make them more attractive to potential visitors. The aim is that there should be no net increase in visits to heaths. These projects are designed to encourage some existing users of the heaths to make fewer visits to provide capacity for new local residents. At the same time, those visiting the heaths are encouraged to make responsible use of the heaths which are, for the most part, open access. Some of the projects are designed to provide alternative facilities for those activities that are undesirable on the heaths, such as BMX cycling and associated activities like ramp building, or to divert the energies of young people who might otherwise carry out damaging activities on the heaths.

So far, diversionary projects have been relatively small but larger strategic sites are planned for the future to draw users away from the most attractive large heaths. These will be developed as part of the emerging Development Plan Document.

Access Management Projects

Whilst there is no intention to prevent visitors using the heaths for recreation there is a need to inform visitors of their potential to cause damage and how to behave responsibly so as to avoid that damage. Most visitors do not stray off the paths so a

Providing BMX tracks nearby may reduce illegal ramp building on heaths
Photo: The Urban Heaths Partnership

well designed path network can lead visitors away from more sensitive areas whilst still allowing them to enjoy the heaths. Signposts and signs encouraging certain routes and behaviours can also limit damage and disturbance. Measures to limit and repair erosion damage may be necessary on well used routes.

Heathland habitats do not exist in isolation, but are set within a framework of woods, meadows, streams, ponds and arable land which contribute to the support of many of their species. The flow of streams and groundwater from adjoining land is often important for maintaining important features such as mires. Sites adjacent to heaths are being targeted for acquisition as 'heathland support areas'. Such sites are particularly important where access routes can be designed so visitors can be directed away from heathland habitats into more robust adjoining areas.

Balance Between Capital and Revenue Projects

The IPF has had to wrestle with the difficult balance between allocation of funds for capital and revenue projects. The built development for which permission is being granted is, in effect, in perpetuity, thus the mitigation should also be the same. This would favour most, if not all, money being spent on long-life capital investments, such as new green spaces. However, such new sites are unlikely to perform the diversionary function intended without education and awareness-raising. At present twice as much is being spent on capital as revenue projects.

Monitoring

Urban pressures and the extent to which mitigations are possible are relatively new areas of scientific research. There are no previous examples we can turn to in town planning that help, but we have reasonably founded optimisim that mitigations will work. Thus monitoring of effectiveness of projects is perhaps all the more important here as it will determine whether this experiment is working, and whether the predicted level of development for the area can proceed in the long term.

Thus far, recording the effects of activities of the UHLP and Open Access Projects have provided some evidence that additional wardening, community education, fire risk and access management have alleviated some urban pressures on the heaths; Natural England has concluded that the continuing decline in conservation status of the urban heaths that had been observed throughout the latter part of the 20th century has halted. However the large historical variances in incidents such as fires mean that much longer data sets are needed before these changes can be relied upon with confidence.

Conclusion

The current Dorset Heathlands Interim Planning Framework has been a triumph of pragmatism and cooperation between several planning authorities and their countryside services to achieve the common aims of allowing housing development to continue whilst protecting European wildlife sites vulnerable to human impacts. It remains to be seen whether, in the longer term via the DPD, the strategy adopted will deliver as expected and allow for measured housing growth.

Acknowledgements

Funding for the Urban Heaths LIFE Project and the Open Access Project that helped pioneer the template for the Dorset Heaths Interim Planning Framework was received from the EU LIFE-nature fund, the former Countryside Agency and the constituent organisations in the Urban Heaths Partnership.

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Correspondence: H.AJ.Tidball@dorsetcc.gov.uk

Can Non-Intrusive Geo-Physical Techniques Assist in Mapping Setts of the Eurasian Badger?

P O'Donoghue CEnv MIEEM, L Dolan*, P D Dansie MIEEM* and I Sharkey***
**Atkins (Ecology), Ireland*
***Apex Geoservices Ltd*

Badgers and Roads

Atkins (Ecology) in Ireland is providing ecological design advice to the main contractor on the N7 Nenagh to Castletown road scheme. This involves advising on ecological matters relating to road construction, including the potential direct and indirect impact of the proposed road corridor on Eurasian badgers *Meles meles***. The N7 road scheme runs for approximately 35 km through an area of predominantly lowland agricultural grassland in Counties Tipperary, Laois and Offaly, Ireland.**

Road impacts on badgers, in particular through disturbance, habitat fragmentation and road mortality are well documented (Harris *et al.* 1994, Forman *et al.* 1995, Roger *et al.* 1997, Clarke *et al.* 1998). Therefore, as per standard best practice (NRA 2006, HA 2001, *etc.*) pre-construction badger surveys were undertaken along the length of the scheme in 2004 (Hyder McCarthy Consultants 2005) and again in 2006 (Flynn Furney Environmental Consultants 2006). A follow-up pre-construction validation survey was also undertaken in 2008 to update the findings of previous surveys (Flynn Furney Environmental Consultants 2008). These studies identified a number of badger setts located inside and just outside the lands made available (LMA) for proposed construction and this informed the design of standard badger mitigation measures including mammal underpasses and mammal resistant fencing and badger gates [as per the *Design Manual for Roads and Bridges* (DMRB) (HA 2001) and National Roads Authority (NRA) Guidelines (NRA 2006)].

Badgers are protected under Irish law by the Irish Wildlife Act 1976 (as amended in 2000[1]). It is an offence under the Wildlife Act to intentionally kill or injure protected species or to wilfully interfere with or destroy the resting or breeding place of a protected animal. In assessing the risk associated with construction, the National Roads Authority has prepared guidelines (NRA 2006) for site works in the vicinity of badger setts. This guidance states that badger sett tunnels may extend up to c. 20 m from sett entrances and recommends that no heavy machinery be used within 30 m of a badger sett unless carried out under licence[2]. Furthermore it recommends that lighter machinery should not be used within 20 m of a sett entrance and that only light work, such as hand digging or scrub removal, should be undertaken within 10 m of sett entrances (NRA 2006). The DMRB considers c. 50 m (HA 2001) from a sett to be safe for machinery.

Those sett complexes located entirely within the LMA were excluded under licence [from National Parks and Wildlife Service; Department of Environment (NPWS), Heritage and Local Government], while for those outside the LMA it was unclear whether tunnels or chambers might extend underneath the LMA. It was therefore necessary to determine the extent of sett complexes at a number of locations[3] in order to determine i) whether proposed construction works might negatively impact upon them, or ii) whether the final road layout for construction would be impacted.

Sett Complexes

Badgers are common and widespread throughout Ireland (Smal 1995, O'Corry-Crowe *et al.* 1993, Sleeman and Mulcahy 2005, Delahay *et al.* 2008). They live in social groups mostly consisting of between two and six adults and their young (NRA 2006[4]). Territory size is on average 80 hectares (range of 25 to 200 ha). Recorded densities in East Offaly close to our study area are 0.7 groups/km^2 (O'Corry-Crowe *et al.* 1993).

Within each badger social group's territory there may be several setts of varying status and usage (HA 2001). Setts vary in size from simple single entrance setts to sett complexes with up to 40 or more entrances spread over 100 metres or more (NRA 2007). Generally, setts are categorised as main, annex, subsidiary or outlier setts, depending on factors such as number of sett entrances, patterns of occupation and connection to a main sett by well-worn pathways (Neal and Cheeseman 1996); an alternative strategy is to recognize only main or outlier setts. If not disturbed, setts can be used by successive generations over a considerable span of time. Furthermore, the influence of landscape, soil and bedrock type *etc.* on the size and design of any given badger sett, is such that the extent of a sett can be difficult to define accurately by examination of surface features alone. This is particularly so in Ireland where many sett entrances are in hedges, with tunnels radiating out under adjoining improved grassland where there are no visible sett structures [*e.g.* O'Corry-Crowe *et al.* (1993) found that most setts (55%) in their East Offaly study area were in hedges, which occupied only 3% of available habitat and that their location was little affected by soil type].

Non-Invasive Geophysical Techniques

As noted, the objective of this study was to determine whether any badger tunnels or chambers extend under lands made available for construction. In accordance with requirements arising from consultation with National Parks and Wildlife Service non-invasive geophysical survey techniques were used. While the possibility of using such techniques is highlighted on advertising material from a range of commercial geophysics companies, a review of the literature highlighted only a single published study; on St. Asaph Bypass, North Wales in 2003 (Nichol *et al.* 2003). This paper therefore outlines our experience of applying these techniques to mitigating impacts on badgers on the N7 road scheme in Ireland.

A combined approach of using Ground Penetrating Radar (GPR) and Electromagnetic (EM) techniques was employed to

carry out this survey, together with a detailed assessment of surface features. With ground penetrating radar high frequency pulses of radio energy are transmitted into the ground. The transmitted pulses are reflected from material boundaries, building up a continuous cross section of the subsurface. Different frequencies are adopted in different situations, with high frequencies giving good spatial resolution of features and lower frequencies providing greater penetration to depth. Electromagnetic (EM38) Conductivity Mapping operates on the principle of inducing currents in conductive substrata and measuring the resultant secondary electro-magnetic field. The strength of this secondary EM field is calibrated to give apparent ground conductivity in milliSiemens/metre (mS/m).

Methods

Ground Penetrating Radar

In this study, Apex Geoservices Ltd were retained to undertake on site investigative works. The GPR survey was carried out using a MALA system, with a 500 MHz cart-mounted antenna, with a built-in odometer wheel. The data were recorded on the hard disk in the operating console and later transferred to a computer for processing and analysis. Notes were taken concerning the position of visible site details. GPR profiles were recorded across survey areas, with a nominal line spacing of 1 m. A time recording window of 56 ns was used giving a corresponding maximum usable depth of penetration of 2.8 m. Some areas were not surveyed due to obstacles such as trees or overgrown areas. All GPR profiles were surveyed using an RTK GPS system to 20 mm accuracy, in Irish National Grid co-ordinates.

In order to calibrate the system on site the location of known sett entrances and associated tunnels were surveyed. As each entrance had an associated tunnel radiating out from it, this provided an opportunity to survey for voids/tunnels in an area where badger tunnels were known to occur. A nearby culvert provided a further opportunity to calibrate the system on site.

The processing of GPR data was carried out using proprietary processing software (ReflexWin v4.5). The following processing was applied to the data:

- spatial relocation (data merge with RTK GPS data);
- temporal relocation (depth correction);
- amplitude recovery gain (time dependant);
- frequency bandpass filtering; and
- background noise removal.

Each GPR trace was analysed and the accurate location of the hyperbolic features were exported to the AutoCad plan drawing of the site with depth below ground level.

Electromagnetic Techniques

The equipment used was a Geonics EM38 Conductivity meter equipped with data logger. The instrument has an optimum depth of investigation of 1 to 1.5 m below ground. Conductivity values were recorded along all of the GPR profiles. Local conditions and variations were noted. The data were downloaded and contoured using proprietary software (Surfer v8.0). Variations in conductivity values were analysed in conjunction with GPR anomalies to identify subsurface voiding.

Result of the Badger Surveys

As noted, a series of pre-construction badger surveys were undertaken along the length of the scheme. Following finalization of the horizontal alignment of the scheme a total of six locations were selected for non-invasive surveys. For the purposes of this report we have presented the results of work from a single sett complex located along the southern boundary of the route. The sett entrance was located on the edge of an overgrown hedgerow, with one sett entrance clearly identifiable in the dense ground cover. Further field signs included a disused sett entrance c. 100 m to the north and evidence of prints and well used tracks.

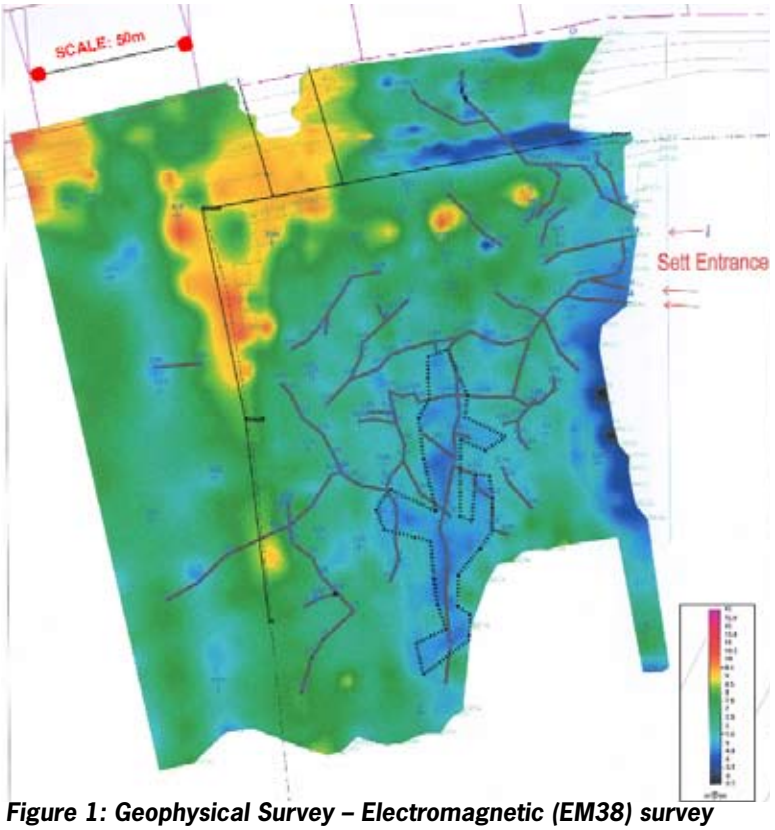

Figure 1: Geophysical Survey – Electromagnetic (EM38) survey results. Black lines indicate inferred tunnels. A central area is highlighted which reflects a core area of signal – potentially a concentration of tunnels and chambers.

As can be seen in Figure 1, three sett entrances were located along the eastern boundary of the sett complex; these were located at 13 m, 16 m and 17 m, respectively from the edge of site works. Each entrance allowed access to a single interconnected complex of tunnels. All structures identified in Figure 1 are between 0 m and c. 2 m below ground, within the known range for badger sett structures (Neal and Cheeseman 1996). However, a significant number were closer to 1 m in depth. The predominantly shallow nature of tunnels may however be explained by ground investigation results, which encountered groundwater intrusion at between 1.3 m and 3 m below surface level[5] in the environs of the sett complex. Using GPR depth readings a conservative core area of c. 22-24 m from the sett entrances can be mapped at depths of 0.5 m to 1.5 m. While the maximum axes lengths for the sett complex are 36 m (on the north-south axis) and c. 33 m (on the northeast-southwest axis), the shallow nature of some of these outlying tunnels likely indicates that these may be artefacts or perhaps old, collapsed tunnels. In a number of instances floating tunnels were also identified. As it is common for setts to be constructed at different levels, these may indicate sections of tunnel, which drop down below the maximum survey depth achieved in this study; though again a number of shallow floating voids are likely to be artefacts.

Discussion

Sett Architecture

The geophysical survey methods discussed above provide useful non-invasive tools for the investigation of the extent of badger setts in situations where direct investigative methods

are not possible or are best avoided. In this study it emerged that the bulk of the sett complex was at a greater distance from the lands made available for construction than were the identified sett entrances. Thus unnecessary disturbance through digging and exclusion of badgers from the sett complex was avoided.

The study also highlighted the need to apply the NRA (2006) guidance, which states that badger sett tunnels may extend up to c. 20 m from sett entrances cautiously. As can be seen from Figure 1 local topography can influence the architecture of a sett; in this case very much biased in extent to the southwest of the sett entrances. Also in this case the outer tunnels do extend more than 20 m from the sett entrance. Thus when considering what type of construction works or site investigative works can be undertaken close to a sett the NRA categories should be used as guidance, but not as a definitive cut-off. Where doubt exists the advice of a qualified ecologist, who can review the context of the sett relative to ground conditions, local topography *etc.*, should be sought. It is in these cases that consideration could be given to the use of non-invasive geophysical survey techniques.

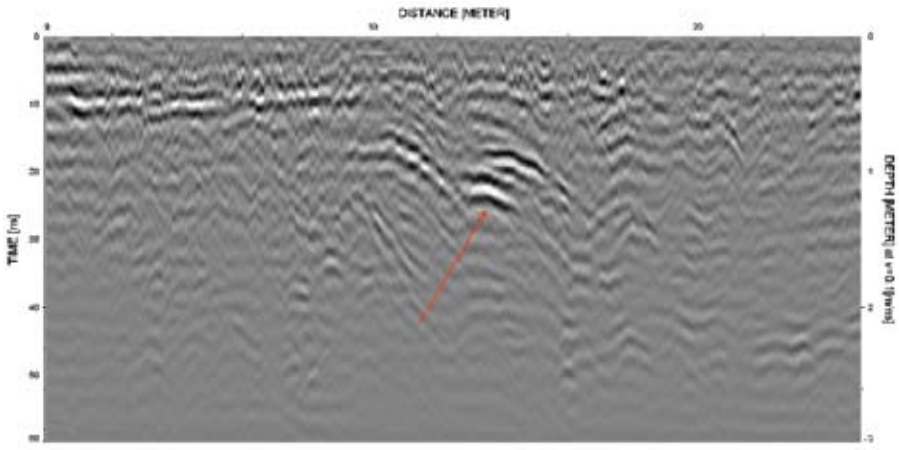

Figure 2: Example of Ground-penetrating radar (GPR) results – the distortion indicated by the red arrow is interpreted as a possible sett structure (tunnel).

Constraints to Consider

Clearly questions remain as to the widespread application of non-invasive geophysical survey techniques and when used, which method should be favoured. The first question is that of data validation. Due to the commercial constraints imposed on this work, it was not possible to validate the findings by undertaking a non-invasive survey of a sett proposed for excavation; those setts within the LMA already being excluded under licence. Such a study would allow for voids identified as putative tunnels to be validated as such. However, in this instance, a sett complex with known entrances from which tunnels were known to radiate, was used to ground truth work on site, as was a nearby culvert. It is proposed to undertake further such surveys in future projects where feasible.

In this study we utilised both Ground penetrating radar (GPR) and Electromagnetic Conductivity. GPR is influenced by both soil type and water content in the soil. The higher the clay content or the water content of soils within the survey zone then the shallower the depth to which the GPR can investigate. Made-ground, metallic objects or utilities can also distort results. Generally speaking bedrock depth is too great to influence results, though in areas of shallow bedrock, such as karst limestone this may be a consideration. Generally speaking the ground to be surveyed has to be reasonably flat, with ideally no hedge or tree roots that could be misinterpreted as voids, though can normally be discriminated (see for example the noise along the eastern side of Figure 1 – hedgerow). Ground conditions on many sites may therefore preclude its use.

In the current study, GPR was found to slightly out perform Electomagnetic (EM) techniques. However, in the current study EM38, which surveys to a depth of 1.5 m, was used (GPR surveyed to 2.8 m). An alternative strategy would, however, be to use EM31, which in horizontal dipole mode has a penetration depth of c. 3 m. It would be our intention to test EM31 at the next opportunity we have to investigate a sett.

While GPR can see the voids, EM gives you a measure of the conductivity. Generally a void gives a low conductivity reading; however, this could potentially be complicated if badgers are urinating within the sett complex; the salty nature of urine can give a high conductivity rating thereby cancelling out the anomaly. This effect may be more pronounced during the winter months when badgers are not coming to the surface to urinate and defecate.

EM signals are disrupted by the presence of metallic features with the resulting noise dominating the results. EM techniques should not be used in the immediate vicinity of fences and power lines where possible (an exclusion zone of 3 m for EM 38 and 10 m for EM31 is generally acceptable. GPR, however, is not affected by the presence of fences and/or power lines.

In the current study, the results of the GPR survey gave a good representation of the location of the tunnels and when viewed in combination with the EM data gave a clear interpretation, highlighting the value of an integrated approach to such studies.

While cost is a further consideration, in this study where we had a number of sites to visit the technique proved cost effective.

As noted, a large proportion of setts in Ireland are in hedges adjoining open agricultural lands; this methodology may therefore be more widely applicable in Ireland than perhaps in the UK.

Conclusions

Clearly, in certain cases this technique could be a valuable addition to the survey methods and mitigation options available to badger surveyors, as in this study where it assisted in defining a safe work area. Whilst the technique is now much easier to use in the field and is becoming more cost effective its precision must be further tested. In order for it to be more widely adopted a series of validated surveys would need to be undertaken under differing ground conditions. This would offer the opportunity to prepare best practice guidance for both ecologist and geophysical surveyors considering undertaking such work.

Acknowledgements

We would like to thank Bowen Somague Joint Venture for permission to use the data. We would also like to thank Andrew Trafford and Frances Williams of Apex Geoservices Ltd and John Box, Linda Hamilton, Penny Lewns, Tim Roper, John Davenport and Paddy Sleeman for valuable comments on the manuscript.

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Correspondence: paul.odonoghue@atkinsglobal.com

Notes

[1] Wildlife Act 1976 (No. 39 of 1976) and Wildlife (Amendment) Act 2000 (No. 38 of 2000) - www.irishstatutebook.ie/

[2] Licences in Ireland are granted by National Parks and Wildlife Service, Department of Environment, Heritage and Local Government.

[3] In order to avoid disturbance of setts we have not included figures showing sett locations.

[4] Smal (1995) recorded an average group size of 5.9 adults per group in Ireland.

[5] Topsoils and subsoils in the environs of the sett complex comprised a mix of soft brown slighty sandy, slightly gravely clays. Gravels were fine to coarse and of various lithologies. In places the topsoil comprised black peaty clay with rootlets.

Understanding the Habitats Directive: Appropriate Assessment - What is it and what is 'appropriate'?

Roger Morris CEnv FIEEM
Senior Specialist (Ports and Estuaries), Natural England

When the Directive was transposed into UK law in 1994, 'appropriate assessment' was new to everyone and it was not long before it became one of the most challenging concepts: what did it mean, how to comply with the law and, occasionally, how could it be circumvented? The role of the 'appropriate assessment' is now better understood, but a huge array of urban myths have developed and these frequently confuse the process and cause considerable angst.

Appropriate assessment has been interpreted by some as the need to produce a parallel document to the Environmental Impact Assessment (EIA) at vast additional expense. Others have failed to realise that an appropriate assessment does not automatically mean that a development proposal will be rejected. This latter misunderstanding has led to some developers and their consultants fighting any suggestion of a 'likely significant effect' (the first test of Regulation 48) ensuing from their proposal. It has resulted in considerable misunderstanding and dissemination of mis-information, together with deliberate campaigns to get Defra to instruct its nature conservation agencies to advise in a particular direction (*e.g.* Hansard 2007).

This catalogue of misconception and intrigue is unfortunate because appropriate assessment and related parts of Regulations 48 and 49 of the Habitats Regulations (1994) are actually quite logical. They follow a sensible sequence that amounts to a well-defined audit trail for decision-making that, if followed, will lead the decision-maker to a sustainable development solution.

A Sustainable Development Framework

In the opening recitals to the Habitats Directive, it is clearly stated that the Directive is intended as a tool to help to deliver sustainable development:

> 'Whereas the preservation, protection and improvement of the quality of the environment, including the conservation of natural habitats and of wild fauna and flora, are an essential objective of general interest pursued by the Community, as stated in Article 130r of the Treaty;
>
> Whereas the European Community policy and action programme on the environment (1987 to 1992)(4) makes provision for measures regarding the conservation of nature and natural resources;
>
> *Whereas, the main aim of this Directive being to promote the maintenance of biodiversity, taking account of economic, social, cultural and regional requirements, this Directive makes a contribution to the general objective of sustainable development*; whereas the maintenance of such biodiversity may in certain cases require the maintenance, or indeed the encouragement, of human activities.'

