

# inpractice

Issue 96 | June 2017



## Grassland Ecology & Grazing

### In this issue

Identifying Grassland  
Habitats of Conservation  
Interest in Ireland

Upland Hay Meadows –  
Applying the Evidence to  
Improve their Conservation

Grazer Selectivity:  
Benefits for Livestock,  
Habitats and People

# Welcome

## Grassland Ecology and Grazing

Who doesn't find a flower-rich hay meadow or a chalk grassland full of orchids uplifting and beautiful? Grasslands form a major part of the natural and cultural heritage of the UK and Ireland and this is being recognised by an increasingly large part of our population. However, both agricultural intensification and neglect have led to a severe reduction in the extent and quality of our grasslands, particularly of hay meadows. Indeed, in some regions, roadside verges are the only places where species-rich grasslands remain.

Grasslands are, almost without exception, the outcome of agricultural management and, in particular, the practice of grazing both in a historical and current context. Grazing management has shaped the form and composition of our grasslands from permanent pastures to hay meadows and floodplain grasslands. Roadside verge grasslands are mown which can be a good substitute for grazing if done at the right time.

How can we best manage and conserve our semi-natural grasslands? The evidence base on how to do this has been building from the early days of nature conservation management in the early 20<sup>th</sup> century. Much of this knowledge has been gained from farmers and land managers working with ecologists and is still very much an experimental process. Proactive work is taking place throughout the UK by statutory agencies and the Third Sector, such as the National Trust through its new Land, Outdoors and Nature Strategy to nurse the environment back to health.

Plantlife, for example, has a particular focus on the conservation of grasslands and connecting more people with them. Working in partnership with the Wildlife Trusts and the Rare Breeds Survival Trust, the *Coronation Meadows* project has designated the best hay meadow in each UK County to celebrate the 60<sup>th</sup> anniversary of the Queen's coronation. More importantly, these meadows are being used as a seed source for the restoration and creation of other meadows. This is being carried out with much public and volunteer involvement and links well with the HLF-funded *Save Our Magnificent Meadows* project which aims to raise public awareness of meadows and species-rich grasslands. Plantlife leads this project, working with 11 partners including the Wildlife Trusts, RSPB and National Trust. An important output of this project is a database of guidance on grassland restoration, creation, monitoring and management, which aims to bring together current knowledge.

CIEEM's ecologists and environmental managers are already playing their part in providing advice, carrying out research, sharing experience such as through this edition of *In Practice* and using online networks. A plea too for the publication of projects which haven't worked well – sharing our mistakes can be painful but really helpful to colleagues in their design and management of future projects.

One of the few positive aspects of Brexit is the opportunity for the redesign of agricultural support systems following the UK leaving the EU. It is to be hoped that future taxpayer support for farming is truly for the delivery of public goods, including species-rich upland and lowland grasslands. Grasslands also have a large part to play in the development of functional ecosystems, such as in catchment management programmes to improve water retention in the uplands and restoring floodplain functionality to our lowland rivers.

We have much of the necessary evidence and skills to conserve, manage, restore and re-create our semi-natural grasslands. What we lack are the policy and financial mechanisms to support this work, most especially an agriculture and land management policy that underpins the more sensitive management of the countryside and which embraces the ecosystem approach and natural capital accounting. Professional ecologists must involve themselves in this post-Brexit policy development otherwise there is a real risk that this current opportunity for radical change will be lost.

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Front cover image:  
Roe deer in wildflower hay meadow.

# Contents



PG 08

## Identifying Grassland Habitats of Conservation Interest in Ireland

*Fionnuala O'Neill*



PG 13

## Upland Hay Meadows – Applying the Evidence to Improve their Conservation

*David Martin and Clare Pinches*



PG 19

## Managing Roadside Grasslands Along the Trunk Roads of Southwest England

*Leonardo Gubert*



PG 25

## Grazer Selectivity: Benefits for Livestock, Habitats and People

*Bill Grayson*



PG 31

## Viewpoint: Northumbrian Water's Partnership with Flexigraze – Helping to Get Hooves onto the Ground for the Benefit of Wildlife

*Mark Morris*



PG 37

## The Bat Roost Trigger Index – A New Systematic Approach to Facilitate Preliminary Bat Roost Assessments

*Nick Underhill-Day*

## 02 Editorial

## 03 Contents

## 04 Chartered Institute News and Activities

## 06 News in Brief

### Feature Articles

08 – Identifying Grassland Habitats of Conservation Interest in Ireland  
*Fionnuala O'Neill*

13 – Upland Hay Meadows – Applying the Evidence to Improve their Conservation  
*David Martin and Clare Pinches*

19 – Managing Roadside Grasslands Along the Trunk Roads of Southwest England  
*Leonardo Gubert*

25 – Grazer Selectivity: Benefits for Livestock, Habitats and People  
*Bill Grayson*

31 – Viewpoint: Northumbrian Water's Partnership with Flexigraze – Helping to Get Hooves onto the Ground for the Benefit of Wildlife  
*Mark Morris*

34 – Viewpoint: Sheepwrecked, Sheepracked or Sheepwrought? – Thoughts on Sheep and the Future of the British Uplands  
*Hugh Watson*

37 – The Bat Roost Trigger Index – A New Systematic Approach to Facilitate Preliminary Bat Roost Assessments  
*Nick Underhill-Day*

44 – Meet the Author – Fionnuala O'Neill

### Professional Updates

45 – CIEEM Skills Gap Project  
*Debbie Bartlett and Eulalia Gomez-Martin*

48 – What's the Point of Conservation Science?  
*Greg Carson*

52 – Employers Investment in Continuing Professional Development (CPD)  
*Karen Hood-Cree*

53 – Developing Ecological Clerk of Works Accreditation

55 – Criminal Prosecution – Are You Covered?

56 – Chartered Membership

57 – British Ecological Society  
*Richard English*

58 – Building Bridges between Farming and Nature: Grazing is Amazing – Welsh Section Conference 2017  
*Diana Clark*

60 CIEEM's Member Networks

62 New Members

63 Recent Publications and Journals

68 Diary

69 External Advertisements

## CIEEM Summer Conference 2017 – Now Open for Bookings!

### **Integrated Management of the Marine Environment**

**4 July 2017, Southampton**

This one-day conference will examine the external impacts on the marine environment and how an integrated management approach can deliver multiple