Several developments at the Port of Felixstowe have been rigorously evaluated and subjected to appropriate assessment. The outcomes have led to a variety of decisions, several of which have involved measures to mitigate and compensate deleterious impacts. Photo: Chris Gibson/Natural England.

Conceptually, sustainable development means many things, and unfortunately the environmental component of the process can mean anything from better urban environments to improved air quality, without necessarily making clear how provision will be made to safeguard our wildlife resource. The Habitats Directive addresses this particular issue and also sets a clear framework for making decisions that follow a clear and unequivocal path. In many ways, this path resembles the process of undertaking an environmental assessment, but instead of setting arbitrary definitions for significance it requires the establishment of conservation objectives[1] against which judgements may be made. It is based on a precautionary approach that gives better protection to Natura 2000 sites and the habitats and species for which they have been designated, than happened previously. This is where the main tension occurs.

The Assessment Process

Differing interpretations of the process of appropriate assessment have led to many tensions in the consents process. Probably the most important issue lies in the understanding of terminology by all participants. Most developers and consultants are readily familiar with terms of significance as these are well established through the EIA process. Significance is a term that means different things in differing situations, however, and can also be scaled to define the impacts

Bathside Bay at Harwich is the site of a proposed new containerport. Its loss will be compensated by a realignment at Little Oakley on Hamford Water.
Photo: Chris Gibson/Natural England

described in EIA (minor, moderate and major significance for example).

Within the Habitats Regulations, significance is quite different. It is used as a coarse filter and the test is a question over the possibility that there will be a significant effect on a key receptor that determines the conservation status of a European site. Thus, determining whether there will be a 'likely significant effect' does not imply that there will be such an effect or even that such an effect is more likely than not; it simply flags the need to test the issues and then make a judgement of the pathways and mechanisms imposed by a project on the designated wildlife interest. This test best equates to the screening and scoping opinions sought for an EIA but is confined to the Natura 2000 and Ramsar interest rather than wider environmental or nature conservation issues.

In this respect it is also important to note that the European Court of Justice has ruled that an appropriate assessment is required unless the likelihood of a significant effect can be ruled out on the basis of objective information (ECJ ruling C-127/02 Waddensee cockle fishing).This reinforces the use of the precautionary principle even though it is not explicit as it is with the 'integrity test' applied during appropriate assessment. If is considered that there will be a 'likely significant effect' then it will be necessary to compile sufficient information to allow decision-makers to judge the degree to which an impact will affect the conservation objectives for a site.

Once relevant information has been assembled, an appropriate assessment can be undertaken. Neither the Habitats Directive nor Habitats Regulations prescribe the form or content of an appropriate assessment. It should though be directed at answering the question that follows; can it be ascertained that the integrity of the site will not be adversely affected? This parallels the assessment process within EIA but it follows a much more clearly defined rulebook. Most importantly, the assessment needs to determine whether the proposals have a detrimental effect upon the conservation objectives for the Natura interest. Furthermore, before most proposals can proceed the decision-maker must ascertain 'no adverse affect' rather than the occurrence of an effect (*i.e.* the application of the precautionary principle). As a consequence, the competent authority undertaking the assessment has three choices:

- there will be no adverse affect;
- we cannot ascertain no adverse affect (deliberate double negative); or
- there will be an adverse affect.

The statutory conservation agencies will be concerned to make sure that the information presented is available to the competent authorities in a format that permits decision-making. Statements such as 'the impact on xxx will be small' are not appropriate – what is small, and by whose standards? If there are physical impacts then these impacts should be described numerically and factually without qualifiers such as 'the loss of habitat will amount to only 0.01% of the designated site', or only 0.2% of the population will be affected. Straight numbers are all that are wanted as the competent authorities are there to decide whether there is a case for or against the level of impact defined. Likewise, qualifiers that state that the level of loss is small in comparison to the effects of climate change or sea level rise are unhelpful and irrelevant. What the process is trying to do is to make sure that Natura interest is not placed under pressure, as a result of the proposal being assessed, over and above those from changes that are largely beyond our immediate control.

Appropriate assessment is exactly that – geared to the scale of the project and the magnitude of the outcomes. It does not demand great tomes but does rely upon the issues being set out clearly and succinctly. If there is one receptor, then the assessment may be very simple: for example a project that has a bearing upon just one of a dozen conservation objectives needs to be considered in this one context, but with clear justification for elimination of objectives pertaining to the other objectives. It is an audit trail not a thesis, and it needs to clearly explain where an impact can be identified or where the pathways are clear but the implications of the impact are difficult to define.

Analysis

The Habitats Directive has undoubtedly influenced decision-making on developments that affect wildlife sites. Some industries now recognise that the proposed policy statements for major industries and infrastructure have been introduced in response to questions over needs and alternatives cases[2] and have responded positively in their actions. This is an important advance in wildlife conservation because it provides much greater clarity about the relative value of wildlife sites and leads to a much greater chance of a reasoned judgement based on sound economics, rather than a serendipitous decision based on local politics.

When development proposals are evaluated against conservation objectives that set the essential parameters for maintaining favourable conservation status, it is most likely that a direct loss of habitat will result in a judgement that *it cannot be ascertained that there will not be an adverse affect on site integrity*. The scale of the loss does not need to be proportional to the size of the site: loss of any detectable magnitude cannot be ruled out as a factor that would impede maintenance of favourable condition. There may of course be exceptions which are usually in locations where the impacted area does not contribute to the ecological function, but has been incorporated either accidentally or because it was not possible to exclude it.

If it cannot be ascertained that there will be no adverse affect, proposals that impact upon Natura 2000 sites must be justifiable on socio-economic grounds and should be able to meet clear tests that there are genuinely no alternatives. This trims the options considerably, as there are alternative options for all but a few industries or projects. As a consequence, the numbers of applications that affect a Natura site should decline as developers realise that these sites are genuinely special and will be treated as such. Where industries are reliant upon a suite of very particular conditions such as safe navigation and links to road and rail networks, then justification for certain types of project is easier to establish. Some of the best examples emerge from recent port development casework (Morris and Gibson 2007).

Analysis against the site(s') conservation objectives requires more detailed consideration and does need to take account of

functional changes that may indirectly influence the outcomes of the conservation objectives (*e.g.* increased visitor pressure on heathlands or the impact of elevated levels of dog activity on breeding birds). Such analyses need to be rigorous, and consequently they are not cheap. This means that there is scope to screen out proposals before they even progress to development on an EIA. If the costs are high, then the risks are also high and this should redress the balance between wildlife and increased commercial and community growth in a particular location.

In the coastal environment where the experience that generated this note was gained, there have been important changes in the philosophy of many key commercial interests. The ports industry has led the way and there are now several high profile examples of sustainable development solutions that have been driven by the Habitats Directive (Morris and Barham 2007). This has not stopped some commentators pushing for alternative ways of working such as the introduction of habitat banking. There are several viewpoints on this issue, but the fundamental question is whether such banks would satisfy the need to tailor compensatory measures to make sure that the conservation objectives are met. Consequently habitat banking is unlikely to provide an acceptable solution unless developed as part of a strategic approach to proposals that are largely assured of consent as a result of clear Government policy and direction (Morris and Huggett 2007). In these very limited situations, any package of compensation would need to be directly linked to a plan, which itself had been assessed and its impacts determined through appropriate assessment.

Concluding Comments

Appropriate assessment is an auditing tool that provides the mechanism for recording the rationale for a judgement that affects Natura interest. There is no need to fear it if the project involved is of national importance and is supported by clear national policy provisions. Lesser projects that affect Natura sites are, however, likely to encounter difficulties unless their impacts can be mitigated. This means that interested parties need to make an early decision on the wisdom of pursuing a particular project. Consultancies can help in this respect because there is no sense in pursuing a project that clearly has little chance of success. Equally, where a project is potentially justifiable the compilation of a clear and straightforward body of information to inform appropriate assessment makes the process more transparent and streamlined. Effort can then be expended upon measures to adequately offset detrimental impacts (compensation).

Acknowledgements

I am most grateful to my colleague David Harrison for helpful comments that have improved this text.

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The Trimley managed realignment site provides compensation for impacts on the Stour and Orwell Estuaries SPA and Ramsar Site arising from channel deepening in 1998. Photo: Chris Gibson/ Natural England

Correspondence: Roger.Morris@naturalengland.org.uk

Notes

[1] These are provided by the Conservation Agencies: Countryside Council for Wales, Natural England, Scottish Natural Heritage and the Environment and Heritage Service (NI).

[2] Mike Garrett of MDS Transmodal at *UK Ports Policy: Reaching Conclusions*, 26 February 2008.

Survey Guidance for Assessing Bat Activity at Proposed On-Shore Wind Farms

James Cook MIEEM, Andrew McCarthy CEnv MIEEM, Stephen Holloway CEnv MIEEM and Gary Oliver CEnv MIEEM
Andrew McCarthy Associates

The need for a detailed, standardised protocol for on-shore wind farm bat surveys is likely to increase as the demand for renewables drives the growth of the wind energy industry. In the absence of detailed methodological guidance, Andrew McCarthy Associates (AMA) has developed an in-house protocol for its surveyors, based upon interim guidance from Natural England (Anon 2008), recommendations from the Bat Conservation Trust (Anon 2007) and drawing on the company's own extensive survey experience, gained during seven years working with the renewables industry and following numerous site-based consultations with local Statutory Nature Conservation Organisation (SNCO) teams. Our in-house protocol is presented here with the intention of promoting comment and discussion. Hopefully this will take us a step closer to the development of a nationally agreed survey methodology for application at all proposed on-shore wind farm sites.

Background

Concerns about the possibility of bats being negatively affected by wind turbines were first raised in the late 1990s during studies on bird-strike in the United States, where large numbers of dead bats were found under some turbines. Since then, further research in the US and mainland Europe has provided insights into the potential effects of wind farm developments on bats, including fatalities caused by collision and 'barotrauma' (the result of sudden changes in pressure experienced by bats flying through vortices associated with rapidly rotating turbine blades), as well as habitat displacement.

In response to these findings, EUROBATS produced *Guidelines for Consideration of Bats in Wind Farm Projects* (Rodrigues *et al.* 2008), which sets out a European-wide, coordinated approach to assist practitioners and decision makers during Environmental Impact Assessment (EIA).

In the UK there has been very little research into the effects of wind farms on bats and it is unclear how readily overseas research findings transpose to the UK EIA situation, given differences in species, physical environment and possibly behaviour. As a result, a precautionary approach to survey and impact assessment has been recommended by the Bat Conservation Trust (Anon 2007) and Natural England (Anon 2008). Whilst the 2008 Natural England *Interim Guidance* document is helpful, it contains little detail on the level of effort

Figure 1: Example of a bat activity summary map for a hypothetical proposed wind farm site. Bat pass rates are shown for each sample point as blue circles (size indicates mean bat passes per five minute sample period). This data can be grouped into the three species risk categories (Low, Medium and High) suggested by Natural England and presented on separate maps. Other areas of high bat activity are shaded blue. These areas can be identified by plotting all non-sample point bat records on a draft site map.

and the techniques that might be appropriate at different wind farm sites. EUROBATS, by contrast, suggests levels of survey that are likely to prove excessive in most UK scenarios. As a consequence, existing guidance is open to a wide variety of interpretations by both statutory agencies and consultants.

General Approach

The survey approach adopted at AMA aims to provide a systematic and repeatable means of obtaining the data necessary for an acceptably robust EIA (which is defendable at Public Inquiry) in most UK wind energy development situations.

The level of survey effort is based upon attempting to find a balance between caution and pragmatism in the absence of targeted research. While this has required the use of subjective judgement in certain areas, the methods presented here are based on objective facts wherever possible. The suggested extent, duration and intensity of survey is less than that recommended by EUROBATS, but it is considered that our methodology enables an appropriate level of information to be collected for EIA purposes, but without being prohibitively expensive. For the purposes of survey methodology development, an assumption has been made that in the UK most bats are relatively inactive during the winter and, unlike in Europe, do not generally migrate across broad fronts in substantial numbers in spring or autumn. Increases in the suggested duration of the survey period and the level of survey effort employed during the spring and autumn may be required if these assumptions prove to be untrue.

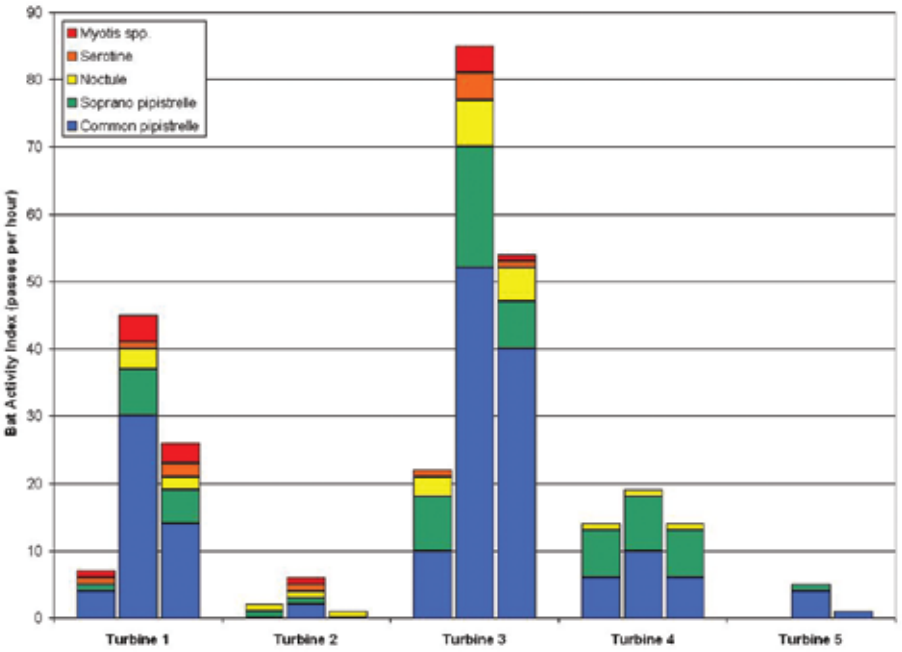

Figure 2: Example of a chart showing summarised results of a hypothetical proposed turbine location automated activity survey. To produce this chart it is necessary to calculate the mean hourly bat pass rate (or similar activity index) for each species/genus at each proposed turbine location during each three-day survey session.

The primary objective, to quantify the level of activity at each proposed turbine location, is achieved using automated bat detector units, such as Anabats (Titley Electronics). The second objective, to quantify the level of activity in the landscape surrounding proposed turbine locations (as bats in these areas could potentially be affected by turbines or associated ancillary developments), is achieved by undertaking manual transect surveys. The third and final objective is to identify any important roosts that might be affected by development. This can be a considerable task and requires the use of a combination of techniques:

- desk-based data searches for bat roost records and potential bat roost structures;
- ground-based visual searches for potential roost structures;
- manual transect surveys in the vicinity of proposed turbine locations to identify nearby commuting routes;
- targeted surveys to identify commuting routes in the wider landscape; and
- emergence and dawn surveys and/or internal inspections (in accordance with Bat Conservation Trust guidelines) of potential bat roost structures from which bats appear to be commuting towards the proposed wind farm site.

Initial Preparations

The first task is to establish where turbines are likely to be installed (although note that proposed turbine locations are often changed prior to installation and may not be known at the project set-up stage) and any site access restrictions or hazards which might affect the deployment of surveyors and equipment.

Providing there are no confidentiality constraints, the local biological records centre and bat group should then be contacted for records of bats and bat roosts within 5 km of the proposed wind farm site, as most species have been found to usually forage within this distance from their roosts. The search radius is extended to 15 km for noctule *Nyctalus noctula* and Leisler's *Nyctalus leisleri*, as these species have been found to range further and have both been suggested by Natural England as being at high risk of collision with wind turbines.

A thorough appraisal of OS maps, aerial/satellite photographs and, where available, previous ecological survey maps of the site and its environs should be undertaken to establish the general habitats present in and around the site and identify any obvious relevant landscape features that could be used by bats in the vicinity of the proposed development. An attempt should be made at this stage to identify potential commuting routes between any known roosts and the proposed wind farm.

The desk-based preparation should be followed by a detailed site walkover to ground truth the habitats and features present.

Automated Activity Survey at Proposed Turbine Locations

This survey is undertaken to quantify levels of bat activity in the immediate vicinity of the proposed turbine locations. It involves use of automated bat detector units, such as Anabats, to collect bat pass frequency data for each proposed turbine location. If the proposed turbine locations are unknown or provisional, a range of potential locations should be sampled and it may be necessary to undertake additional survey sessions once the final turbine locations are confirmed, if these differ considerably from those sampled (note that this may not be possible or practical – therefore, sufficient initial data must be collected across the wider site in order that a reasonable assessment can be made in the absence of additional field work).

In order to account for hourly, nightly and seasonal variation in bat activity, it is recommended that a minimum of three complete nights of data are collected for each turbine location, on at least three occasions throughout the main bat activity season (from April to September inclusive); preferably towards

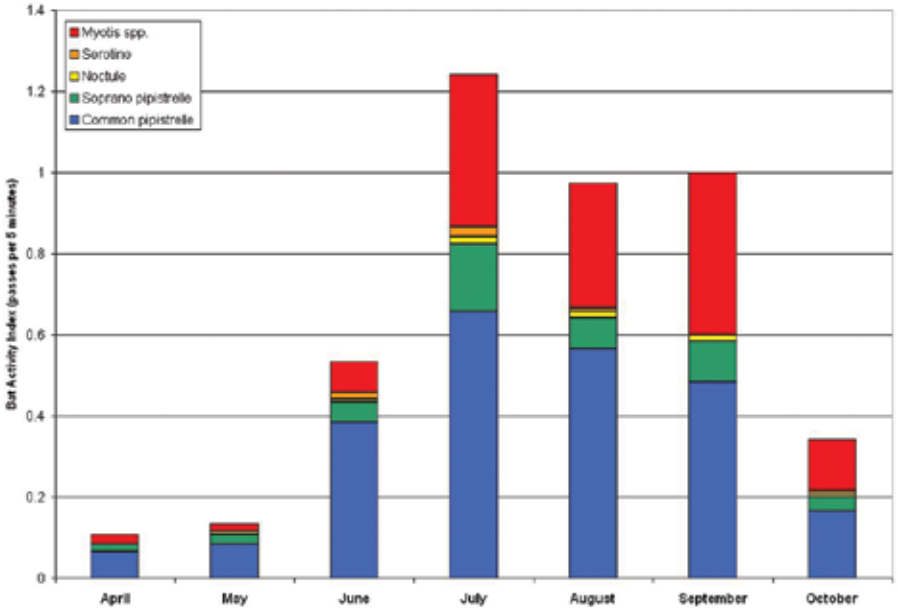

Figure 3: Example of a chart showing the average site bat activity index (the mean pass rate per five minute sample period for all sample points) for each species, for each manual activity survey session throughout a hypothetical survey season.

the beginning, middle and end of the period respectively. If an insufficient number of automated detectors are available to enable all turbine locations to be sampled concurrently, the units are then rotated accordingly.

Ideally, it would be useful to record bat activity across the entire altitudinal range of the proposed wind turbines (from base to blade tip) and, in some situations, this might be possible by mounting bat detector microphones on a mast, met station tower or an existing wind turbine (in the case of re-powering projects). Whilst the feasibility of these options should always be explored, it is likely that only ground sampling will be possible in most cases. If only ground-based detectors are used, the microphone should be directed upwards towards where the hub of the turbine would be located.

On completion of each survey session, the recorded data need to be analysed to tally the number of bat passes for each species (or genus where species identification is not always possible, as with *Myotis* bats) for each turbine location. The time required for such analysis can be considerable and it is vital that this is taken into account at the project planning stage. Even if only the minimum recommended amount of survey is undertaken (*i.e.* three separate three-night survey sessions over the bat activity season), a proposed five turbine site would generate 45 nights of data.

Manual Activity Survey of Surrounding Habitats

This survey technique enables levels of activity across the wider site to be quantified and provides supplementary qualitative information on activity patterns, such as the location of key commuting routes. It involves surveyors equipped with broad band bat detectors recording bat pass frequency at pre-defined sample points, as well as any other bat observations that occur whilst walking between these sample points.

The 'wider site' is defined as all areas within 200 m of the proposed turbine locations (where these areas are accessible) as well as all areas likely to be affected by any proposed ancillary developments, such as access tracks. Although the EUROBATS guidelines recommend a survey radius of 1 km around each proposed turbine location, it is considered that in most scenarios resources will be constrained and access to surrounding areas will be restricted, particularly where there are confidentiality issues. Thus, this recommendation is unlikely to be practical and, instead, survey efforts are probably better focused on areas closer to turbines. If subsequent research indicates that the zone of influence of turbines on bats may be greater (or less) than 200 m, these survey areas may need to be amended accordingly in the future.

Following the site walkover and desk-based appraisal, sample points should be selected and marked onto a detailed site plan. These sample points should be evenly distributed amongst the various habitats on site, so that all the broad habitat types (including perceived low quality bat habitats such as arable fields) and potentially important landscape features are represented equally. The number of sample points is determined by the size of the site, which, in turn, determines the number of surveyors required to undertake the survey. As a general guideline, at least one sample point should be established for every 2 ha of site in order to provide sufficient data to obtain an understanding of the spatial distribution of bat activity. One surveyor should be able to survey around 20 sample points during a single survey session. The distance between sample points also needs to be taken into consideration, as a surveyor will only have time to walk approximately 3 km during a typical survey (allowing for time spent at sample points and assuming a walking speed of 3 km/h).

Where potential impacts are expected to be relatively minor (*i.e.* on smaller sites, where habitats are sub-optimal and/or where there are very few potential roosts sites in the area) appropriate survey frequency may be three visits during the main bat activity season in order to account for seasonal variation in activity. On more complex sites with higher potential for foraging or commuting bats, or where a particularly robust approach is required for planning purposes, monthly manual surveys may be appropriate. If this is the case, survey sessions would be carried out during April to October, in order to provide additional data as well as ensuring that any weather-dependent variation is accounted for. In exceptional circumstances (for example where known roosts of nationally scarce species are located nearby), the number of visits may need to be greater than this; possibly up to two visits per month from April to October inclusive.

Surveys should commence at sunset (when bats that tend to emerge earlier, such as noctule, might first be recorded) and take approximately three hours to complete. During this time, surveyors equipped with broad band bat detectors (preferably not time expansion so as to avoid missing bat passes) connected to audio-recording equipment, should walk to each of their allotted sample points and record the number of bat passes per species detected at those points within a five minute sample period. A single bat pass is defined as an unbroken stream of echolocation up to 10 seconds long (the number of seconds being arbitrary, as long as the figure chosen remains consistent). Therefore 27 seconds of unbroken echolocation would count as three passes. If it is suspected that multiple passes are being made by the same bat(s), this should be noted, but the number of passes still needs to be recorded. To reduce survey bias, the surveyors must change the order in which they visit the sample points each survey session. This is easiest to achieve if the sample points are arranged in such a way that they can be reached by a circular route; the survey start point can then be rotated each session.

In addition to recording bat pass rates at each of the sample

points, surveyors should record all bat activity observed between sample points on a detailed site plan or GPS. This information may help to identify key foraging areas, commuting routes and possibly roosts not covered by the sample points or at the automated detector locations. If it becomes apparent after the first survey session that important bat areas are not being adequately sampled, it may be possible to amend the distribution of sample points accordingly. Once these are considered satisfactory, however, they should remain unchanged for the remainder of the survey.

Basic meteorological information such as temperature, wind speed and precipitation should be recorded during each survey session to assist with interpretation of bat activity data.

After each survey, all audio recordings should be analysed using appropriate sonogram analysis software to confirm the species (or at least genus) of the bats recorded.

Commuting Route Survey

This is undertaken to identify any important commuting routes in and out of the proposed wind farm site to help determine whether any roosts of conservation significance in the surrounding landscape might be affected by the development. It involves one or more surveyors walking or driving to selected points around the perimeter of the site, where potential commuting routes have been identified, to survey for commuting bats. Of all the methods described here, this is the most site dependent. If, during the initial evaluation, the likelihood of bats commuting into the proposed wind farm site from significant roosts is deemed to be negligible, little or no commuting route survey may be deemed necessary.

If potential commuting routes are identified, the level of survey effort should be sufficient to determine whether or not they are actually used by bats. Each potential commuting route should be surveyed on at least three occasions throughout the main bat activity season. During a survey session, more than one potential commuting route may be checked by rotating between them every 10 minutes, for example, as long as each point is sampled for at least 30 minutes each session. In order to reduce survey bias, the order in which potential commuting routes are sampled should be rotated each session.

Commuting route surveys should commence 30 minutes before sunset and last for approximately two hours. During this time, the surveyor(s), should record all bat passes (including time, species and direction of flight) at each sample point. The amount of time spent at each sample point should be recorded to enable calculation of bat pass rates for each potential commuting route. Night vision cameras with infra red lamps, and remote detectors may provide useful additional survey tools if resources are limited and there are numerous potential commuting routes.

Where frequently used commuting routes are identified, additional backtracking and emergence/dawn swarming surveys may be required to determine the location and conservation significance of the source roost(s).

Analysis and Interpretation of Survey Results

Data obtained using the three survey methods described above should be processed and presented in such a way as to enable a transparent assessment of bat activity, which is both relevant to the proposed development and as objective as possible. Figures 1, 2 and 3 provide examples of the three main visual outputs which can be produced for this purpose.

If the preliminary visual analysis reveals any trends which could be of particular relevance to assessing the impact of the proposed development, further analysis of the spatial distribution of individual species and fine-scale temporal trends in activity can be undertaken as appropriate.

By standardising the approach to surveying proposed wind farm development sites and using a methodology which can be applied equally well to post development monitoring to enable quantified bat activity comparisons and inference of development impacts, we will be taking an important step towards improving the accuracy with which we can predict the impacts of wind farm developments on bats.

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Acknowledgements

The authors wish to thank Simon Geary, Tim Palmer, Sacha Rogers and Elly Weir for their valuable contributions.

Correspondence: JCook@amaenvironment.co.uk

Neglected Biodiversity: Mosses, Liverworts and Ecological Impact Assessment

Des A Callaghan MIEEM
Associate Director, Faber Maunsell

Introduction

Bryophytes (mosses, liverworts and hornworts) were the first green plants to radiate across land (Shaw and Renzaglia 2004), with major consequences for life on earth. They now contribute substantially to UK biodiversity and include many species of national conservation concern (Figure 1).

Figure 1:* Sphagnum riparium *beside Allt Ach' a' Bathaich (East Sutherland), a nationally scarce species
Photo: Des Callaghan

Unfortunately, because of their small size and identification challenges, they are largely neglected and few people develop much of an interest in them. For example, although a set of criteria for the identification of Sites of Special Scientific Interest (SSSIs) were published for bryophytes some sixteen years ago (Hodgetts 1992), these plants are a designated feature of few SSSIs and are rarely mentioned in any detail in SSSI citations. When it comes to Ecological Impact Assessment (EcIA) their neglect is obvious, with few Environmental Statements (ESs) even bothering to mention them being scoped out of consideration. The aim of this article is to improve awareness of this diverse assemblage of cryptogams[1] amongst ecology professionals, in particular with an intention to promote their adequate consideration within EcIAs and associated ESs.

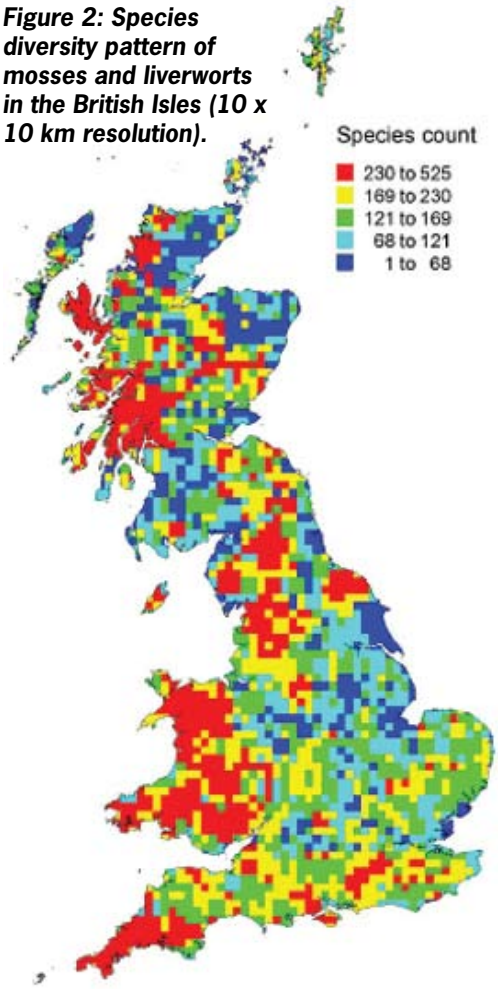
The Importance of the British Bryoflora

Some 14,000-16,000 bryophyte species have been described worldwide, which is maybe half of the actual total in existence today (Krishnamurthy 2003, Bebber *et al.* 2007). Unusually, species-richness can often be alike between areas of similar size in tropical and temperate regions, though gamma diversity (*i.e.* overall species-richness) is higher in the tropics (Hedenäs 2007). A robust example of the sort of diversity that a temperate country can support is provided by the UK, where the register of bryophytes is more-or-less complete and includes 1,057 species[2], comprising four hornworts, 297 liverworts and 756 mosses (Hill *et al.* 2007). Species-richness is highest along the mild and wet west coast of our islands (Figure 2), which is home to the renowned 'Atlantic bryophytes' (Ratcliffe 1968, Figure 3), comprising those species that need the wettest climate to grow and reproduce. Species diversity can be impressive, with the number of species per hectad (10 x 10 km square) frequently reaching >300 and, occasionally, >500. Indeed, areas along the west coast of Britain and Ireland are possibly the best places in Europe for bryophytes. That said, this does not mean the drier parts of our country can be dismissed as unimportant, since even here diversity usually reaches >100 species per hectad, including many species of conservation concern.

Habitats and Vegetation Communities

Bryophytes grow on a wide variety of substrates, though most typically this includes soil, rock or tree bark. Other less utilised substrates, sometimes used by specialist species, include decaying vegetation, animal bones, animal dung, other bryophytes and floating on water. Bryophytes also grow in many types of habitats, from littoral sediment to alpine grassland, and from coastal cliffs to the surface of small farm ponds. Some of the best habitats are rocky outcrops, deciduous woodland (Figure 4) and the margins of inland waterbodies, while some of the worst are coastal shingle, eutrophic pastures and urban buildings. Habitats that frequently occur within typical development sites can support high bryophyte richness, such as low density buildings, extractive industry sites and inland habitats with sparse vegetation.

Figure 2: Species diversity pattern of mosses and liverworts in the British Isles (10 x 10 km resolution).



Although the National Vegetation Classification (Rodwell 1991-2000) is based upon a

Figure 3:* Trichocolea tomentella *at Nantgwynant (Snowdonia), one of the famous 'Atlantic bryophytes'
Photo: Des Callaghan

significant amount of bryological data, mosses and liverworts occurring within quadrats were likely over-looked quite often (Callaghan and Ashton 2007). That aside, many NVC communities have been defined with reference to their bryophyte flora. Indeed, bryophytes are identified as being a core component of some NVC communities (Figure 5), such as many of the mire, heath, montane and sand-dune communities. Thirty-one species are listed as constant species[3] of one or more communities, and 29 communities have at least one bryophyte species listed as a constant species. Thus, although the quality of the bryological data fed into the determination of NVC communities was probably substantially inferior to the vascular plant data, these little plants have still emerged as important components of a wide range of communities. This illustrates the importance that bryophytes can have in determining the structure and function of ecological communities and supporting biodiversity.

Species of Conservation Concern

There are eight main 'conservation designations' that are assigned to British bryophytes (Table 1), which collectively provide a list of 493 species of conservation concern (*i.e.* 47% of all British species) (Figure 6). Indeed, as is the general rule amongst groups of organisms, most bryophyte species are rare or uncommon (*i.e.* commonness is rare). The species of conservation concern are distributed throughout the British Isles and likely show a collective distribution that is similar to the overall species diversity pattern (Figure 2), given that areas of high species richness tend to support a disproportionately high number of rare species (Callaghan and Ashton 2008). The most high profile and strictly protected populations of bryophytes are those which are designated features of Special Areas of Conservation (SACs). Perhaps the most famous is *Petalophyllum ralfsii* (Figure 7), known as Petalwort. This is a thallose liverwort that forms tiny rosettes (c. 5 mm across), typically occurring in the thin, damp turf associated with dune slacks, and has become a designated feature of ten SACs, including for example the Sefton Coast (Lancashire), Braunton Burrows (Devon) and Kenfig (Vale of Glamorgan).

***Figure 4: Deciduous woodland habitat can support an impressive richness of bryophyte species, such as* Dicranum majus**
Photo: Des Callaghan

Effects of Development on Bryophytes

Aside from the obvious direct effect of habitat loss on bryophyte populations, there are a wide range of other effects that can give rise to significant impacts from development projects. The most common are probably related to hydrology and air quality. Hydrological circumstances are particularly critical to the survival of bryophyte populations and communities, which is a reflection of their poikilohydric[4] condition. Relatively small changes in water regimes can lead to significant shifts in the population sizes of bryophtyes, and the loss and gain of species in an affected area. This could be related to, for example, inundation cycles at the margins of rivers and waterbodies, or the seasonal water-table dynamics of a mire or dune slack. Species that are dependent on a narrower set of hydrological conditions will of course be more vulnerable to such changes. For instance, Sphagnum species are classically distributed amongst micro-elevation zones within their hummock-hollow formations in bogs; the species of the hollows and pools (*e.g. Sphagnum denticulatum*, *S. cuspidatum* and the rare *S. majus*) will obviously suffer most in the event of a lowered water-table.

Figure 5: Bryophytes are a key component of some vegetation communities, such as this mire community on Easington Fell (Forest of Bowland) where* Polytrichum *commune predominates
Photo: Des Callaghan

As for air quality effects, bryophtyes appear to be at least as sensitive to the major atmospheric pollutants as the much more intensively studied lichens (Bates 2000, 2003). For example, although nitrogen (N) is an essential nutrient for plants, above certain levels it has been shown to retard growth in bryophytes and may lead to shifts in community composition by providing a competitive advantage to more N-dependent species (Mitchell *et al.* 2004, Koranda *et al.* 2007, Bobbink *et al.* 1998). Likewise, bisulfite (HSO_3^-), an ionic form of SO_2 that predominates in acidic conditions, is known to significantly impact upon the process of photosynthesis in bryophytes (Bharali and Bates 2002). Following the large-scale decline in SO_2 levels over the past couple of decades within the UK, many bryophytes have shown an impressive expansion in their range. However, SO_2 deposition can still be a significant potential problem locally, such as when important bryophyte species and communities are located near to proposed energy-from-waste developments.

These types of effects illustrate how EcIA can be a complex undertaking, requiring close cross-disciplinary engagement and understanding. It also exemplifies the importance of applied ecological research, which is needed to inform our predictions of the effects of changes in baseline conditions on species and communities.

Consideration of Bryophytes Within Ecological Impact Assessment

Bryophytes are mentioned rarely in ESs, and when they are it

Figure 6:* Sphagnum pulchrum *is a beautiful but nationally scarce species, which can be seen in abundance on some of the heathland sites near Poole (Dorset), for example as pictured here at Morden Bog
Photo: Des Callaghan

is usually limited to occasions when a development is likely to have a significant effect on a statutory protected site for which bryophytes happen to be a designated feature. This general neglect of bryophytes within EclA is likely to have lead to developments that have caused significant and unnoticed negative impacts, perhaps quite frequently. In order to reduce this problem, it is recommended that EclA managers seek close engagement with suitably experienced bryologists. The goal should be to give reasonable consideration to potential significant impacts on bryophytes, in order to meet the requirements of local, national and European legislation and policy. A decision framework to guide adequate consideration of bryophytes in impact assessments is shown in Figure 8. Working with this framework and an adequately experienced bryologist will help ensure bryophytes become less neglected in EclA, promote compliance with legislation and policy, and provide a better future for our internationally important flora.

Web Links

www.britishbryologicalsociety.co.uk

Acknowledgements

Many thanks to Dr Mark O Hill and The British Bryological Society for providing the data used to create Figure 2.

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Table 1: Conservation designations of UK bryophyte species

Conservation designation*	Number of bryophyte species	Notes
World Red Data Book	3	*Ditrichum cornubicum, Jamesoniella undulifolia* and *Thamnobryum angustifolium* (IUCN 2007).
Appendix I of The Convention on the Conservation of European Wildlife and Natural Habitats 1979 (Bern Convention)	5	*Buxbaumia viridis, Bruchia vogesiaca, Hamatocaulis vernicosus, Marsupella profunda* and *Petalophyllum ralfsii.*
Annex II of The European Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora 1992 (Habitats Directive)	5	*Buxbaumia viridis, Bruchia vogesiaca, Hamatocaulis vernicosus, Marsupella profunda* and *Petalophyllum ralfsii.*
Schedule 8 of The Wildlife and Countryside Act 1981 (as amended)	37	There were no bryophytes included on the original Schedule 8 of The Wildlife and Countryside Act. In 1992, this changed dramatically with the addition of 33 species, followed by a further four in 1998.
UK Priority Species under the UK Biodiversity Action Plan	111	The revised UK List of Priority Species and Habitats (www.ukbap.org.uk/NewPriorityList.aspx) includes 111 species of bryophytes, of which 35 have Species Action Plans and nine have Species Statements produced under the UK BAP.
National Red Data Book	250	Species qualifying under the new IUCN Red List Categories and Criteria (IUCN 2001) as Extinct, Critically Endangered, Endangered, Vulnerable, Low Risk (near-threatened) or Data Deficient in the UK (Church *et al.* 2001).
Nationally rare	217	Occurring in ≤15 10 x 10 km squares in the British Isles, determined from data provided in Hill *et al.* (2007).
Nationally scarce	276	Occurring in 16-100 10 x 10 km squares in the British Isles, determined from data provided in Hill *et al.* (2007).
TOTAL	493	

**The Red Data Book of European Bryophytes (ECCB 1995) has not been considered here since it is substantially out-dated, though efforts are being made to update it (www.bio.ntnu.no/ECCB/RDB.php).*

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Figure 7: The much celebrated* Petalophyllum ralfsii*, clearly showing the unique parallel lamellae across the plant body
Photo: Des Callaghan

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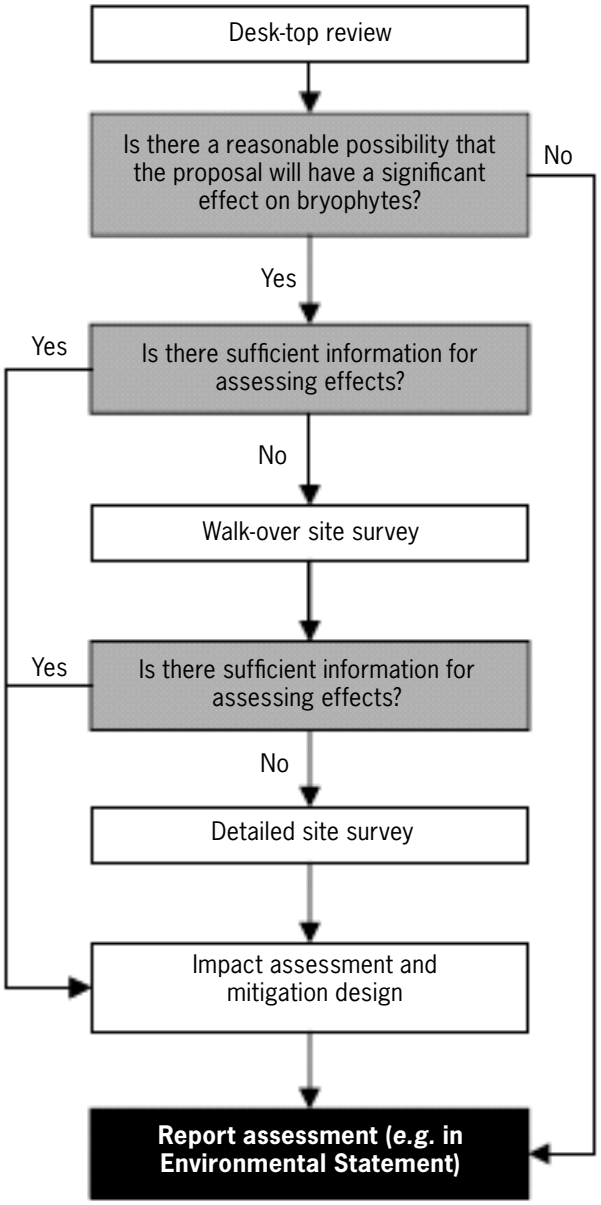
Correspondence: derek.callaghan@o2.co.uk

Figure 8: Framework for the consideration of bryophytes within Ecological Impact Assessment.



Bryophyte Workshops 2009

Learn more about mosses and liverworts out in the field with Des Callaghan on one of his bryophyte workshops at some stunning locations in 2009:

- Saturday 7 March 2009
  Mosses and liverworts of heathland and mires
  Location: Cannock Chase SSSI/SAC
- Saturday 4 April 2009
  Mosses and liverworts of woodland
  Location: Windsor Forest SSSI/SAC
- Saturday 9 May 2009
  Mosses and liverworts of grassland
  Location: Rodborough Common SSSI/SAC

More information: www.ieem.net/workshops.asp

Notes

[1] Plants that produce spores rather than seeds.

[2] Seventeen of these species have not been recorded since 1950.

[3] A constant species in an NVC community is a species that is always present in any given stand of vegetation belonging to that community.

[4] Poikilohydry is a condition in organisms that lack a mechanism to prevent desiccation, such as stomata in vascular plants.

Restoration Network Ireland

Catherine A Farrell MIEEM
Chair of Commission V, International Peat Society and Rehabilitation and Restoration Ecologist

Restoration ecology is a growing discipline in Ireland and there are a number of long-established projects that have provided an insight as to how best restore and/or rehabilitate as the need arises. An initiative to collate data on restoration projects in Ireland is considered fundamental to facilitating the detail and lessons learned from these restoration projects reaching the wider community within Ireland, and indeed the global community. Following discussion with a number of colleagues I am proposing the establishment of a Restoration Network in Ireland, with links to the wider international networks of restoration ecologists and ecological restoration practitioners, in particular, members of the International Peat Society (www.peatsociety.org) who are active in peatland restoration and members of the Society of Ecological Restoration (www.ser.org) who operate in a wider context.

My own interest stems from working on the rehabilitation and restoration of post-industrial peat production areas in Ireland, and trying to translate that work onto other degraded habitats within broader landscapes. I have recently been appointed Chairperson of Commission V (After-use and restoration of peatlands) of the International Peat Society and will endeavour for the next four years (2008-2012) to be pro-active in encouraging discussion and awareness of restoration practices, particularly within Ireland. While the main focus of Commission V of the IPS is on peatlands, there is scope to activate discussion of broader restoration principles to embrace other habitats and species. It is also important to share knowledge and make it available to those who may be just starting out on restoration projects which would benefit from shared experience.

There is therefore a need to draw together the knowledge and skills that have been generated by restoration practitioners in Ireland, and to combine this with some of the more theoretical aspects such as valuing the effects of restoration in ecological, economic, social and cultural terms. Such a network could help to heighten awareness and influence national policy in terms of conservation management and the potential for restoration. It is regrettably apparent that most habitats and species in Ireland would benefit from some form of restoration work. This has been highlighted in the Habitat Assessment Reports presented earlier in the year by the National Parks and Wildlife Service to the European Commission. It is also apparent that there has been a lot of restoration work carried out by Irish practitioners, and that pooling the knowledge and experience gained to date would be of great benefit for future restoration projects.

The future policy decisions relating to conservation of biodiversity and future climate scenarios that are implemented in Ireland should be informed by the concerns and knowledge generated by environmental and ecological practitioners. It would therefore be helpful to bring all members of that community together to influence such decisions in a non-political and non-prejudiced manner. Science-based and tried-and-tested practical measures should be the foundation for formulating a strategic and synergistic way forward for conservation management in Ireland. Ultimately any policy will have to recognise the needs of the Irish people and also the national commitments to international targets on biodiversity and climate change.

The potential benefits of establishing an ecological restoration network in Ireland would include the following:

- the creation of an appropriate interface to disseminate the experience of practitioners and provide a forum for discussion and knowledge sharing;
- the establishment of a database of restoration projects carried out within Ireland;
- sharing knowledge of practical aspects of restoration through specialised workshops;
- generating submissions that could positively influence national policy decisions on conservation management of biodiversity and climate change; and
- building links to the pool of expertise in ecological restoration which already exists on an international level.

Groups that may be interested in participating in such a network include: National Parks and Wildlife Service, Fisheries Boards, The Heritage Council, Institute of Ecology and Environmental Management, International Peat Society (Irish branch and extended community), Coillte, Woodlands of Ireland, BirdWatch, Irish Peatland Conservation Council (IPCC), Coast Watch Ireland, as well as businesses and individuals involved in any form of ecological restoration.

This list is by no means exhaustive and further suggestions as to groups/individuals for inclusion are welcome. The establishment of the network is intended to facilitate ease of communication and knowledge sharing. Most of the work could be carried out via e-mail and internet; with occasional more or less formal meetings. The intention is not to set up yet another organisation with top-heavy committee structures *etc.* It is rather to facilitate communication between people working in this important field, at both theoretical and practical levels, and offer a platform to make this work better known and understood in the community at large.

Consultation meetings relating to the proposed Restoration Network Ireland have already been held during October 2008 in Dublin and Tullamore, and support for the initiative has been expressed by over 100 restoration practitioners in Ireland with a small group in the UK. The agreed mechanism is a website interface where members can register and submit data on restoration projects. The data will be added to the pool of knowledge and it is hoped that people will be able to take part in active and relevant discussion on current issues relating to nature conservation and restoration both on a national and global level. The initial phase will involve establishing the website interface and it is hoped that this will be completed in the near future. Following from that, it will be up to practitioners to upload details of projects and register for different discussion groups. If you would like to be included on the mailing list for the initiative please contact Catherine.farrell@bnm.ie.

Autumn Conference Report

Nick Jackson AIEEM
Education and Professional Development Officer, IEEM

The Institute's annual conference took place on 18-20 November 2008 in Glasgow and was entitled '*Mitigation: Smoke and Mirrors or Biodiversity Enhancement*.' The conference considered the growing body of opinion that new developments should deliver net ecological gain rather than simply being designed to achieve mere damage limitation. Due to the uncertainty associated with the success of proposed mitigation, evidence is required to demonstrate the effectiveness of mitigation measures; and to what extent this success can be guaranteed. The aim of the conference was to understand the current status of mitigation practice in the UK and Ireland, and showcase examples of good practice and highlight issues in the development of mitigation measures. It was the best attended IEEM conference to date, with over 400 delegates.

Clyde Muirshiel Regional Park
Photo: Carol Crawford

David Tyldesley MIEEM (David Tyldesley Associates) gave the keynote lecture at the start of the conference on Wednesday morning, providing a strategic overview and putting the subject into context. His talk covered the definition and different types of mitigation; why we need mitigation and why it is important; the differences between mitigation and enhancement; and explained translocation and habitat banking. He finished by talking about the importance of post-mitigation monitoring and asked whether or not this should be made compulsory? David has also written the editorial in this edition of *In Practice*.

The subsequent talks in the first session covered mitigation and environmental enhancement through Environmental Impact Assessment; bridging the gap between ecologists and planners; trunk road design and mitigation; the use of adaptive management for mitigation; and finally an interesting talk on whether there is any point actually creating habitats (rather than letting areas of land regenerate naturally).

The afternoon session saw the conference delegates going out on various field excursions to local sites showing both, examples of practical mitigation projects on the ground, as well as local nature reserves and sites of ecological importance in the area around Glasgow. Field sites included Loch Lomond and the Trossachs National Park, Lochwinnoch RSPB Reserve, Clyde Muirshiel Regional Park, Whitelee Windfarm, Gartcosh Nature Reserve, Katrine Water Project, Millersneuk Wetland, Cathkin Nature Reserve, Glasgow Botanic Gardens as well as a more 'cultural' trip to the Glasgow School of Art looking at the Charles Rennie Mackintosh art collection.

The Institute's AGM took place on Wednesday evening and Professor Stephen Ormerod FIEEM officially became our new President. See *Institute News* on page 42 for further details about the AGM. A conference dinner attended by over half the delegates took place on the Wednesday evening and gave the opportunity for plenty of networking.

Thursday's sessions focused on practical examples of mitigation - from large-scale projects such as the Channel Tunnel Rail Link, Manchester Airport's second runway, pipelines, reservoirs and housing developments; to mitigation related to protected species such as great crested newts, bats, badgers, invertebrates, reptiles and water voles.

The conference ended with a closing talk from Professor Andrew Pullin (Centre for Evidence Based Conservation, University of Bangor) who talked about the challenge of building an evidence base for mitigation. Andrew explained some of the barriers to evidence based conservation and informed conference delegates about the Collaboration for Environmental Evidence website (www.environmentalevidence.org), which is a collection of systematic reviews for conservation and environmental management. This website allows anyone to submit results from projects and the data can then be used to assess the effectiveness of different mitigation techniques.

The PowerPoint presentations will shortly be available on the IEEM website. The proceedings from the conference will be edited then compiled onto a CD-ROM and sent to all IEEM members in 2009 (a printed copy to those who attended the conference).

I would like to thank all the speakers for a very thought provoking and interesting conference, the chairs of each session and the people who led the field excursions for their time and effort. For details of our conferences in 2009 please see the *Diary* on page 56.

The IEEM Medal: Citation for Professor Charles Gimingham

The IEEM Medal was awarded to Professor Charles Gimingham at the IEEM Autumn Conference in Glasgow on 18 November 2008. Below is the citation, written by Pat Rae CEnv MIEEM and Una Urquhart CEnv FIEEM, for the award.

Charles Gimingham is an internationally respected Ecologist of over 60 years standing. He is very well known to the Institute having been a Patron since 2000. His life has been full – but only a few of his achievements are mentioned here.

Charles qualified with a first class BA from Cambridge in 1944 and soon moved to Aberdeen University for his PhD and later to become a Lecturer in the Botany Department. He settled down in Aberdeen to marry and raise his family of three daughters and to pursue a lifetime career of research and teaching. From that base he has applied his ecological knowledge in Europe, Africa, south east Asia, Japan and Antarctica. He was awarded a personal Chair in Botany in 1969 and became Head of Department and Regius Professor of Botany in 1981.

In tandem with his university career he found time to contribute knowledge and experience to various roles. At a time when scientifically based conservation practices were much needed, he served on the boards and technical advisory groups of the main institutions for further education and research both in the north east of Scotland and nationally, including the Countryside Commission for Scotland from 1980 to 1991.

He has been a prolific writer and reviewer of research papers and editor of journals – the *Journal of Ecology* for one. He was President of the Botanical Society of Edinburgh from 1982 to 1984, and in 1986 was elected President of the British Ecological Society.

Charles became Professor Emeritus in 1988 but he has continued to apply his knowledge and expertise to some of the key issues of the day. For example, in 1994 he was a member of the UK Biodiversity Steering Group, from which Biodiversity Action Plans have evolved. He has served on the North East Regional Board of Scottish Natural Heritage and on its Scientific Advisory Committee from 1996 to 1999, and was President of the Heather Trust in 2004.

This was most appropriate as Charles has long been an advocate of the practical application of ecological knowledge to the management of heathlands and moorlands – habitats which play an important part in the economy of the uplands. It is for this work that he is perhaps best known and where he has exerted most influence. He pioneered an early leaflet on heather-burning, from which the present Muirburn Code has developed. His 1972 book *The Ecology of Heathlands* became a standard text and in 1993 *The Lowland Heathland Management Handbook* was a major contribution to the practical management of heathland habitats. Much of our understanding of ecological processes and the landscape character of the uplands is due to Charles' work and influence. Who better, then, to play a large part in the designation in 2003 of the new Cairngorms National Park, and in 2002, to edit *The Ecology, Land Use and Conservation of the Cairngorms*, the scientific basis for the Park's future research and management decisions?

In recognition of his work he has been awarded several honours. Amongst these, he became a Fellow of the Royal Society of Edinburgh in 1961, a Fellow of the Institute of Biology in 1969, and a Doctor of Science at Cambridge University in 1977, and he was awarded an OBE in 1990. In 2004 he was made an Honorary Member of the British Ecological Society – their highest honour.

Charles himself has said that his lifelong interest in *Calluna*, and also his approach to teaching, were inspired by A S Watt (of *Pattern and Process* fame) who in turn had been a student of Sir Arthur Tansley. That is a very impressive thought – a worthy example of continued 'succession' from the early 1900s!

In that vein, perhaps the biggest lifetime contribution Charles has made is to our future - not just through the pursuit of scientific knowledge, but through the lives of those students from around the world whom he inspired with his teaching, advice and invaluable practical help.

Charles has always been approachable, and never afraid to get his hands dirty in the outdoor class room of a peat bog or when sharing the washing-up on field-courses. At a time when other Professors seemed remote, the affection with which he was held was apparent in the late 1970's, when his research students and staff dressed in identical T-shirts on which were the words '*Prof Gim Rules OK*'. Many of his undergraduates and research students have gone on to be pioneers in their own right, in successful and influential careers in ecology not only in the UK but around the world.

Charles never draws attention to his own success and always shows great humility, whether hosting a conference, chairing a meeting or going with students to a local hostelry after a day's field-work.

Just as his research, books and emphasis on practical ecological management were pioneering, so was his approach to teaching. He continues to offer ecological and botanical advice to individuals, to comment on national policies and to contribute to public awareness of ecology.

Our Patron, Professor Emeritus Charles Henry Gimingham OBE BA PhD ScD FRSE FIBiol, is a most worthy recipient of the IEEM Medal.

Una Urquhart, Charles Gimingham and Pat Rae

Best Practice Awards 2008

Mimoza Nushi
Marketing and Public Relations Officer, IEEM

IEEM is pleased to announce that the second year of the Best Practice Awards has been a great success. Entries were received from across the UK and Ireland and from all sectors of the ecology profession. The awards were presented on the evening of 19 November 2008 at the IEEM Autumn Conference in Glasgow. The winner was: The Former Avenue Coking Works, by TEP, a multi-disciplinary environmental consultancy, on behalf of the East Midlands Development Agency. The other finalists were: The Abberton Scheme, by Essex and Suffolk Water; and the Hesketh Outmarsh West Managed Realignment Project, by the Environment Agency. Congratulations go out to all three finalists and indeed to all the entrants of the competition, the entries were all of a most encouraging standard. Below are short introductions to the three finalist projects.

Hesketh Outmarsh West Managed Realignment Project - Environment Agency

A massive 168 hectares of new saltmarsh (equivalent to 270 football pitches) has just been created in the North West providing a new RSPB nature reserve.

The Environment Agency, RSPB, Lancaster City Council and Natural England have worked together on this project which has reduced flood risk while creating valuable saltmarsh habitat. This is in line with the Government's 'Making Space for Water' programme.

Hesketh Out Marsh West is on the southern boundary of the Ribble Estuary SPA SSSI, approximately 7km to the west of Preston. Tidal inundation of the site had been prevented by private flood defences since the early 1980s and the land used for intensive agriculture.

By working in partnership The Royal Society for the Protection of Birds (RSPB) bought the site in 2006. Since then RSPB have been working with the Environment Agency to create salt marsh creeks and lagoons to reinstate natural tidal inundation across the entire site.

The Environment Agency used half a million tonnes of material excavated from the within the site to create creeks and lagoons and repair the inland sea embankment. This has helped to protect 4000 homes from flooding. By using soil from the site, rather than importing it, the Environment Agency has reduced the impact of their work on neighbouring villages and farming communities. Using on site material has also reduced the scheme's 'carbon footprint' by avoiding transportation and reduced the cost of the project by £2million pounds.

The project reinstates natural tidal inundation by creating four breaches in the outer sea defences surrounding the site. The first breach was carried out on the 16 September 2008. High tides now inundate the site starting the process of saltmarsh development.

This provides important new saltmarsh habitat at a time when this priority BAP habitat is being lost at many other coastal locations due to rising sea levels and coastal squeeze. This project alone has exceeded the national annual target for saltmarsh creation under the UK Biodiversity Action Plan.

The Environment Agency used LIDAR data and tidal modelling to confirm the site levels were suitable for saltmarsh creation. This data helped determine the best locations for the breaches in the embankment. It was also used to design the creeks and lagoons to maximise the area of new saltmarsh habitat and ensure flood protection standards.

Hesketh Out Marsh West has now become a new RSPB nature reserve providing habitat for waders, wildfowl, invertebrates and fish. New tidal pools have been created adjacent to the Environment Agency's embankments to allow visitors an opportunity to observe birds using the new marsh.

Birds have already started to use the new reserve in good numbers. The RSPB have recorded an increase in lapwing by 29% and wigeon by 53%. Breeding oystercatcher numbers have increased by 60% and new species colonising the site already include breeding avocet, redshank and teal. The new reserve is expected to become nationally important for wintering and breeding birds.

The partnership has established a monitoring programme to study the developing saltmarsh. Staff and students from Edge Hill University are recording the developing vegetation and carrying out sediment analysis, invertebrate surveys and monitoring fish populations. This will inform future managed realignment projects.

In addition the Environment Agency will be creating a further 3 hectares of new freshwater wetland habitat on adjacent land owned by Natural England. These ponds and reedbeds will provide additional habitat diversity along the entrance to the new reserve.

The project demonstrates best practice in terms of partnership working for ecological benefit. It shows that effective flood protection can be provided with benefits to people and wildlife, by working with nature not against it and making space for water.

The Abberton Scheme - Essex & Suffolk Water

Abberton Reservoir, owned and managed by Essex & Suffolk Water, is the largest freshwater body in Essex. It is designated a Special Protection Area (under the EU Wild Birds Directive), a Ramsar site and a Site of Special Scientific Interest on the basis of its waterfowl populations.

The Abberton Scheme will address an existing deficit of water available in Essex and some of the London Boroughs. It will provide water for these areas into the future in a way that takes account of the reservoirs' nature conservation importance and also substantially enhances it.

The capacity of the reservoir will be increased by 58% by raising the top water level by 3.2 m. In the process some 200 ha of new wetland shoreline is to be created, together with new lagoons, reedbeds, wetland scrapes, farmland bird habitat on adjacent land, and the removal of much of the existing concrete perimeter wall. The project also involves the transfer of water from Denver

(Norfolk) to Essex and the abstraction of water from the River Stour – assessments of these European sites have also been undertaken.

Best practice has been applied consistently to the data collection, evaluation, impact assessment and design. Specific areas of importance in this regard are:

- ecological surveys and impact assessments have been conducted using the IEEM EclA guidelines;
- a holisitc approach to ecological assessment has been used across the components of the Scheme – Ouse Washes, The Wash, pipeline routes, abstraction licences, River Stour, Stour Estuary and Abberton Reservoir, operating as one inter-connected system. The same team of consultants has been used;
- high levels of consultation have been undertaken from the outset;
- high quality data have been collected at all sites, *e.g.* at Abberton, baseline conditions have been surveyed for four years *i.e.* waterfowl species on the SPA citation – spatial distribution mapped in 979 50 m^2 grids fortnightly, allowing spatial assessment of numbers in association with:
    - habitat depth distribution;
    - distribution change depending on water levels/ drawdown;
    - determining the construction window;
    - predicted habitat requirement as a result of potential displacement during concrete edge removal; and
    - long term design, viability and function of raised reservoir under different water demand and climate scenarios; and
- enhancement of biodiversity and landscape has been built into the overall ethos of the project, compliant with PPS9, the 50 year Wetland Vision, regional BAP targets, access to the countryside initiatives and support for a NGO in perpetuity.

The project was first considered in 1993 and has taken 15 years to reach a point where the local planning authority for the reservoir (Colchester) have voted in favour of the Scheme being granted planning permission (subject to legal agreements).

Further support for the approach taken to the Scheme has been received from Natural England who in their response to Colchester Borough Council concluded '*Having carefully considered the comprehensive information presented in the Environmental Statement and supporting documents, Natural England raises no objection to the Abberton Scheme…. In our view, the Abberton Reservoir Scheme is likley to have a significant positive effect on the conservation status of the migratory and wintering waterfowl assemblages in the short-, medium- and long-term future of the statutorily designated site.*'

The Former Avenue Coking Works - TEP on behalf of EMDA

Situated on the banks of the River Rother, just south of Chesterfield, Derbyshire, the original Avenue Colliery dates back to the 19th Century. It was expanded to include lime and iron works, but operations ceased by 1938. The Avenue Coking Works became operational in 1956, employing 800 people. It carbonised 2,175 tons coal a day, producing 1,400 tons smokeless fuel, 65 tons sulphuric acid, 35 tons ammonium sulphate, 20,000 gallons crude benzole and 250 tons tar. Closing in 1992, it lay derelict as one of the most contaminated sites in Western Europe, causing significant concern to neighbouring communities.

In 1999 East Midlands Development Agency with funding through the English Partnerships National Coalfields Programme, started the clean-up operation of the 240 acre site. TEP was engaged, through the lead technical consultant, Jacobs, to inform the planning, design, implementation and long-term management of the site. Surveys, including landscape and biodiversity assessments, were carried out from 1999 to 2001, informing the demolition and dismantling of the above-ground elements of major structures such as chimneys, coking ovens and chemical plant.

Despite its contamination, the Avenue has wide-ranging ecological interest, including great crested newts, grass snakes, many bird species, water voles, badgers and other small mammals. Ongoing surveys update and guide site proposals and management to further understand successful mitigation options.

Ongoing commitment to monitoring is upheld through the site's Environmental Management System. The EMS, first accredited in 2001 to ISO14001, was upgraded to Eco-Management and Auditing System in 2007, with biodiversity a key aspect.

Ecologists work with a broad range of professionals and regulators, with ecology a standard item at meetings for estate management and reclamation. It is a learning experience for all of the project team, improving understanding and collaboration across disciplines.

The forward-thinking multidiscipline approach of the Avenue team has allowed the masterplanning and restoration to be advised by a hefty evidence base. Over four years of ecological data have inputted to the plan, preserving the current ecology of the Avenue and reflecting biodiversity aspirations for the site and wider area. Local communities and nature conservation bodies are involved to ensure design meets public and biodiversity requirements. The traditional approach would have required removal of contaminants off-site. Extensive research was undertaken to develop sustainable and effective techniques for on-site remediation and re-use of contaminated soils, resulting in a complex on-site remediation strategy for the re-use of treated materials.

Regeneration of the Avenue balances a range of needs including economic regeneration, flood defence, biodiversity and public open space provision, accommodating the challenges of climate change through the incorporation of floodplain habitats and a sustainable soil strategy.

Ecology and landscape play an integral role in assessing impacts and delivering a forward thinking mitigation strategy that will not only secure the future for the site's existing biodiversity interest, but provide significant enhancement for new species and those currently resident. Extensive new habitats were designed for sustainable long-term management, which were created several years ahead of main site remediation and redevelopment to ensure sufficient establishment. They have since been taken on by The Land Restoration Trust and The Derbyshire Wildlife Trust as The Washlands Local Nature Reserve.

The Avenue is promoted as a best-practice test-bed, encouraging collaborative partnerships to investigate particular issues; for example over 30 trials of decontamination technology were completed, articles in environmental presses are encouraged and the site has been used by universities, IEEM and Natural England for training opportunities.

TEP representatives receive their award from Steve Ormerod

Ecological Skills Gap Project

Jill Sutcliffe MIEEM
Ecological Skills Gap Project Officer, IEEM

It is some 40 years since the first environmentally-oriented courses were introduced into universities in the UK. The first ecologically-oriented degree was an MSc in Conservation set up at University College London, which was designed in conjunction with the staff of the then Nature Conservancy Council. They were concerned that not enough suitably qualified staff were coming forward to work in the wildlife organisation advising government. The aim of the course was to address this gap and the link continues today, although it is not the only relevant postgraduate qualification now available. However, currently, across the marine, freshwater and terrestrial ecology sectors, recruitment of specialist and generalist ecologists with the relevant skills appears to be an issue.

Increasingly, demands are being placed on a range of organisations and their ecological staff in response to new and developing environmental legislation and policy. These demands require not only an expansion of people's current set of skills but also the development of new skills and knowledge. To meet this changing situation, and to provide a professional and effective advisory service, the ecological profession has to ensure that it has the 'right people with the right skills'. So IEEM has set up a project for three years that is designed to establish the extent and significance of the ecological skills gap or gaps. The Institute appointed a Project Officer who started work in May 2008.

Some preliminary work demonstrated that: there are problems in education and training provision that have been identified at all levels from early school through to professional training - the IEEM project will concentrate on graduates while the British Ecological Society Education Committee has been focusing their attention on school age options. Employers are reporting that an increasing number of job vacancies are being advertised in the environmental sector, but that these jobs are proving hard to fill as applicants generally lack the appropriate skills. A third of employers reported problems with regard to nature conservation and biodiversity; and many participants involved in training point out that a substantial number of courses exist but that there is a need to match these to the needs of employers.

During the three year research period, the work will involve gathering evidence across the ecological sector by: using a range of appropriate methodologies; undertaking a literature review of what has been done up to now; assisting in an evaluation of what the future needs will be for ecologists – people with an educational qualification in understanding the detailed needs of species and the links between them and their environment; circulating a questionnaire to staff in key organisations concerning ecological training and qualifications and experience; and assessing whether or not current courses provide the knowledge required.

Findings So Far

An immediate difficulty is that of finding the statistics. The term 'environmental' acts as a mask hiding the relevant courses and many such courses are now based in related departments such as Biological Sciences or Conservation. It is also the case that 'ecology' hides within the general term of 'environmental science'. Often these are **not** the courses which appear on the front page of a university web site and they can take some tracking down. In 2008, 38 single subject Ecology courses were available at undergraduate level and some 43 postgraduate courses. There are, of course, other courses available as Wildlife Management, Conservation or linking ecology to other subjects.

As the 'ecological' stream is a sub-set of those doing biological or other types of science, the numbers taking such courses have to be obtained separately from the Higher Education Statistics Association. These are on order. As yet, we do not know how these are fluctuating. Clearly, in the 1970s to 1980s student numbers soared as the courses first became available.

One set of statistics that **is** available shows that with regard to full time academic staff at UK higher education departments of earth, marine and environmental science from 2006 to 2007, women were poorly represented. Women formed 25% of staff including almost a third in research but only 18% reached positions of Senior Lecturer and some 8% are professors. In 2007-08, 27% of females taking A-level Biology gained A grades compared to 26% of males.

An aspect widely shared among professional ecologists is that they have taken diverse routes to their careers. Unlike, for example, medics, where there is usually a seven year training period followed by practical experience and making a choice to become a GP or undertaking further specialisation to become a consultant, ecologists may not have started by taking an ecological degree.

The routes can include academic courses; practical training courses; experience on the job; personal interest; voluntary work; or something else altogether. There is also a large subset of people who take up ecology later in their working life coming from a finance or engineering background for example.

The issue for the modern academic course in the UK is this: is it providing the right range of skills? Fieldwork and practical skills have certainly decreased in the content of many degree courses, because of funding cuts, an increase in student numbers making fieldwork more difficult to do, or from a lack of staff with the background to teach the skills. So what are the relevant skills? IEEM has produced a booklet, *What A Graduate Should Know*, on key skills a graduate should possess. However, there is currently no Botany Department left at a UK university, only seven botany courses, and not one mycology course.

UK Projects – Environmental Science Gaps

In the UK, the 40 year watershed has prompted some other organisations to look at this issue. Two organisations have been examining the issues in the context of the Environmental Sciences. The Environmental Research Funders Forum was set up in 2002 and one of its current projects is to undertake a project on the Identification of the skill needs and training priorities in the environmental science sector for the next 10 years. In order to do this they have let a contract to the Institute for Employment Research at the University of Warwick whose first task has been to review what is available. In turn, this will inform Stage 2, interviews with stakeholders. This is a large project designed to assess postgraduate provision and to provide a long term assessment of what will be needed in the next 10 years including supply and demand. The group Project Board includes the main Research Councils so that any recommendations can be effectively implemented. IEEM has a seat at this board.

The Committee Heads of Environmental Science issued a report, *Mapping the Environmental Science Landscape*, investigating the state of the environmental science subject in higher education

in March 2008 and discussed it at a workshop in June 2008. The recommendations for the future included: the need for more positive views to be communicated for Environmental Science as a subject and its associated careers; gaps in the curriculum – there is a need to consider the possible addition of work-based modules; coordination needs to be improved between those with an interest (*i.e.* to improve links across the sector); a 'can do' attitude needs to be employed to improve people's attributes and motivation; fieldwork was seen as an effective tool by which to increase confidence in the students; a mismatch of needs – especially with UCAS and the coding of degree programmes; promotion of the sustainability agenda; and the need to keep track of Lantra's Land based diploma for 14-19 year olds (due to be introduced in 2009).

Currently, the UK government department concerned with Environmental issues, Defra, has issued a call for those with ecotoxicological skills as these are in short supply.

College Projects in the UK and Ireland

Plymouth University is looking into the feasibility of setting up a two year course in Biological Surveying and Monitoring. This is at an early stage of information gathering and they have put a questionnaire on their website and received replies from employers, whereas the University of Cork in Ireland, having identified a gap in fieldwork provision, has established a year long postgraduate course. At Newcastle University, the Centre for Rural Economy is examining how good the communication channels (knowledge brokering) is between the research community and those passing on the information whether they are land agents, vets or ecologists. Nottingham University is involved in the Open Air Laboratories (OPAL) project to provide a link between local communities and ecological research.

European Projects – Specialist Skills Gaps

In Europe, the EU and OECD found a shortage of radioecological skills across the Community and have set up an MSc in Radioecology at the University of Norway; and in response to concerns about the dwindling number of taxonomists, the EU has also established the European Distributed Institute of Taxonomy (EDIT).

International Developments – Policy Gap

Following extensive discussions and consultation, an international advisory group has been set up, the International Mechanism of Scientific Expertise on Biodiversity (IMoSEB). A key problem is that, because of the complexity of biodiversity issues, the community dealing with biodiversity at large is very diverse and fragmented, and, as a result, scientific information often does not reach decision making places. The consultative process towards setting up IMoSEB received support in the 'Potsdam initiative - Biological Diversity 2010' from the G8+5. In addition, there is The European Platform for Biodiversity Research Strategy: Promoting Knowledge for Sustainability.

Employment

Professor Nigel Bell has been responsible for running the MSc course in Environmental Technology at Imperial College for 30 years and he can remember when the first student joined an ecological consultancy - it was in 1982. Since then, ecological and environmental consultancies have boomed. In a recent ENDS survey, the UK environmental services industry was estimated to be worth more than £25 billion in 2005 and employing 400,000 people across 17,000 companies.

Recruitment consultants and employers tend to agree that there is a shortage of qualified environmental staff across all major technical disciplines. The skills gaps that they identified were in waste management, EMS and auditing, sustainable development, and energy management. About a third of consultancies reported a gap in their staffing for the coverage of wildlife and nature conservation.

Context: The Next Generation

There is a widespread desire to find and to enthuse the next generation of naturalists, so we have gathered the evidence for all options from pre-school to lifelong learning. There is a concern that there is less contact with wildlife and the outdoors and that too much time is spent glued to TVs or computers nowadays.

A recent *BBC Wildlife* survey among 700 nine to eleven year olds in Bristol established that few could identify 10 common UK species. This is in contrast to the 2,000 young members of the Cornwall Wildlife Trust's (CWT) Fox Club, the youth branch of the CWT who were captivated by school visits and regular monthly outings reinforced by the termly newsletter *Pawprint*. The club celebrated its 25th birthday this year. The success of the club revolves around an enthusiastic team of people and keen teaching staff in the schools.

Often, at the back of someone's interest in ecology lies a person. It was someone who stimulated an interest be it on a field course, in the lab or birdwatching and so it will be important that the IEEM Skills Gap Project captures the very wide range of experiences that can provide the stimulus for a lifelong interest and work in the area.

Community and Amateur Involvement

The OPAL network is an England-wide initiative designed to inspire and support communities to explore, study and protect their local environment through engagement with some of the country's leading scientists, which has been funded by the Big Lottery to the tune of £12 million. Over the next five years sixteen OPAL partners, including the Natural History Museum, The Open University, Imperial College and nine regional universities, will run projects based on the needs and priorities of the local communities.

We urgently need to know more about the quality of our local environments and OPAL will hopefully provide the training, practical experience, tools and support needed for communities to record the plants, animals and fungi in their local environments.

The OPAL press release continues by flagging up the project as the first community-led study of the natural world around us. This is not entirely the case as there have been, and are, many similar projects already working on the ground. For example, the Manhood Wildlife and Heritage Group (in Sussex) has been going for 11 years, producing the first Parish BAP in 2001 and winning a Green Apple award for the best conservation project in the UK in November 2006. This is one of the challenges. Much work is ongoing but there is not one website where such records can be kept and an overview can be taken. Reducing duplication is one priority that was agreed at a Natural England series of workshops held on future needs in 2007. We must link up better so that all our efforts are not dissipated or repeated.

And, of course, the knowledge about Britain's plants and animals has greatly relied on the contributions made by the amateur communities based in a range of specialist societies that far exceeds that found elsewhere. In this context, the NGOs that focus on a range of habitats and species have increasingly provided an important resource.

Future Developments

The ecological sector is a very disparate one. Not only is there no clear career path or career progression, there are a large number of organisations in need of ecologists where the input of ecology is vital and fundamental to being able to address current environmental problems. Without ecology and the understanding of natural systems we cannot address the issues that face us. What we yet have to discover is what the size and nature of the various gaps are and what we will need to put in place to address them.

Correspondence: jillsutcliffe@ieem.net

IUCN World Conservation Congress

Jill Sutcliffe MIEEM
Ecological Skills Gap Project Officer, IEEM

The International Union for the Conservation of Nature has come a long way in its 60 years and the 4th Congress, held in Barcelona in October, demonstrated the huge range of projects being undertaken within the Conference themes of:

- safeguarding the diversity of life;
- healthy environments, healthy people; and
- a new climate for change.

More than 7,200 of the world's leading decision makers in sustainable development from governments, NGOs, business, the UN and academia met for 10 days to debate, share, network, learn, commit, vote and decide. The objective was to come up with ideas, actions and solutions for a diverse and sustainable world.

The Conference Centre in Barcelona is a new, purpose built facility and provides excellent audio visual facilities and a dramatic backdrop for the range of meetings taking place from small round table discussions known as Knowledge Cafés with up to 20 people participating, to an auditorium holding 3,200 delegates. There were continuous workshops lasting one and a half hours and learning opportunities of some four hours in length focusing on enabling NGOs to do an effective job. The entrance hall itself housed seven main topics providing foci points on, for example, Biodiversity and Business, Freshwater, Marine, and Red Lists together with a site devoted to Catalunya.

There were a number of elections and Ashok Khosla from India was appointed the new IUCN President.

The Exhibition area featured over 100 stands, was well organised and provided much literature to bump up the weight of the luggage on the way home. It certainly provided excellent contacts and discussion for IEEM and the British Ecological Society, who jointly shared a stand and the latter attending for the first time. Jill Sutcliffe and Nick Jackson ran the IEEM Knowledge Café on '*The Barcelona Legacy - are the skills available?*' and Andy Tasker, Jim Thompson and Linda Yost presented the workshop on professionalism in ecology and environmental management and using the EcIA Guidelines as an example. But the message for professionalism of the ecological movement is not an easy one to communicate when compared, for example, with the input from the Save the Dugong group from Japan, which was indefatigable – they ran a stand, made origami dugongs to give to those signing their petition, provided musical interludes and presented a play outside the entrance doors to highlight the dugong's plight. Concerning IEEM, President Andy Tasker felt that there was much to merit international links with similar organisations seeking to improve standards of the profession.

A number of high profile commitments were made in support of IUCN's work to include:

Innovation:

- an interactive map undertaken with Google of marine protected areas was launched; and
- of particular interest was the application of mapping for campaigns. A group in the rain forest knew that illegal logging was taking place. Google zoomed in and showed what was happening. It was clear to everyone. How's that for immediate coverage of an issue?

Financial aid:

- the MacArthur Foundation will invest $50 million in climate change mitigation and adaptation;
- the Mohammad Bin Zayed Species Conservation Fund will invest €25 million for worldwide biodiversity; and
- the Alcoa Foundation announced a $9 million five-year extension of its Sustainability Fellows Programme.

IEEM and BES at the Congress

Protection:

- Russia pledged to protect 80 million new hectares; and
- Sumatran provinces agreed to stop clearing old-growth forests.

A number of publications were published to coincide with the meeting including the 2008 *Review of the IUCN Red List of Threatened Species*, which provides an in-depth analysis of the main findings of *The 2008 Red List*. It consists of a series of chapters that will also be available as individual brochures. *Sustaining Life: How Human Health Depends on Biodiversity* edited by Eric Chivian and Aaron Bernstein provides a clear argument as to why human health relies on a healthy environment.

After a lot of hard work, talking, deciding, promoting, publishing and drinking and eating, the end of the Congress was presented jointly by a representative of the Spanish hosts and the Australian deputy director of IUCN. They flagged up the successes and achievements interspersed by three talks – the first by Professor Tim Flannery from McQuarrie University, Australia and author of *The Weather Makers: How Man is Changing the Climate and what it Means for Life on Earth*. His main point was that ecologists have failed to stress the importance of ecological measures in contributing to offsetting climate change (*i.e.* rely on mechanisms we know to work). Janine Benyus, author of *Biomimicry* stressed the importance of mimicking nature and explained that new products are emerging daily that work with rather than against nature; and the leader of Emirates Wildlife brought a message from His Highness Mohammad Bin Zayed committing €25 million to species conservation as his Highness feels that the work for species has receded recently.

A particular highlight of the closing ceremony was the appearance of the Flyways project. Flyways is a musical celebration of the great bird migrations between Africa and Eurasia. This is an international group of musicians drawn from the 22 countries over which the migrating birds fly. Flyways is a project of Music for the Earth, a non-profit organisation, in collaboration with a range of partners, including environmental organizations, ornithologists, conservationists, ethno-musicologists, and musicians.

New Fellows

Mimoza Nushi
Marketing and Public Relations Officer, IEEM

Fellows Evening

On the evening of 2 October 2008 IEEM organised the first stand alone Fellow's evening in London. IEEM president Andy Tasker introduced Lord Smith of Finsbury, newly appointed Chairman of the Environment Agency, as guest speaker.

Lord Smith spoke of the profession developing around environmental responsibility and the increasing awareness of environment concerns amongst the general public and politicians. He added that to move forward, effective partnerships to overcome the challenges we face are the only road to success.


Robin Buxton, Alan Baker and Roger Morris

After his opening remarks, Lord Smith presented Fellow certificates to the members listed below.

Professor Alan Baker FIEEM was awarded his Fellowship some time ago but has been unable to attend a presentation ceremony due to being resident in Australia where he was Professor of Botany in the University of Melbourne. He has had a career in universities and research approaching 40 years. He has taken a practical approach to increasing public awareness of environmental issues and the need for greater understanding of the demands of a modern society and the developing world. He has a particular interest in the restoration, revegetation and management of metalliferous mine sites and has specialised in phytoremediation research in which he has a worldwide reputation. His approach has been to work at the interface of research and industry and to provide research consultancy, independent specialist advice and training courses based on sound science and experimentation.

Dr Robin Buxton MBE CEnv FIEEM has served in varying capacities on IEEM Committees, TECDC, F&GP, Council and currently External Affairs. He has also been IEEM's Company Secretary. Robin has made an outstanding contribution to the development of NGOs, both locally and nationally, and has acted with exemplary skill in many advisory situations. He has worked in a variety of locations including the Tsavo National Park in Kenya, in Parma, Italy and for many years has been involved with the Northmoor Trust in Oxfordshire. He was awarded an MBE for services to nature conservation and the environment in 2006 and is a Founder member of IEEM.


Keith Kirby

Dr Keith Kirby FIEEM is a highly respected woodland specialist and currently is the Forestry and Woodland Officer for Natural England, having joined the Nature Conservancy Council in 1978. He has published extensively and held many diverse positions related to his subject area. He is much respected in forestry circles, both in the UK and internationally, for his views on woodland assessment and management for nature conservation. He also has a strong commitment to training and has provided a number of courses within the IEEM workshop programme.

Mr Roger Morris CEnv FIEEM is Senior Specialist (Ports and Estuaries) for Natural England, having joined the Nature Conservancy Council in 1988. His outstanding contribution includes safeguarding species and habitats in England, especially coastal habitats, maintaining and enhancing entomological recording and significantly contributing to improving knowledge on the ecology of Diptera and Hymenoptera. He has a successful track record of advocacy with key coastal stakeholders, particularly the ports industry.


Sally Monks and Fred Edwards

Mr Frederick Edwards LVO CEnv FIEEM was unable to attend the ceremony in London, due to illness, and has since sadly passed away. Fred was a key figure in Scottish environment circles for a number of years and has been highly influential in promoting ecology at the Board and political level. He was on the Scottish Wildlife Trust Board for six years, Friends of the Earth Scotland Board for 10 years, President of Scottish Environment LINK for three years, Fellow of Scottish Environment LINK, Board of the East Region of SEPA for six years, and the Main Board of SEPA for six years.

Glasgow Conference

Fellowship certificates were also awarded at the Glasgow Conference in November 2008. The certificates were presented to the Fellows listed below by Mr Michael Russell MSP, Scottish Environment Minister.

Mr Russell spoke about recent developments in the protection of the Scottish environment, outlining some of the challenges faced by Scottish Parliament. He drew parallels with issues faced throughout the country and outlined how the Scottish Parliament is giving a clear lead in how to overcome these issues.

Professor Roger Crofts FIEEM was awarded a CBE in 1999 for services to environmental management. He has numerous publications. He was Chief Executive of SNH for 10 years. He produced the Natural Heritage Futures Programme for Scotland, the Durban Accord and Action Plan 2003, the review of the IUCN Protected Areas Programme and World Commission on Protected Areas 1998 and has made many other national and international contributions to protected areas.

Mr Steve Pullan CEnv FIEEM has given freely of his time to IEEM activities, both on Council, and the MAC and TECDC Committees. He was the first chair of the North East Section for 6 years. He has contributed to research, the establishment of professional standards through teaching at Newcastle University and elsewhere. He contributes to the practice of ecological management and biodiversity conservation though his current work with Natural England.

Please see the citation for **Ms Jacqui Green CEnv FIEEM** in *In Practice* 58, December 2007.


Roger Crofts, Michael Russell, Una Urquhart, Charles Gimingham, Jacqui Green and Steve Pullan

Tony Bradshaw Obituary

David Parker CEnv MIEEM
IEEM President 1997-2000

Professor Anthony (Tony) Bradshaw FRS (1926-2008)

Founder Member and First IEEM President 1991-94

IEEM owes a great debt to Tony Bradshaw who was its first President and an inspirational force in the field of ecology and environmental management for over 40 years.

Tony first made his mark in the 1960s, at the University of Wales, Bangor, where he developed an international reputation in the field of ecological genetics. He worked on the evolution of metal tolerance of plants and, through this, he developed metal tolerant grasses that could be used to restore contaminated land.

This was to be the typical pattern for the rest of his career: the use of sound science to solve practical problems. He was able to see things that other people could not – he was able to simplify what he saw and provide elegant solutions to the problems he was given.

His move to Liverpool in 1968, as Professor of Botany in the University, gave Tony the opportunity to develop his ideas. His early focus was on the restoration of china clay waste in south west England, but this also extended to colliery spoil and the wastes of the post-industrial landscape in north west England. Tony chose to live in the city of Liverpool from the outset and this set off his passion for urban ecology and restoration.

Tony's inspirational force worked in several ways. At Liverpool he attracted and supervised over 60 PhD students, post-Docs, and many overseas visitors whose research and time in Liverpool led on to successful and influential careers. Many owe their current positions to Tony's early influence on their careers; the opportunities he unlocked, the supervision he gave, and the support he willingly provided.

He was an inspirational lecturer too. Tony always published his work and shared his ideas in an open way. His seminal publication, in 1980, with Mike Chadwick, *The Restoration of Land: the Ecology and Reclamation of Derelict and Degraded Land*, set out, for the first time, a manual for the restoration of despoiled land. Many other publications followed, but this book established his reputation.

He was probably the first applied ecologist to be made a Fellow of the Royal Society (FRS in 1982) and he was a President of the British Ecological Society. He also served on the Board of the Nature Conservancy Council and was always passionate about nature conservation. Tony's career was internationally recognised by the academic community through his many publications in scientific journals and elsewhere, some 250 in all. He was invited to give lectures and consulted by governments throughout the world, particularly in North America, China, India and Australia.

In the late 1970s, Tony recognised a growing demand for scientific advice on land restoration and the environmental impacts of development. In response to this, he set up one of the first commercial environmental consultancies in the UK, the Environmental Rehabilitation Unit of the University of Liverpool, becoming later the Environmental Advisory Unit, staffed by restoration specialists (many his own PhD students!). It developed into a successful business, at its peak employing almost 100 staff.


Tony Bradshaw

Tony saw, developing around him, a new profession: that is, ecologists working to apply their knowledge to solving environmental problems and providing advice to decision-makers. Responding to this, Tony was instrumental in the founding of the IEEM, in 1991, a professional body to support this fledgling profession, and became its first President from 1991-94. Tony guided the Institute through its difficult early years and watched it grow, with some little satisfaction, to the present day with over 3,500 members and serving a profession that continues to expand. He received the IEEM Medal in 2007 in recognition of his services to the profession.

Tony was fond of Liverpool and involved himself in projects that set out to improve the environment of the city and to engage its people. He had a strong sense of community and was a catalyst to many organisations on Merseyside, including the Merseyside Environmental Trust. He gave his time freely to organisations and individuals who were interested in doing positive things.

Tony was a patron to the Liverpool charity Landlife for 30 years and provided the inspiration and insight which led to its concentration on the reclamation of derelict land in the city. Close to Liverpool, in St Helens, Tony was appointed by the Countryside Commission to the Board of what was the very first Groundwork Trust, established in 1981. Groundwork is still with us, now a UK-wide organisation (and copied overseas) working on the restoration of derelict land, using the ecological approaches pioneered by Tony.

He became the first Chair of the National Wildflower Centre at Knowsley. He provided the critical momentum which made it a successful Millennium Project. He was also involved in the Eden Project in Cornwall, a Millennium Project that has used his pioneering work on the reclamation of china clay waste.

Tony formally 'retired' from the University of Liverpool in 1988 but, as we have seen, he continued to publish, lecture and inspire colleagues. He was, to the end, a man who was generous with his ideas and his time and was genuinely interested in the work of other people.

Tony was a practical man who preferred to work behind the scenes and not to cultivate a celebrity status, which seems to be the normal practice in today's times. It is important to judge Tony's contribution to what really mattered to him, that is the environmental outcomes that have resulted from his work, both directly and through all the people, policies and projects he has influenced.

He will be greatly missed, but the wider world including this Institute and its members, will continue to benefit from his life and work.

Institute News

Steve Ormerod takes over as the new President as Andy Tasker steps down

Steve Ormerod officially took over as the new President of IEEM at the AGM on 19 November 2008. Andy Tasker had completed his two year term after what everyone agreed was a very successful period. Steve paid warm tribute to Andy at both the conclusion of the AGM and in the awards ceremony later that day. Andy will be staying on Council for a further year.

Are you feeling depressed - again?

Very few members responded to this question in the last edition. Those that did, indicated an increase in winning tenders and more competitive pricing, but not really anything to set the alarm bells ringing. Is this changing? We would be interested to know.

October membership applications hit an all time high

Is it because of the depression or in spite of the depression but the October membership application figures reached an all time high of 134 including 17 applying to upgrade from Associate to Full Membership.

Membership renewals

Those members who have not already renewed will have recently received their reminder letters – do please act on this as soon as possible.

Spring Conference, 1 April 2009, Wildlife Crime, Leeds

The theme, date and location for our next one-day conference have now been agreed and will be a move out of London to Leeds. Early indications are that it will be a full day indeed if we are to cover the various aspects of this important subject.

Annual Conference, 24-26 November 2009, Protected Areas, East Anglia

If the numbers for Glasgow are repeated for our next conference, it would be as well to note this conference in the 2009 diary right now. It is some time since the overall theme of protected areas has been looked at by IEEM and we hope it will be of particular interest to those working in this field. Offers of papers are most welcome.

IEEM Logo

This is just a friendly reminder to all members that usage of the IEEM logo is strictly limited to IEEM activities only. In all cases you should contact the IEEM office to find out if you can use the logo or not. If you are currently using the IEEM logo (on your website, in your promotional material, on your reports, *etc.*) please remove this as soon as possible.

Fellows

Council at its last meeting in October 2008 approved three new Fellows bringing the total to 31. See the full report on page 40.

More applications from members to be Fellows are always welcome – the forms can now be downloaded from the member's section of the website.

Obituaries

Fred Edwards FIEEM sadly passed away shortly after having been awarded his Fellowship of IEEM. He took great pleasure in this award when it was presented to him by the Chairman of the Scottish Section, Sally Monks.

Charles Gibson CEnv MIEEM represented the ideal combination of academic ecologist and consummate professional as a consultant. He was highly respected as a strategic thinker and expert witness, whilst maintaining high regard amongst the conservation sector. He was an IEEM founder member.

2008 AGM

The AGM held in very positive mood on the first day of the Conference attracted a particularly good attendance. Alex Tait, Janet Swan and Karen Colebourn retired from Council each having completed six years of service and Mick Hall was elected for the first time. Particular thanks were paid to Alex Tait as Treasurer who was leaving the finances of the Institute in a much enhanced position.

There were various points made during the discussion at the end of the AGM and there was a short debate on the pros and cons of IEEM seeking individual chartered Status at this stage. There was a small majority in favour of the individual status but with many delegates being undecided.

Following the elections, the new Council is:

President
Steve Ormerod
Professor of Ecology at Cardiff University and Chairman of RSPB Cymru
ormerod@cf.ac.uk

Vice-President
Eirene Williams
Lecturer (Retired)
EireneNDW@aol.com

Secretary
Mike Barker
Associate, Arup
mike.barker@arup.com

Treasurer
Richard Graves
Director of Ecology, Faber Maunsell
richard.graves@fabermaunsell.com

Council Members

Colin Buttery
Director of Parks and Deputy Chief Executive, the Royal Parks Agency
cbuttery@royalparks.gsi.gov.uk

Greg Carson
Associate Ecologist, White Young Green
greg.carson@wyg.com

Mick Hall
Associate Director, Arup
mick.hall@arup.com

Richard Jefferson
Grassland Ecologist, Natural England
richard.jefferson@naturalengland.org.uk

Tom Keatley
Team Leader, Natural England
tom.keatley@defra.gsi.gov.uk

Cathy Mordaunt
Ecologist, Mountain Environment Services (Cairn Gorm Mountain)
cathy@mountainenvironmentservices.com

Mieke Muyllaert
Field Botanist/Ecologist (self employed)
mieke@eircom.net

Jenny Neff
Director and Principal Ecologist, Ecological Advisory and Consultancy Service, Ireland
info@eacs.iol.ie

Pam Nolan
National Ecology Manager, Environment Agency
pam.nolan@environment-agency.gov.uk

Paul Rooney
Senior Lecturer, Liverpool Hope University
rooneyp@hope.ac.uk

Jane Southey
Senior Ecologist, Scott Wilson Ltd
jane.southey@scottwilson.com

Andy Tasker
Director, Warwickshire Wildlife Trust
andy.tasker@wkwt.org.uk

Adrian Yallop
Environmental Consultant, Cranfield University
a.r.yallop@cranfield.ac.uk

Ireland Section News

Autumn Conference

The Annual Autumn Conference was held at the Marine Institute HQ, near Galway, on 13 October on the subject of 'Coastal and Marine Environment: Biodiversity, Management and Protection'. This was the first Irish Section conference with a marine theme and proved useful in both updating the membership on the latest findings in key areas of marine biodiversity and policy initiatives that would have a bearing on the conservation of this vital resource in the future. About 80 delegates attended from all parts of Ireland, Scotland and even from Radnorshire in Wales. Academic institutions, consulting firms, NGOs and statutory bodies were all well represented.

In his keynote address Terry McMahon of the Marine Institute told us about the Marine Strategy Framework Directive (2006/56/EC) – the marine counterpart of the Water Framework Directive – and its implications for protecting marine biodiversity within EU territorial waters. The aim of the strategy (which came into force on 15 July 2008) is to protect more effectively the marine environment across Europe. Terry told us that the aim is to achieve good environmental status of the EU's marine waters by 2021 and to protect the resource base upon which marine-related economic and social activities depend, including fisheries.

Karen Gaynor (National Parks and Wildlife Service) discussed the conservation status assessments of 16 coastal habitats and pointed out that none has yet managed to achieve 'favourable conservation status'. Steve Newton of BirdWatch Ireland then outlined current trends in coastal bird populations. While sufficient baseline data now exist for some species, the population levels have still to be established for others, such as the globally endangered Balearic and Sooty Shearwaters. He discussed the phenomenon of 'short-stopping' whereby populations of some species no longer appear to make their full historic migrations and that this might explain recent changes in the Irish wintering populations. An example is the Greenland Sanderling population, more of which now appears to winter in Ireland rather than going further south to West Africa.

Hidden deep beneath the Atlantic are cold-water coral reefs which, as Anthony Grehan (NUI Galway) explained, form part of a vulnerable marine ecosystem that is now partly protected by SAC designation. Staying with an underwater theme, Bernard Picton (National Museums of Northern Ireland) described the remarkably rich sponge communities of Rathlin Island where 134 species have now been recorded, some of them new to science. Finally, the morning session was concluded by Simon Berrow of the Irish Whale and Dolphin Group with a run down of Ireland's rich cetacean biodiversity and what further steps are required to protect it.

After lunch, five talks focused on managing and protecting coastal and marine biodiversity including: an update on progress with the Water Framework Directive in estuarine and coastal waters by Shane O'Boyle (Environmental Protection Agency); marine policy work in Northern Ireland, with a new Marine Bill now in draft form and due for implementation in 2011 (Melanie Gomes, NI Marine Task Force); the development of the *Guidelines for Ecological Impact Assessment in Britain and Ireland: Marine and Coastal* (Mick Green of Ecology Matters Ltd); and a presentation on recent Irish and EU developments in the field of Integrated Coastal Zone Management and local attitudes to ecological designations (Anne Marie O'Hagan, University College Cork). Finally, Tasman Crowe (University College Dublin) presented the results of a study on rocky shore communities which showed how molluscan assemblages could be used as an indicator of nutrient levels.

The previous evening IEEM members were treated to a fascinating talk by Dr Ken Whelan, a Marine Institute Director, entitled 'Where have all the salmon gone?' about the ambitious International €5.5 million SALSEA-Merge Programme to investigate increasing mortality of salmon at sea. Initial results suggest that changes in ocean currents and upwelling zones arising from global warming may be implicated. Afterwards, Ken - who is a keen angler - regaled us with tales of salmon fishing expeditions to remote destinations such as Mongolia where the reaction of local farmers to the use of an artificial mouse as a lure for the 20-40 lb Taimen, was one of utter bewilderment!

Irish Section AGM

The Irish Section AGM saw the departure of a number of long-standing Committee members including Richard Nairn FIEEM who helped launch the Irish Section, Sasha Bosbeer, Katherine Duff, Norma O'Hea and Pascal Sweeney. Linda Yost thanked them all for their valuable contribution to the Institute's work. Convenor Mieke Muyllaert remains with us for a further year, as does Treasurer Paul Scott. The other committee members staying on are Orla Maguire, Karl Partridge, Janet Slattery and Faith Wilson, while James McCrory has offered to help out. It was emphasised at the AGM that the Section will not survive unless new members are found for the Committee and members were urged, once again, to consider putting their names forward. We also require a student/graduate representative. Any volunteers?

Karl Partridge MIEEM
Committee Member

From left to right: Terry McMahon, Mieke Muyllaert (front), Gemma Langdon-Saunders, Jenny Neff, Linda Yost and Shane O'Boyle

North West England Section News

The North West England Section continues to thrive and has seen a very active year having organised more events for members than ever before. Thank you to everyone who offered events, and those who supported them. Examples of just some of the events are provided below:

- 'Countryside Management Conference: Future of Upland Management' organised by Liz Price and Manchester Metropolitan University
- 'Discussion of climate change adaptation of natural environment using information gained from the Cumbria High Fells Project' organised by Ian Crosher
- 'BioBank and Blooms' a joint event with Merseyside BioBank (local records centre) and Landlife, which provided an introductory workshop to the use of Recorder 6 and a talk by Grant Luscombe on Landlife's soil inversion research as a creative conservation technique. This event was a first for the Section in that it was targeted particularly at members at an early stage of their career.

In the spirit of IEEM being a practical organisation based upon sound science that promotes professional standards we held a hugely successful bat event at the Bowland Kilns. An account of this is provided below by Ellen Partington.

The Section Committee met recently and is working on the next events programme. We hope that this will include sessions on the Water Framework Directive, Coastal Managed Re-alignment and aspects of the Habitat Regulations. If you have any suggestions or offers for the new programme please contact me as soon as possible on rooneyp@hope.ac.uk. Finally, it is with a sad heart that we learned of the recent death of Professor Tony Bradshaw FIEEM. Tony was a founding force of IEEM and also a staunch supporter as we established the North West Section by both leading excursions and providing the lecture at our first AGM. He is greatly missed.

Paul Rooney CEnv MIEEM
Section Convenor

Bowland Kilns and Caves Research Project

IEEM's North West England Section and East Lancashire Bat Group hosted a simultaneous bat emergence survey of lime kilns in the Forest of Bowland AONB on 30 April 2008. The event forms part of the Bowland Kilns and Caves Research Project - a collaborative investigation into the natural history and cultural heritage of Bowland's lime kilns, caves and mines.

The project has been underway since the autumn of 2007 and is the inspiration of Dave Fisher of Earthworks Environmental Design, working with staff from Bowland Ecology Ltd and East Lancashire Bat Group. Lime kilns have been the focus of the work so far and nearly 70 kilns have been identified in the area, all of which have been visited and documented as part of the project. Much of the work has relied heavily on local knowledge, as the location of kilns are rarely indicated on modern maps.

The evening event began with a talk on the natural history and cultural heritage of lime kilns by Dave Fisher at Slaidburn Village Hall (www.slaidburnvillagehall.com). The lime kilns are one of the defining archaeological features of the Forest of Bowland and date back to the period 1750-1850 when quicklime production for agricultural use was a thriving local industry contributing significantly to the local economy. It would have been a dangerous, labour-intensive and time consuming process involving many local farming families. Limestone quarried nearby was crushed (often by hand) and layers of coal and limestone were built up in the kiln. The kiln was then kindled at the bottom, and the fire gradually spread upwards. When completely burned, the lime was cooled and raked out through the base. Kilns would typically have taken a day to load, three days to burn, two days to cool and a day to unload, so a one-week turnaround was normal.

Many of the kilns in the Forest of Bowland have been lost or are in very poor condition, but of those that have survived many are in remarkably good condition, given that they have been neglected for 150 years or more. Many have developed into a valuable wildlife resource, often fenced off from grazing stock and visitors and left completely to nature. These sites can support invertebrates, nesting birds, snails, spiders, lower plants and, as the project has discovered, roosting bats. Survey work so far has identified that Natterer's and Daubenton's bats use the kilns for roosting in the autumn and spring periods. Most commonly single bats or up to three bats, exceptionally four bats were found within the same kiln, all roosting separately. Feeding remains of brown long-eared bats have also been found in a number of the kilns.

The event was well attended, with over 20 participants from the Section. Following the introductory talks, the group was split into six survey teams, focussing on the most promising kilns. The survey provided the perfect opportunity to further investigate the use of these structures by bats. An experienced bat worker led each team and the survey used a combination of heterodyne and frequency division detectors. Key locations for detecting bat foraging activity such as the River Hodder in Slaidburn were also visited by several of the teams.

Following the survey, the groups re-assembled at Slaidburn Village Hall for feedback and refreshments. Of the six kilns surveyed, four had positive results. Of these, single Natterer's bats emerged from three of the kilns, whilst one group of surveyors observed a Natterer's and a Daubenton's bat emerging. Whilst not the most dramatic of emergence surveys, the counts provide an insight into the use of these structures by bats, and generated a number of questions to stimulate further research into the project. The surveys confirmed that the low numbers identified by visual inspection were representative of the use of the kilns, although this raises questions as to why other apparently suitable crevices within kilns are not utilised by additional individuals. It is likely that most individuals observed within the kilns are males, given that all the bats located were roosting singly. Similar results are found in old stone bridges within the district.

The event generated useful information for the research project, and provided an excellent opportunity for bat workers to share knowledge and compare notes, experiences and bat detectors!

We are extremely grateful to Dave Fisher and members of East Lancashire Bat Group, who made great contributions to the evening, both during the event and in the organisational stages.

Ellen Partington MIEEM
Bowland Ecology Ltd

South East England Section News

Inaugural Event

On Sunday, 5 October the South East England Shadow Section (SEESS) held their inaugural event at the Wildfowl and Wetland Trust (WWT) London Wetland Centre in Barnes, London. The purpose of the event was to give IEEM members and non-members a chance to get together, learn something new, and find out more about how they can get involved with IEEM in the south east and London.

The event was hosted by Richard Bullock MIEEM, Senior Biodiversity Officer at the reserve with assistance from volunteer guides Alistair Mackay and Christina Jackson. The day comprised two parts- a family friendly morning tour of the centre, followed by some more technical sessions in the afternoon. Despite some very heavy rain, we had a good turn out with about 20 attendees including IEEM members, their spouses and children and interested members of the public.

We started the day gathered in the impressive bird observatory that overlooks the largest lake at the reserve. After a brief introduction by IEEM, Richard explained the history of the site and the role of WWT in managing the site. The site had formerly been four reservoirs, but with the development of larger facilities to the south west of London in the 1980s, the reservoirs had became surplus to requirements. For a long period of time it appeared that the site would be sold to developers for housing, however in the end, the site was rented by Thames Water to WWT for a 'peppercorn rent' and turned into the wildlife haven that is found today. The reserve, complete with a stunning visitor centre and a range of accessible hides and circular paths, opened in 2000. It was designated as a Site of Special Scientific Interest (SSSI) in 2002 and has become one of the capital's environmental success stories.

Getting wet at WWT London Wetland Centre

Having become familiar with the history of the site, we set out on a guided tour before lunch. The rain meant that attendees were left bolting from one bird hide to the next, however the tour guides provided an excellent commentary both within the hides and between them.

The habitats found within the 42 hectare site include large and small areas of open water, reedbeds, ponds, grazing marsh, woodland carr and a number of wetland micro habitats. These habitats in turn support a diverse range of notable and protected flora and fauna, including; nationally important wintering populations of shoveler; significant numbers of wintering gadwall and an outstanding assemblage of regularly breeding birds associated with lowland open waters and their margins. Numbers of birds using the site, both breeding and overwintering, have been increasing year on year, and talk of London's first SPA is beginning to gather pace. The birdlife is however only part of the story, the site also supports an important invertebrate assemblage, good numbers of the four common reptile species, all UK amphibian species, bats (serotine, noctule, Daubenton's and both pipistrelle species) and water voles.

Evidence of water vole grazing amongst the reeds

After lunch, Richard led two more technical sessions. The first covered water level and quality management. It touched on issues relating to water supply, grazing and the challenges associated with climate change and loss of water through increased evaporation and evapo-transpiration. Do you let the water levels drop, or do you keep them artificially high? The jury is still out. The second session focused on invertebrates, herptiles and water voles. Richard presented the findings of several research papers conducted at the wetlands centre and discussed how the site was being managed to encourage these species and species groups. The weather dried up just in time for our final walk around the site to spot field signs of water vole, such as droppings and evidence of grazing.

A successful day concluded at 4.30 pm and attendees left satisfied and keen for more regionally focused events. A key theme of the feedback we received was that many of the attendees enjoyed being able to bring their families to an event that allowed them to network with their peers. Equally, the event gave those attendees who were not members of IEEM a positive impression of the benefits of membership.

Over the coming months SEESS is hoping to build on this success and hold more events across the region. A number of other events are already in the pipeline, but the Shadow Committee is open to ideas for the new year. Therefore, if you have ideas for an event, conference, workshop *etc.* or feel that you could host or be involved in one, please feel free to contact us (contact details at www.ieem.net/sesection.asp). We would love to hear from you.

William Miles AIEEM
URS Corporation Limited

Partnership News

European Federation of Associations of Environmental Professionals

The General Assembly of EFAEP was held in Florence from 11-12 September 2008 and attended by Mike Barker, Jim Thompson and Jason Reeves. It was hosted by the three Italian members of EFAEP who did an excellent job. It was preceded by a symposium on '*Biofuels: Threat or Opportunity?*' that attracted a wide range of interesting speakers and the presentation on Biofuels in relation to biodiversity was given by Jason Reeves, who is also the EFAEP Co-ordinator. Stavros Dimas, the European Commissioner for the Environment, sent a specially prepared message in support of the symposium and the overall work of EFAEP. As an outcome there was clear scepticism about the benefit of the current situation, but that the next generation of biofuels could offer more hope. The presentations can be viewed at www.efaep.org/documents/topic/41.

The General Assembly itself is similar to an AGM. New Byelaws were approved as well as accepting the budget outturn of last year and approving the budget for 2008. Working groups are likely to be a key focus of activities in the future and there is currently one on climate change and one on EMS.

The excellent new website was launched during the meeting. All in all EFAEP continues to grow in size and influence and has recently developed a series of useful contacts within the EU Commission.

Don't forget to sign up to the European Network for Environmental Professionals (ENEP) - as an IEEM member, there is no extra cost.

www.efaep.org / www.environmentalprofessionals.eu

Europarc Federation

The annual conference of Europarc was held at Poina Brasov in the Carpathian mountains in Romania as the current President of Europarc is Erica Stanciu who is also Romanian. IEEM had a poster and distributed a quantity of its literature. Our material seemed to attract considerable interest and in particular the workshop programme. Raising the profile of professionalism in central and eastern Europe is an important consideration but although the location was useful, it will not be straightforward. There were several references to corruption and a number of examples of conflict between economic development and protected areas conservation. One striking example is that WWF are taking the Romanian Orthodox Church to court in Romania in an attempt to put a halt to development of commercial activities near a monastery!

Europarc has been through something of an upheaval recently, but there was a clear will to see it move forward again and the meeting approved new Statutes and a new Committee. A feature of any Europarc meeting is the excursion day – the day was memorable as those on the more demanding excursions (5 boots!) made it up the mountain tracks in a supposedly brilliant scenic area through the rain, mist and finally snow – in mid September!

www.europarc.org / www.europarc-ai.org

Society for the Environment

Good news for SocEnv! SocEnv is delighted to announce that His Royal Highness The Prince of Wales has accepted an Honorary Fellowship of the Society for the Environment.

The Society recognises The Prince of Wales as an outstanding ambassador for environmental matters across the many disciplines represented by SocEnv's membership, from ecology and resource management to engineering and the built environment.

Through initiatives such as Accounting for Sustainability and The Prince's Foundation for the Built Environment and The Prince's Rainforests Project, The Prince of Wales has demonstrated a tireless commitment to issues of sustainability, and has promoted innovative, practical solutions to some of our most pressing global challenges.

The representation from IEEM continues to be Eirene Williams and Jim Thompson on the Board and Alex Tait (who is also an Honorary Fellow) on the Registration Authority. Currently, the search is on for a new Chief Executive to take SocEnv forward and an appointment is expected shortly. Despite the lack of a CEO since the start of this year, SocEnv continues to develop and recently three new Constituent bodies have been approved, bringing the total to 23.

IEEM is pleased to congratulate the following members who have acheived Chartered Environmentalist status: **Dr Penelope Angold**, **Dr Paul Clack**, **Mr Nicholas Clark**, **Mr Paul Doyle**, **Mr Jonathan Durward**, **Mr Tobias Fisher**, **Miss Hannah Graves**, **Mr Peter Jones**, **Ms Lisa Kerslake**, **Miss Veronica Lawrie**, **Mr Brian Minshull**, **Mr Graham Morgan**, **Mr Alastair Ross**, **Mr Keith Ross**, **Dr Brian Sutton**, **Miss Natalie Walker**, **Mr Andrew Whitfield**, and **Mrs Tamsin Wray-Williams**.

www.socenv.org.uk

Eurosite

IEEM recently joined Eurosite and our first encounter was the conference entitled '*Jobs for Nature*' held in Lyon. This was attended by about 150 delegates including Jim Thompson and Jill Sutcliffe from IEEM. Jim Thompson gave a presentation about being a professional in a roundtable session on 'why and how to invest in (Professional) networks'. Again there was plenty of interest in the IEEM literature. Of particular interest is the work being done by ATEN, Atelier Technique des Espaces Naturels. They have produced a jobs directory detailing the various competences required for people working in protected and related areas and this is useful in the context of the Ecological Skills Gap work within IEEM. They distinguished between formalised knowledge and practical knowledge. Formalised knowledge is the facts, techniques, methods and tools - content that is well defined and easily transmissible. Practical knowledge is that acquired though practice and is more difficult to formalise and transmit. There was also representation from Europarc and it is interesting to see the two organizations working more closely together, although their styles are rather different.

www.eurosite.org

In the Journals

Jim Thompson CEnv MIEEM and Jason Reeves AIEEM

M Wolters *et al.*

Restoration of salt-marsh vegetation in relation to site suitability, species pool and dispersal traits

Journal of Applied Ecology 2008, **45**: 904-912

Restoration of salt marshes on previously reclaimed land provides an excellent opportunity to study plant colonization and subsequent development of salt-marsh vegetation. The authors evaluated the process of salt-marsh restoration at a species- and plant-community level and investigated how the sequence of species establishment is related to site suitability, availability of the target species in the local and regional species pools and dispersal traits. It took approximately five years for species diversity in the restoration site to become similar to a local reference marsh. The annual species colonized and reached maximum abundance first. Perennial species only started to colonize or increase notably in abundance after three years of restoration. Plant composition at the highest elevation of the restoration site developed from an annual *Salicornia* community into a *Puccinellia maritima* salt marsh, which was similar to the local reference marsh. After eight years, the lower elevations were still covered by annual *Salicornia* salt marsh despite the potential for the development of a *Puccinellia* community. Salt tolerance appeared to be much more important in explaining the sequence of species establishment than the availability of the species in the local or regional species pools or dispersal traits. The prospect of salt-marsh restoration after de-embankment is good, with target species establishing spontaneously and vegetation succession taking place. Because most salt-marsh species are dispersed over short distances, it is important that a well-developed salt marsh is adjacent to the restoration site. The rate of salt-marsh development and species diversity appears to be affected mainly by surface elevation. Proper elevation in relation to tidal inundation is therefore a prerequisite for the successful restoration of salt-marsh vegetation after de-embankment.

Correspondence: h.e.wolters@rug.nl

L P Koh

Can oil palm plantations be made more hospitable for forest butterflies and birds?

Journal of Applied Ecology 2008, **45**:1002-1009

Rising global demand for palm oil is likely to exacerbate deforestation rates in oil palm-producing countries. This will lead to a net reduction in biodiversity unless measures can be taken to improve the value of oil palm plantations. The author investigated whether the biodiversity of oil palm plantations can be increased by determining how forest-dwelling butterflies and birds in plantations are affected by vegetation characteristics at the local level (*e.g.* epiphyte prevalence) and by natural forest cover at the landscape level (*e.g.* old-growth forests surrounding oil palm estates). The most important predictors of species richness across transects were percentage ground cover of weeds for butterflies; and epiphyte prevalence and presence of leguminous crops for birds. The most important predictors of species richness across estates were percentage cover of old-growth forests surrounding an estate for butterflies; and percentage cover of young secondary forests surrounding an estate for birds.

In order to maximize biodiversity in oil palm plantations, oil palm companies and local governments should preserve as much of the remaining natural forests as possible by, for example, creating forested buffer zones around oil palm estates or protecting remnant forest patches in the landscape.

Correspondence: lkoh@princetown.edu

N K Dulvy *et al.*

Climate change and deepening of the North Sea fish assemblage: a biotic indicator of warming seas

Journal of Applied Ecology 2008, **45**: 1029-1039

European shelf seas are warming faster than the adjacent land masses and faster than the global average. The authors explored the year-by-year distributional response of North Sea bottom-dwelling fishes to temperature change over the 25 years from 1980 to 2004. The centres of latitudinal and depth distributions of 28 fishes were estimated from species-abundance-location data collected on an annual fish monitoring survey. North Sea winter bottom temperature has increased by 1.6 °C over 25 years, with a 1 °C increase in 1988-1989 alone. During this period, the whole bottom-dwelling fish assemblage deepened by ~3.6 m decade^{-1}. The latitudinal response to warming was heterogeneous, and reflects (i) a northward shift in the mean latitude of abundant, widespread thermal specialists, and (ii) the southward shift of relatively small, abundant southerly species with limited occupancy and a northern range boundary in the North Sea.

The deepening of North Sea bottom-dwelling fishes in response to climate change is the marine analogue of the upward movement of terrestrial species to higher altitudes. The deepening of this fish assemblage in response to temperature could be used as a biotic indicator of the effects of climate change in the North Sea and other semi-enclosed seas.

Correspondence: nick_dulvy@sfu.ca

H Schekkerman, W Teunissen and E Oosterveld

The effect of 'mosaic management' on the demography of black-tailed godwit *Limosa limosa* on farmland

Journal of Applied Ecology 2008, **45**: 1067-1075

The largest European population of the black-tailed godwit *Limosa limosa*, in the Netherlands, has been declining for decades despite conservation measures including agri-environment schemes (AES). In a new experimental AES aiming to reverse this decline, collectives of farmers implemented mosaic management including delayed and staggered mowing of fields, refuge strips and active nest protection. The authors evaluated the effectiveness of this mosaic management by measuring godwit breeding success in six experimental sites and paired controls. Productivity was higher in mosaics than in controls due to fewer agricultural nest losses. Chick fledging success was poor in both treatments. However, chick survival increased with the availability of tall grass among sites. Available estimates of productivity in Dutch godwits suggest a strong reduction over the past 20 years and implicate chick survival as the main driver of their decline. Earlier mowing of grassland is the main causal mechanism, but changes in vegetation structure and composition, and increased predation may also have contributed.

Correspondence: h.schekkerman@nioo.knaw.nl

C Lavigne *et al.*

How do genetically modified (GM) crops contribute to background levels of GM pollen in an agricultural landscape?

Journal of Applied Ecology 2008, **45**: 1104-1113

Pollen-mediated gene flow among natural plant populations depends on a complex interaction between the spatial distribution of pollen sources and the short- and long-distance components of pollen dispersal. Despite this, spatial isolation strategies proposed in Europe to ensure the harvest purity of conventional crops are based on distance from the nearest genetically modified (GM) crop and on empirical data from two-plot experiments. The authors investigated the circumstances under which the multiplicity of pollen sources over the landscape should be considered in strategies to contain GM crops. They simulated pollen dispersal over eighty 6 × 6 km simulated landscapes differing in field characteristics and in amount of GM and conventional maize.

Distance to the closest GM crop had most impact on impurity rates in conventional fields. However, impurity rates also depended on intermediate- to long-distance dispersal from distant GM crops. Therefore, isolation distances as currently defined will probably not allow long-term coexistence of GM and conventional crops, especially as the proportion of GM crops grown increases.

Correspondence: Claire.lavigne@avignon.inra.fr

T J Webb and D Raffaelli

Conversations in conservation: revealing and dealing with language differences in environmental conflicts

Journal of Applied Ecology 2008, **45**: 1198-1204

Applied ecology aims to translate research into policy recommendations. However, conflicts frequently develop if these recommendations propose a contentious course of action. A first step towards addressing such conflicts is to attempt to understand the values underpinning stakeholder viewpoints. Using the conflict arising over proposals to cull hedgehogs *Erinaceus europaeus* on several Scottish islands, they showed how different stakeholder groups frame the problem in different ways. Stakeholder groups supporting different courses of action (culling vs. translocating hedgehogs) use different arguments, the former emphasizing conservation and biodiversity, the latter focusing on animal welfare. Texts obtained from media sources illustrate how the media can exacerbate environmental conflicts through the issues they emphasize and the vocabulary they use.

Correspondence: t.j.webb@sheffield.ac.uk

J P G Jones *et al.*

Testing the use of interviews as a tool for monitoring trends in the harvesting of wild species

Journal of Applied Ecology 2008, **45**: 1205-1212

Ecologists are increasingly using social techniques and it is vital that they are subject to rigorous testing to ensure robustness in trend detection. The authors carried out rapid assessment interviews with villagers in Madagascar about the quantity, timing and spatial patterns of crayfish *Astacoides granulimanus* and firewood collection. They compared the results with information from daily interviews with the same informants. The study suggests that interviews can be used to monitor changes in harvesting patterns by resource users, but whether the power is adequate will depend on the needs of the study. To maximize the power of interviews, informants should be interviewed independently and the same informants interviewed in subsequent years.

Correspondence: julia.jones@bangor.ac.uk

S Carpenter *et al.*

An assessment of *Culicoides* surveillance techniques in northern Europe: have we underestimated a potential bluetongue virus vector?

Journal of Applied Ecology 2008, **45**: 1237-1245

Bluetongue virus (BTV), a pathogen of ruminants transmitted by *Culicoides* midges, has emerged dramatically across Europe since 1998. Surveillance of *Culicoides* is currently carried out in every European country affected by BTV, most commonly using standardized light-suction traps that sample the population of adult *Culicoides* present. But it is not clear whether these trap catches accurately reflect the biting population of *Culicoides*. The authors carried out 192 drop-trap catches at dusk on Poll Dorset sheep, drawing comparisons with surveillance samples taken using standard trapping protocol at the same site and allowing for identification to species level. Light-trapping surveillance was found to substantially underestimate the numbers of *Culicoides chiopterus* present on sheep. This finding is extremely significant given that, due to the low numbers of this species caught at light traps across northern Europe, *C. chiopterus* had not been seriously considered as a potential vector of BTV. Models constructed of successful blood feeding predict that while biting rates on sheep are significantly reduced under conditions adverse to midge flight, low levels of biting can also occur under sub-optimal meteorological conditions.

Considering the huge economic and animal welfare impact of BTV incursions, it is vital that alternative/additional methods of surveillance are explored.

Correspondence: simon.carpenter@bbsrc.ac.uk

K C Fagan *et al.*

Do restored calcareous grasslands on former arable fields resemble ancient targets? The effect of time, methods and environment on outcomes

Journal of Applied Ecology 2008, **45**: 1293-1303

A great deal of money is being invested in calcareous grassland restoration on arable land within agri-environment schemes in the European Union. There is little evidence that the target ecosystem can be obtained from the restoration techniques and management practices currently used. The authors evaluated these techniques using a multi-site approach in order to improve the success of future restoration efforts. They compared 40 restoration sites with 40 paired reference sites with the following questions: (i) Are plant communities of restoration sites becoming more like those of mature calcareous grassland? (ii) How long does the restoration process take? (iii) Are there any environmental filters that hinder the process? (iv) Is there a difference in plant attributes between restored and ancient grassland communities, and between restored communities of different ages? They found that there was little overlap between restored and ancient grassland communities even after 60 years. Successful restoration of calcareous grasslands is achievable but the process is slow. Different plant attributes were present at different frequencies in restored and reference sites, and the frequency of some attributes became more like those of reference sites with increasing age of restored site (*e.g.* perenniality and ruderality). Seeding restoration sites with a low diversity mix appeared detrimental to restoration. Sites that regenerated naturally moved towards the target over time, although success was affected by proximity to ancient grassland vegetation. High soil phosphorus concentration was detrimental to restoration.

Correspondence: katecf@hotmail.com

H Van Calster *et al.*

Unexpectedly high 20th century floristic losses in a rural landscape in northern France

Journal of Ecology 2008, **96**: 927-936

Resurveys of regional floras allow assessment of long-term floristic change and to pinpoint driving forces behind these changes. Causes of floristic decline derived from such resurveys depend on the considered landscape, but are often associated with human activities especially in urbanized areas. Much could be learned from comparisons of contrasting landscapes. Vascular plant abundance categories from a detailed, late 19th century flora were matched with distribution data from a late 20th century plant database in a rural area (Thiérache; 1,673 km^2) in northern France. Floristic change was characterized both in absolute numbers of extinct and extant species and by a measure for relative change in range size. Knowledge of land use changes and ecological correlates of floristic change permitted the causes for species change to be inferred and to identify which traits are associated with species vulnerability. Extinction rates were compared with similar studies from contrasting landscapes, taking into account the negative relationship between standardized extinction rates and log-transformed size of the study area. Of the 959 species from the historical list, 186 (19.4%) may be considered regionally extinct. Most extinct species were already rare historically. Differences among habitats indicated strong declines for aquatic species and arable weeds and least change for forest species. Percentage species loss per year in Thiérache equalled 0.22, which was higher than two other similar sized predominantly rural landscapes. Across the main habitat groups, relative species decline was always associated with relatively higher stress tolerance and lower competitiveness and biased towards therophytes. The main causes of species decline were management intensification, eutrophication, secondary succession in semi-natural open habitats and land use change.

Correspondence: hvancalster@gmail.com

K Taylor and S R J Woodell

Biological Flora of the British Isles: *Primula elatior* (L.) Hill

Journal of Ecology 2008, **96**: 1098-1116

Primula elatior, the oxlip, is the subject of this Biological Flora which corresponds to the usual format of distribution, habitat, communities, responses to biotic factors, responses to environment, structure and physiology, phenology, floral and seed characters, herbivores and disease, history, and conservation. *Primula elatior* is a native perennial herb, within a compact area in the British Isles, in ancient woods and copses on the chalky boulder clay in East Anglia, where it is abundant locally although scarce nationally. British material is ssp. *elatior*, which extends across much of Europe, becoming rarer towards the south. *Primula elatior* is a shade tolerant species, but only flowers in profusion in the increased light levels following tree felling in traditionally coppiced woods. In the British Isles it is found where soils are seasonally waterlogged and ill-aerated, and is very tolerant of the toxic levels of ferrous iron which accumulate in the surface horizons in the spring months. It has a poorly developed drought tolerance. Within its restricted distribution area *P. elatior* replaces *P. vulgaris* completely. At the margins of their distributions the two species occur together in a number of woodland sites and can give rise to hybrid swarms. Changes in climate, woodland management practices and intensities of deer grazing, especially by fallow deer, are likely to have a major effect on populations of *P. elatior*. Since the species colonizes new or secondary woodlands very slowly, management should focus on the conservation of ancient semi-natural woodlands.

Correspondence: ktaylor@ceh.ac.uk

M Huck *et al.*

Low genetic variability, female-biased dispersal and high movement rates in an urban population of Eurasian badgers *Meles meles*

Journal of Animal Ecology 2008, **77**: 905-915

Urban and rural populations of animals can differ in their behaviour, both in order to meet their ecological requirements and due to the constraints imposed by different environments. The authors used hair samples to estimate the population size of badgers *Meles meles* in Brighton and calculated population-specific parameters of genetic variability and sex-specific rates of outbreeding and dispersal. Population density was high due to a high density of social groups rather than large numbers of individuals per group. The allelic richness of the population was low compared with other British populations but was still outbred. Although members of both sexes visited other groups, there was a trend for more females to make intergroup movements. The results reveal that urban badgers can achieve high densities and suggest that while some population parameters are similar between urban and rural populations, the frequency of intergroup movements is higher among urban badgers. In a wider context, these results demonstrate the ability of non-invasive genetic sampling to provide information about the population density, social structure and behaviour of urban wildlife.

Correspondence: maren_huck@hotmail.com

S C Votier *et al.*

Recruitment and survival of immature seabirds in relation to oil spills and climate variability

Journal of Animal Ecology 2008, **77**: 974-983

In long-lived animals with delayed maturity, the non-breeding component of the population may play an important role in buffering the effects of stochastic mortality. Populations of colonial seabirds often consist of more than 50% non-breeders, yet because they spend much of their early life at sea, we understand little about their impact on the demographic process. Using multistate capture- mark-recapture techniques, the authors analysed a long-term data set of individually identifiable common guillemots, *Uria aalge* Pont., to assess factors influencing their immature survival and two-stage recruitment process. Analysis of the distribution of ringed individuals during the non-breeding season, separated by age classes, revealed that all age classes were potentially at risk from four major oil spills. However, the youngest age class (0-3 years) were far more widely spread than birds 4-6 years old, which were more widely spread than birds aged 6 and over. Therefore the chance of encountering an oil spill was age-dependent. In years following four oil spills, juvenile recruitment was almost double the value in non-oil-spill years. Recent work from Skomer Island showed a doubling of adult mortality associated with major oil spills, which probably reduced competition at the breeding colony, allowing increased immature recruitment to compensate for these losses.

Correspondence: stephen.votier@plymouth.ac.uk

C Rutz

The establishment of an urban bird population

Journal of Animal Ecology 2008, **77**: 1008-1019

Using data from a 60-year study period, this paper provides a detailed description of how the northern goshawk *Accipiter gentilis* L. (generally considered a shy forest species) colonized the city of Hamburg. The spatio-temporal analysis of 2,556 goshawk chance observations (extracted from a total data set of 1,174,493 bird observations; 1946-2003) showed that they regularly visited the city centre decades before the first successful breeding attempts were recorded. Many observations were made in parts of the city where territories were established in later years, demonstrating that these early visitors had encountered, but not used, potential nest sites. Pioneer settlement coincided with: (i) an increase in

hunting pressure on goshawks in nearby rural areas; (ii) an increase in avian prey abundance in the city; and (iii) a succession of severe winters in the Greater Hamburg area. There was no evidence to suggest that the early stages of the invasion were due to: (i) decreasing food availability in rural areas; (ii) major habitat changes in the city; or (iii) rural intraguild dynamics forcing hawks into urban refugia. While breeding numbers of a potential rural source population were at a long-term low when the city was colonized, prior to first settlement there was a sharp increase of goshawk chance observations in the city and its rural periphery. The urban population expanded rapidly, and pair numbers began to stabilize after about 10 years. Ringing data (219 ringed nestlings from 70 urban broods; 1996-2000) demonstrated that most urban recruits had fledged in the city, but also confirmed considerable gene flow between urban and rural habitats.

Correspondence: Christian.Rutz@zoo.ox.ac.uk

R J Mitchell, R J Rose and S C F Palmer

Restoration of *Calluna vulgaris* on grass-dominated moorlands: The importance of disturbance, grazing and seeding

Biological Conservation 2008, **141**: 2100-2111

Degradation has occurred throughout the range of *Calluna vulgaris*-dominated heaths and moorlands with *Calluna* typically being replaced by grass species. Ceasing grazing is often impractical and rarely results in the recovery of *Calluna* abundance when it is initially present at low cover. Therefore, restoration methods need to be developed, which are practical at a large-scale, in remote areas and create suitable conditions for *Calluna* germination and establishment, whilst still allowing grazing. The authors established a replicated field experiment on *Nardus stricta* and *Molinia caerulea*-dominated moorlands to test the efficacy of different grazing regimes and intervention techniques aimed at establishing *Calluna*. Disturbance (rotavation and trampling) to create bare ground increased *Calluna* establishment. On the *Nardus* site, *Calluna* establishment was equally successful on rotavated and trampled plots, but rotavation was more successful on the *Molinia* site. Seeding with *Calluna* increased *Calluna* establishment irrespective of whether a seed-bank was present. At the *Nardus* site, cattle grazing led to *Calluna* establishment and growth similar to that of ungrazed plots and was more successful than a mixed grazing regime or a sheep only regime. The creation of small patches of bare ground, seed addition and low intensity grazing enabled the rapid establishment of *Calluna* on grass-dominated moorlands; such techniques may also be applicable in other habitats where restoration requires the addition of a single/few species and minimal intervention.

Correspondence: r.mitchell@abdn.ac.uk

J Bright *et al.*

Map of bird sensitivities to wind farms in Scotland: A tool to aid planning and conservation

Biological Conservation 2008, **141**: 2342-2356

Government targets for renewable energy have led to a huge increase in wind farm proposals and due to Scotland's high wind resource it has more proposed wind farms than any other UK country. However, Scotland's upland habitats support many birds of conservation concern, leading to potential conflict with wind farms. To help reduce this conflict, a map of bird sensitivities has been created to guide the location of onshore wind farms in Scotland, based on distributions of 16 bird species of conservation priority and statutory Special Protection Areas. The likely sensitivity of each species to wind farms was based on foraging ranges, collision risk and sensitivity to disturbance. The individual species maps were used to create a composite map for all species. The map indicates greater bird sensitivity in northwest Scotland, particularly the Highlands, Western and Northern Isles. The overlap of the mapped species with proposed and existing wind farm developments was assessed and species for which cumulative effects of multiple wind farms are of particular concern identified. Within a Scottish context, bean goose, red kite and hen harrier showed the greatest overlap.

Correspondence: Jenny.Bright@rspb.org.uk

L P Koh and J Ghazoul

Biofuels, biodiversity, and people: Understanding the conflicts and finding opportunities

Biological Conservation 2008, **141**: 2450-2460

Biofuels are viewed by many policy makers as a key to reducing reliance on foreign oil, lowering carbon emissions and meeting rural development goals. However, political and public support for biofuels has recently been undermined due to environmental and food security concerns, and by reports questioning biofuel carbon emission savings. The authors discuss the potential of biofuels as a renewable energy source, the environmental and societal costs of biofuel use, and highlight on-going developments in selection and production technologies. They highlight net positive carbon emissions, threats to forests and biodiversity, food price increases, and competition for water resources as the key negative impacts of biofuel use. The authors also show that some of the environmental and societal costs may be ameliorated or reversed with the development and use of next generation biofuel feedstocks and production technologies. The authors conclude that certain types of biofuels do represent potential sources of alternative energy, but their use needs to be considered with a comprehensive assessment of their environmental impacts. Together with increased energy conservation, efficiencies and technologies, biofuels should be included in a diverse portfolio of renewable energy sources to reduce our dependence on the planet's finite supply of fossil fuels and to insure a sustainable future.

Correspondence: lian.koh@env.ethz.ch

S Bertolino *et al.*

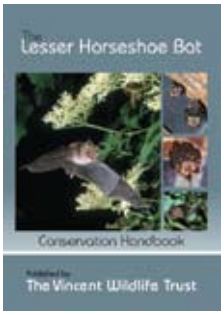
Predicting the spread of the American grey squirrel (*Sciurus carolinensis*) in Europe: A call for a co-ordinated European approach

Biological Conservation 2008, **141**: 2564-2575

The introduced American eastern grey squirrel *Sciurus carolinensis* is causing a dramatic decline of the native European red squirrel *Sciurus vulgaris* in Europe. The authors used population dynamics models to illustrate the potential expansion of the grey squirrel from Italy into neighbouring countries. Simulations started with the known grey squirrel distributions in 1996 and modelled the spread for the next 100 years in two different scenarios: 'best case' and 'worst case'. In the best case scenario, it will take 30–40 years for grey squirrels to start invading the Alps and about 70–75 years to cross into France. The first populations in Switzerland are predicted in 2051–2066. In the worst case scenario, the spread will be significantly faster: the species is predicted to reach France in 2026–2031 and Switzerland in 2031–2041. Removing two of the three populations of grey squirrel will likely postpone the invasion of Switzerland but not of France. Large areas of Europe contain potentially good habitat for grey squirrels, and expansion from Italy to France, Switzerland and most of Eurasia is simply a matter of time. This will represent a serious risk for the conservation of the native red squirrel and will have implications for forest management. There is not a European policy towards introduced species and there is therefore a need for a co-ordinated European approach to the management of the grey squirrel and other introduced species.

Correspondence: sandro.bertolino@unito.it

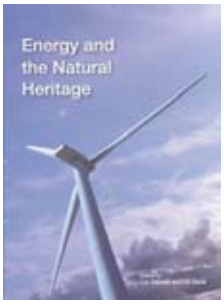
Recent Publications



The Lesser Horseshoe Bat Conservation Handbook

Author: H Schofield (Vincent Wildlife Trust)
ISBN: 9780946081523
Available from: vwt@vwt.org.uk or 01531 636441
Price: £19.95

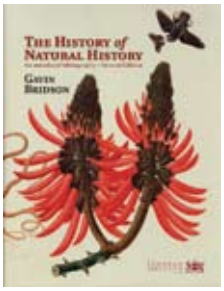
The Vincent Wildlife Trust hopes that this handbook will set a standard for the conservation of the lesser horseshoe bat in Europe. The new handbook has been written as a practical and easy-to-use reference for environmental consultants, conservation bodies, local authorities and conservationists. It provides advice on improving roost buildings as well as information on how to improve commuting and foraging habitats in the surrounding area. The first section of the handbook deals with the theory of roosting ecology and activity patterns, while the second section provides a practical guide to surveying and enhancing roosts with plenty of examples and case studies.



Energy and the Natural Heritage

Editors: C A Galbraith and J M Baxter
ISBN: 9780114973414
Available from: www.tsoshop.co.uk
Price: £25.00

This new Scottish Natural Heritage publication contains the information from their 2004 conference of the same name and looks closely at the impacts that energy use and generation have on wildlife and landscapes. The publication covers a wide range of subjects including: transports increasing emissions, nuclear energy, renewable technologies, carbon sequestration, and the effects of wind farms. It is aimed at those involved in energy planning, the energy industry, scientists, academics and environmentalists and is a useful source of information.



The History of Natural History

Author: G Bridson
ISBN: 9780950620787
Available from: www.linnean.org
Price: £65.00

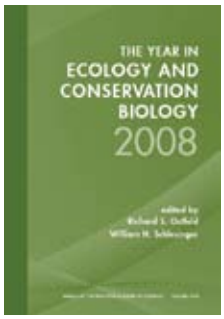
This is an revision of the 1994 first edition and has been substantially updated with over 5,300 additional references. It provides a comprehensive catalogue of over 1,100 pages of source information including collected biographies of naturalists and natural history artists; important library resources and catalogues; core bibliographies for the history of natural history, exploration, voyages and travel; resources for the history of botany and zoology; and references for natural history illustrations, cabinets and museums. Sadly, Gavin Bridson passed away in early 2008 and was not able to see his new edition published.

Green City Guidelines

Author: Natura Environmental Consultants Ireland
ISBN: 9781905254330
Available from: info@natura.ie

These guidelines are designed to provide practical guidance for planners and developers on how to integrate biodiversity into new housing developments, specifically medium to high-density housing in urban areas. As our awareness develops of how our activities effect the natural environment, we must rethink how our basic requirements of sanitation, transport and housing are provided. As a result, best practice measures are constantly evolving to better facilitate the incorporation of biodiversity into development. The *Green City Guidelines* was one of three finalists in IEEM's Best Practice Awards in 2007.

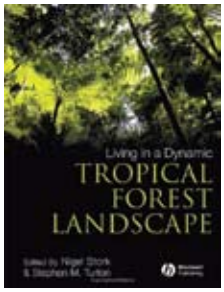
The Year in Ecology and Conservation Biology 2008



Editors: R S Ostfeld and W H Schlesinger
ISBN: 9781573317252
Available from: www.nyas.org
Price: £70.00

This is the inaugural volume of a new annual review of ecology and conservation biology covering in-depth scholarly reviews of the most timely and important topics and issues affecting these fields. This first volume includes 12 reviews covering, for example, bioclimatic models and invasive species, ecosystem services and birds, infectious disease in cervids, biodiversity conservation in tropical agroecosystems, birds and wind-power generators, ice dynamics and polar marine ecosystems, and ocean acidification and marine ecosystems. An important collection of review articles on the science and development of ecology and conservation biology.

Living in a Dynamic Tropical Forest Landscape



Editors: N Stork and S Turton
ISBN: 9781405156431
Available from: www.blackwell.co.uk
Price: £45.00

This interdisciplinary text provides a holistic view of the tropical forest environment, including the social and economic dimensions. It is a collection of current knowledge of the so–called 'wet tropics' of northeast Australia. These forested landscapes are significant both nationally and internationally. Like many tropical forests, sustainable management has been hindered by a lack of baseline information and applied research. This publication explores progress in areas including conservation genetics, vegetation modeling, agroforestry and revegetation techniques, biodiversity assessment and modeling, impacts of climate change, and the integration of science in natural resource management.

News in Brief

Farmland bird numbers at lowest level on record

A recent survey by Defra shows that the number of breeding pairs of farmland birds has more than halved since the 1960s. Popular farmland birds like turtle dove, grey partridge and linnet have declined to their lowest level on record, with some species becoming extinct in regions of the UK. There is particular concern because the latest fall follows an earlier halt in the long-term decline for a few years from 1999-2005, and about the cause of the decline as European farming subsidies are supposed to pay farmers to introduce wildlife-friendly practices. Experts also warned that the latest figures for 2005-07 do not take account of a forecast drop in populations this year because of the abolition of payments for 'set aside'. The 2007 Wild Bird Populations report shows seabird numbers also fell slightly, but total wild bird populations, which also include woodland and water and wetland species, were stable.

Economic growth from Scottish forests

Plans to use Scotland's forests to fuel economic growth and increase renewable energy capacity have been unveiled by Environment Minister Mike Russell. A consultation paper, *Climate Change and the National Forest Estate*, wants communities, landowners and the forestry sector to unlock the potential of woodlands. Scotland's forests, worth about £850m, could potentially make a vital contribution towards a greener and wealthier Scotland. The consultation paper will be open until 27 January 2009.

New question marks over eco-towns

UK ministers have acknowledged that nearly all the locations earmarked for new eco-towns have question marks about them. Of the 12 sites identified as having development potential, only one, Rackheath near Norwich, is currently regarded as generally suitable. The site in Weston Otmoor, Oxfordshire, is the most unlikely to proceed. The government intends to build up to ten eco-towns in England, which it says will be subject to the 'toughest ever green standards'. The current shortlist includes 12 sites and the final shortlist is expected in the New Year, although the government says they will still have to go through the normal planning process.

Army creates new homes for bats

Soldiers' homes on Salisbury Plain and in Aldershot are being fitted with bat bricks as part of an £8bn Ministry of Defence rebuilding programme. Project Allenby/Connaught began in 2006 with the aim of renovating Victorian and Edwardian buildings and bringing them up to modern standards. Some of the barracks are home to populations of bats and more than 2,500 special bat bricks, which have been designed to mimic the bats natural habitat of cracks and crevasses, are being installed as part of the 35-year rebuilding scheme.

Frog, snail and moth protected

A moth threatened by rising sea levels, a rare frog and an aquatic snail have all been granted legal protection. The Fisher's estuarine moth, which only eats the Hog's Fennel plant is found only on the coasts of north-east Essex and north Kent, is one of the most threatened species in the UK. The lesser whirlpool ram's-horn snail, which is rarely more than 5 mm across, is restricted to a few locations in Norfolk, Suffolk and Sussex. It is threatened by land drainage and inappropriate land management. The pool frog is now found at only one site in Norfolk. It is hoped that with the new legal protection it will be possible to reintroduce it to ponds in other parts of East Anglia. The three species will be protected from being killed, taken, injured, disturbed, owned or sold, or having their resting or breeding places destroyed. The new protection for the three species, under the Habitats Regulations, came into force on 1 October 2008.

Growth in green roofs

At the recent World Green Roof Congress in London it was revealed that in 2004 there were 76,682 m^2 of green roofs in the capital, with a further 16,000m^2 planned, and that between 2005 and 2008 over 163,234 m^2 have been installed and that there is over 324,443 m^2 planned. It is likely that green roofs will become an important part of how London adapts to climate change.

Trump golf resort approved in Scotland

Donald Trump's controversial plans for a £1 billion golf resort in Aberdeenshire have won approval from the Scottish Government. The American billionaire has been fighting opposition by environmentalists to his plans to build what he claims will be the finest course in the world, complete with a five-star hotel, exclusive chalets, a golf academy, 950 timeshare flats, and a 'Trump Boulevard'. Part of the development will encroach on protected sand dunes near Balmedie, north of Aberdeen, and the RSPB and the Scottish Wildlife Trust were among those who opposed the project, which was rejected by a local council committee last November. The decision to reject the application was viewed by business leaders as a lost opportunity for huge investment in the area, and a public inquiry was launched in June after the plans were called in by the Scottish Government. The First Minister, Alex Salmond, who is also the local MSP for Gordon, where the resort will be built, has said that the economic and social benefits for the north-east of Scotland substantially outweigh any environmental impact. Trump still faces obstacles to making the project a reality, including raising the capital for the project and the owner of a farm in the middle of the site has insisted he will never sell his land to Trump.

Project shows young people taking the lead

An environmental conservation programme in England is showing how volunteering can encourage excluded young people to take a positive and leading role in society. The *My Space? Our Space!* programme, set up by BTCV, has seen excluded teenagers and young Asylum Seekers revitalising woodlands, growing plants to brighten communities and combining mountain biking with conservation work.

Soil research needed

A new report from the Royal Agricultural Society of England, *The Current State of Soil and Water Management in England*, warns that deteriorating soil quality could render some parts of the country unfit for productive farming. Eastern England, with its intensive cropping for fruit and vegetables, is highlighted as a likely candidate. The team of leading soil scientists who wrote the report is calling for more government-backed research on food production and less on environmental protection.

Gardeners warned not to buy alien pond plant

Water primrose, *Ludwigia*, is out of control in rivers and canals in France, and Belgium and the Netherlands are also spending hundreds of thousands of pounds battling the alien invader, originally from South America. At least six sites of infestation have been identified in southern England and Wales, including at the Wildfowl and Wetland Trust's centre in London, according to the Environment Agency. Now the government is considering banning its sale. Environmentalists now hope that

Defra will agree an amendment to the Wildlife and Countryside Act under which water primrose cannot be introduced to the wild without a licence.

Project to map wildlife of Britain

An £11 million project to create the most accurate map of Britain's wildlife has been launched at the Natural History Museum in London. The scheme, run by Imperial College, aims to persuade people to track their local wildlife. Five national surveys investigating soil, air, biodiversity, water and climate are scheduled to take place between now and 2012. The public is being urged to take part by tracking animals and plants they see and logging them online at www.opalexplorenature.org.

Hundreds oppose wind farm plans

Hundreds of people have complained about plans to build a wind farm on the edge of the Yorkshire Dales. Energiekontor UK Ltd wants to put five 328 ft (100 m) turbines at Brightenber Hill near Gargrave, Skipton. A 250-strong group of residents have formed Friends of Craven Landscape and are campaigning against the plans. Craven Council has received 600 letters of objection and a 600-signature petition, but its planning committee has been asked to approve the plans.

Protect Planet Ocean launched

Protect Planet Ocean is an unprecidented global collaboration between some of the leading names in ocean conservation. They have come together to develop a new website as a way of bringing the best information on Marine Protected Areas to a global audience. They hope to develop the website to best serve the global community, both specialists and those with a more general interest in our oceans and seas. More information at www.protectplanetocean.org.

Licensing under the Marine Bill

Defra has announced the launch of a new booklet on marine licensing. The booklet, *Managing our marine resources – licensing under the Marine Bill*, explains the changes they are proposing to make to the marine licensing and enforcement systems through the Marine Bill and how these will work in practice. These changes will: provide a clear proportionate regulatory system to protect the marine environment and allow low risk activities to take place where appropriate; streamline the decision-making process, allowing more strategic and sustainable choices to be made about what we want in our seas; and enable a more flexible and proportionate approach to be taken when dealing with licensing offences. An electronic (pdf) version of the booklet is attached with this email and will be available on the Defra website - www.defra.gov.uk/marine/index.htm.

Marine Impact Assessments

The Joint Nature Conservation Committee (JNCC) has published the first impact assessments (IAs) for seven marine Natura 2000 sites in the UK. Natura 2000 sites are those designated as Special Protection Areas (SPAs) or Special Areas of Conservation (SACs) under the European Wild Birds or Habitats Directives respectively. The IAs are available here: www.jncc.gov.uk/marineconsult.

Sea eagles in England

Conservationists are planning to bring the sea eagle, the UK's largest bird of prey, back to the skies of England. The bird could be reintroduced into Norfolk next summer if the scheme, by Natural England, the RSPB and Anglian Water, gets the go-ahead. It was driven out of England more than 200 years ago and had disappeared from the UK by 1918. The plans come after the sea eagle was brought back to west Scotland in a project that began in 1975. There are now more than 40 breeding pairs in west Scotland, with 34 chicks produced last year, and another scheme has begun in east Scotland. Norfolk has been assessed as the best place in England for releasing sea eagles, because it contains large areas of wetland habitat. The reintroduction of the birds in Scotland has produced problems, including poisoning incidents and claims that the birds have been taking lambs. Natural England and the RSPB are now keen to consult local people and landowners before deciding whether to attempt to reintroduce them elsewhere.

LIFE and Europe's Forests

A new legislative package is currently being introduced by the EU, which includes a Communication on deforestation and a proposal for placing timber and timber products on the market, which aims to strengthen Member States' powers regarding self regulation of sustainable timber products. This latter proposal will oblige timber traders to identify the source of their products and provide assurances that it has been harvested according to the relevant laws of that country. It also includes a new Global Forest Carbon mechanism, funded partly from auctioning of EU ETS allowances. This new Communication was one of the many topics of debate at European Forest Week, which took place in October 2008.

Environmental progress hindered by lack of qualified employees

A new report commissioned by UNEP, *Green Jobs: Towards Decent Work in a Sustainable, Low-Carbon World*, reveals that climate change adaptation strategies, including pollution control and the shift from fossil fuels to renewables, will result in the creation of a high number of 'green' jobs. It predicts that adaptation to climate change and emissions reduction schemes are creating new employment opportunities across the globe. One aspect of the report highlights the need for new training schemes to meet the growing needs of green industries. The annual global market for environmental products and services is projected to reach US$2,740 billion by 2020, leading to a rapid growth in 'green' job opportunities globally. However, as the growth in green industries accelerates, 'skills gaps' have been identified. Germany's renewables industry is suffering from a shortage of qualified employees, especially those needed in highly skilled positions. The Confederation of British Industry has expressed concern that green sectors are struggling to find technical specialists, designers, engineers and electricians. Meanwhile, the US National Renewable Energy Laboratory has identified the shortage of skills and training as a leading barrier to renewable energy and energy-efficiency growth.

Scientists discover Patagonian diesel that grows on trees

A tree fungus could provide green fuel that can be pumped directly into vehicle tanks. The organism, found in the Patagonian rainforest, naturally produces a mixture of chemicals that is remarkably similar to diesel. The fungus *Gliocladium roseum* was discovered growing inside the ulmo tree *Eucryphia cordifolia* in northern Patagonia. It produces a range of hydrocarbon molecules that are virtually identical to the fuel-grade compounds in existing fossil fuels.

500 places to see before they disappear

The first guidebook of 'last chance saloon' holidays has been published for travellers who want to visit the most endangered tourist destinations across the world. Frommer's *500 Places To See Before They Disappear* provides a list of sites where it is still possible to see rare and vulnerable animal species, special landscapes and unique cultural sights in their unspoilt glory. Destinations include the Everglades, the Dead Sea, the Falkland Islands, the Nazca lines in Peru, New York's Little Italy, Battersea power station, the Holderness coast in East Yorkshire, and St Mary's Parish Church in Stow-in-Lindsey in Lincolnshire.

Tauro-Scatology and Reverse Logistics

This edition of *In Practice* sees Basil O'Saurus, our resident Professor of Tauro-Scatology, telling us about another new initiative that should interest IEEM members. What is it this time, Prof?

I was heading up the M11 a few months ago, en route to Stansted Airport in yet another attempt to export tauro-scatology to the world, when I saw a lorry with 'Reverse Logistics' written on its side and this gave me a great idea for a new consultancy.

Another money-making wheeze?

I prefer to say that it is another service for the hard-pressed environmental professional.

I had no idea what 'Reverse Logistics' was when I saw this lorry, but I knew what 'logistics' is – it is the art of getting all the people and equipment to the place where they and it are needed, in order to do a particular job. When I got home, I Googled 'Reverse Logistics' and came up with a very dull explanation, so I decided to invent my own concept. If 'logistics' is getting the people and equipment to the right place to do a job, then 'inverse logistics' ought to be landing the job or contract that will justify buying the kit you've always had your eye on, or taking you to places you've always wanted to see.

Give us an example.

Plenty of good ones. Show me the self-employed environmental consultant who doesn't have a top-of-the-range waterproof that just happens to be very useful for weekends walking or climbing in the Lake District or Scotland. I'll bet you that they put the receipt through the books as a legitimate business expense.

Next, suppose you've got your eye on a flashy camera phone but can't really afford it. How about using a plant survey as an excuse so that you can snap an image of any rare plant and send it to an expert for instant verification? Just make sure that the camera has a 'macro' facility. Your boss can't fail to be impressed by your dedication. That's two examples of 'inverse logistics' already.

Not bad. That should work so long as you don't fill the 'phone's memory up with holiday snaps or embarrassing shots of the boss at the staff Christmas party. Any more?

Ever fancied driving a quad bike? Get a contract that involves surveying remote upland areas. A quad bike is so much more environmentally-friendly than a four-wheel drive vehicle and so much quicker than walking. Save time and money. Who can refuse you? On the same theme – and this next example is absolutely true by the way – at least two of our regulatory bodies have bought hovercraft in order to survey soft intertidal sediments. Boy's toys or what?

While we're on the subject of gadgets, don't forget that an MP3 player can double as an external hard drive for your laptop. You should get your entire hard disk on one, and still have space for your music. And, let me add, some soothing Bach is the ideal way to filter out disturbing background noise when trying to work on a train, so you'll actually be more productive if your boss buys you an MP3 player than if he doesn't.

I can hear groans of despair from boardrooms up and down the country...

...and I haven't even got to the really good ones yet. Let's apply inverse logistics theory to professional development. We've all got to do it, so why not make the most of the opportunity. Ever done an aquatic macrophyte survey? So you'll know how difficult the Charophytes can be. What you need is some unstructured professional development looking at some almost pristine water bodies stuffed with Charophytes, rare sedges and goodness knows what else. How about Loch Kinnabus or Loch Lossit? Both of which just happen to be on Islay. So, you can do the distillery tour you've always dreamed about and put the travel and subsistence through the books.

You should, of course, be aware that this approach has some pitfalls. The IEEM discourages lone working in remote places, especially when mobile reception is unpredictable. There is, I'm afraid, only one solution.

What's that?

Take a friend. And put their travel and subsistence through the books as well.

Brilliant. You know, our fellow IEEM members really ought to be told about this. It will put a smile on their faces in these recession-hit times. Why not come along to the next IEEM conference?

I did wonder about coming along to the meeting in Glasgow in November to put forward my theory but...

But what?

I decided to invest my professional development budget on a different conference. I audited my current range of skills and identified areas where I thought I ought to enhance my competence. Then I looked around for conferences and workshops that fulfilled these needs. Curiously enough, the IEEM meeting on mitigation didn't fit this need. But, fortunately, I found one in Croatia in September which did. And blew my professional development budget on that instead.

The fact that the Adriatic in September is so much warmer than the Clyde in November didn't sway you at all?

Not at all. A purely objective decision.

Another illuminating conversation, Prof. Thank you very much. Should we tell the readers that at least half this article is based on fact?

Better not. My reputation may suffer.

New and Prospective Members

APPLICANTS

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 Executive Director by telephone or letter before **15 January 2009**. Any communications will be handled discreetly. The decision on admission is usually taken by the Membership Admissions Committee under delegated authority from Council but may be taken directly by Council itself. IEEM is pleased to welcome applications for Membership from the following:

APPLICATIONS FOR FULL MEMBERSHIP

Ms Sarah Jennings, Mrs Penelope J. Hemphill, Mr Rupert M. Johnson, Dr Grant H. Jones, Ms Emma J. Simmonds, Mr Andy R. Swan, Mr Matthew J. Thomas, Mr Stuart G. Thomas

APPLICATIONS FOR ASSOCIATE MEMBERSHIP

Mr Philip Ames, Miss Mandy M. Apps, Miss Deborah E. Brown, Miss Amy Buckenham, Ms Moya Burns, Mrs Rachael Cooper, Ms Ceirios J.H. Davies, Mrs Erica Dixon, Miss Katherine A. Drayson, Mr Gavin Eaton, Miss Kerry Elliott, Ms Mazel Goulding, Mr John H. Harris, Miss Laura Hartley, Mr Robert Masters, Mr Neil E. Middleton, Miss Katie Partington, Miss Katharine Roper, Mr Simon M. Sharp, Miss Jodie Smith, Dr Nina Sraj, Mr John C. Stone, Miss Anna Swift, Mr Paul Turner, Dr Sarah J. Watson-Jones, Miss Ann M. Weddle, Mr Daniel E. Walker, Mrs Li-Lian J. Williams, Mr Ryan Wilson-Parr, Miss Jill Wood, Mr Jonathan Woods

ADMISSIONS

IEEM is very pleased to welcome the following new Members:

FULL MEMBERS

Ms Rebecca Barrett, Miss Lesley Brown, Mr David Chadwick, Miss Lois J. Crisp, Dr Marcus Cross, Mrs Erica Dixon, Mr Hugh B. Dixon, Mr Paul Eckersley, Dr Mikael L. Forup, Mr Daniel Hardie, Mr Derek Hilton-Brown, Miss Sylvia Jay, Mrs Fiona Lanc, Dr Catherine E.Z. Larman, Mr Richard E. Law, Mrs Merle A. Leeds, Mr Dylan Lloyd, Mr Michael J. McDermott, Miss Wendy McFarlane, Mr Roy Mosley, Mr Philip Quinn, Ms Alison E. Slade, Miss Jenny L. Storey, Dr Jason M. Weeks

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Mr Muhammad Akhlas, Mr Zeb Amir, Mr Jean-Michel J. Bellas, Mr Tim Bernhard, Mr Oliver J. Binks, Miss Aislinn L. Blackmore, Mr Andrew Buxton, Mr Richard Cattan, Mr Christopher P. Cockel, Mr Andrew Cross, Miss Marianne Curtis, Ms Patricia Davies, Miss Lucy E. Franks, Miss Louise Hawkins, Mr Charles A. Heal, Miss Gwennan E. Hughes, Mr Nicholas Hughes, Mr Jaspar Kenter, Miss Carole A. Lowther, Miss Mhairi C. MacLaughlan, Mr Tony Marshall, Mr Mark Millard, Miss Fiona J. Oldroyd, Miss Nichola G. Palfreman, Miss Jennifer Pannell, Miss Emma A. Platt, Mr Daniel R. Richards, Miss Nicole Robinson, Mr Andrew Saxby, Miss Nathalie Stephens, Moshe A. Stern Esq, Miss Naomi Taylor, Mr Paul Tinsley-Marshall, Mr Edward G. Waudby, Mr Adam B. Webb, Miss Lorna E. Wickham

UPGRADES

The following have successfully upgraded their Membership:

ASSOCIATE to FULL MEMBERSHIP

Dr Fintan Bracken, Ms Karen Banks, Mr Simon Boulter, Dr Richard J. Burkmar, Ms Jessica Durkota, Miss Fern L.H. Fellowes, Miss Ruth C. Fletcher, Mr Stephen J. Foot, Miss Hannah Gibbons, Mrs Hannah G. Gray, Dr Anne L. Halpin, Dr Mererid Howells, Mr Steven Jackson, Mrs Gaynor Jones Jenkins, Mr William Lever, Dr Ann T. O'Leary, Mr James R. Pattenden, Miss Georgina C. Reynolds, Mrs Catherine Sharp, Mr Michael Shewring, Miss Harriet R. Spray, Miss Georgina H. Starkie, Miss Hannah Walker, Mr Samuel T. Watson, Mr William R.C. Watson, Mr Stephen P.B.West

GRADUATE to ASSOCIATE MEMBERSHIP

Ms Alys Black, Mrs Juli J. Comery (nee Titherington), Miss Claire Holder, Dr Martin L. Page, Mr Brady Roberts, Mr David A. Sanderson, Miss Elizabeth M. Wandrag,

AFFILIATE to ASSOCIATE MEMBERSHIP

Mr Freddy Brookes

STUDENT to GRADUATE MEMBERSHIP

Miss Katherine Allen, Dr Angela Brennan, Miss Hannah K. Chard, Mr Michael C. Coleman, Miss Caroline Coletto, Miss Lisa Durrant, Miss Johanna Elwell, Mrs Karen Eynon, Miss Katherine H. Fraser, Miss Simone Gentner, Mr James F. Goodrum, Mr Andrew J. Halcro-Johnston, Mr Paul M. Hiscocks, Miss Kylie N. Jones, Miss Erin Logan, Miss Sarah L. Muddell, Mr William Salmon, Miss Elizabeth Stewart, Mr Akter Uzzaman, Mr Antony J. Witts

What's on January - March 2009

13 January 2009
ZSL Scientific Meeting - Environmental influences on development
London
www.ieem.net/otherevents.asp

20-21 January 2009
Coastal Futures
London
www.ieem.net/otherevents.asp

22 January 2009
The Flooding and Water Bill - Realising the Opportunity
London
www.ieem.net/otherevents.asp

10 February 2009
ZSL Scientific Meeting - Darwin, finches, faith and fossils
London
www.ieem.net/otherevents.asp

10 February 2009
CIWEM World Wetlands Day Conference 2009
London
www.ieem.net/otherevents.asp

11 February 2009
Water Framework Directive – River Basin Management Plans
London
www.ieem.net/otherevents.asp

12 February 2009
Sight and Sound - Field Identification Skills - Coastal Habitats
Near Edinburgh
www.ieem.net/otherevents.asp

3-5 March 2009
Good Practice Stakeholder Participation... with a focus on the environment
London
www.ieem.net/otherevents.asp

5 March 2009
Water Conservation
London
www.ieem.net/otherevents.asp

10 March 2009
ZSL Scientific Meeting - Understanding variation in population sizes: does the biological model matter?
London
www.ieem.net/otherevents.asp

11 March 2009
NE Section - Potential impacts of climatic change on European breeding birds
Location tbc
www.ieem.net/nesection.asp

13 February - 20 March 2009
WATER! ecology, conservation, floods, and droughts: freshwater habitat issues in the UK
Birkbeck, London WC1
www.ieem.net/otherevents.asp

15-19 March 2008
Workshop 'Evolution 150'
Cuenca, Spain
www.ieem.net/otherevents.asp

16-18 March 2009
Habitat Creation
Losehill Hall, Peak District National Park
www.ieem.net/otherevents.asp

24 March 2009
Sight and Sound - Field Identification Skills - Freshwater Habitats
Near Edinburgh
www.ieem.net/otherevents.asp

30 March-2 April 2009
Geographical Information Systems
Nottingham Trent University's Brackenhurst campus
www.ieem.net/otherevents.asp

24 March 2009
Joint CIWEM/CLG Conference: Water and Planning: Planning Guidance for Water Issues in Sustainable Development
London
www.ieem.net/otherevents.asp

30 March - 2 April 2009
Geographical Information Systems
Nottingham Trent University's Brackenhurst campus
www.ieem.net/otherevents.asp

1 April 2009
IEEM Spring Conference - Wildlife Crime
Leeds
www.ieem.net/conferences.asp

22 April 2009
Darwin-Wallace Celebratory Meeting - 'Insect evolution below the species level: ecological specialisation and the origin of species'
Harpenden, Hertfordshire
www.ieem.net/otherevents.asp

17-19 April 2009
Mammal Society Easter Conference and AGM
Winchester
www.ieem.net/otherevents.asp

24-26 November 2009
IEEM Autumn Conference - Protected Areas and Landscape Ecology
East of England
www.ieem.net/conferences.asp

For IEEM workshops please refer to the Training Workshop Programme, which can be found at: www.ieem.net/workshops.asp

Centres offering course programmes that might be of interest to IEEM members. Information from:

Centre for Alternative Technology, Machynlleth, Powys, SY20 9AZ
01654 705950
www.cat.org.uk

Field Studies Council, Preston Montford, Montford Bridge, Shrewsbury, Shropshire, SY4 1HW
0845 345 4071
enquiries@field-studiescouncil.org
www.fieldstudiescouncil.org

Freshwater Biological Association, The Ferry Landing, Far Sawrey, Ambleside, Cumbria, LA22 0LP
01539 442468
info@fba.org.uk
www.fba.org.uk

Losehill Hall, Peak District National Park Centre, Castleton, Hope Valley, Derbyshire S33 8WB
01433 620373
training.losehill@peakdistrict-npa.gov.uk
www.losehill-training.org.uk

Plas Tan-y-Bwlch, Maentwrog, Blaenau Ffestiniog, Gwynedd LL41 3YU
01766 590324
Plastanybwlch@compuserve.com

BTCV Training Programmes Unit, Red House, Hill Lane, Great Barr, Birmingham B43 6LZ
0121 358 2155
info@btcv.org.uk
www.btcv.org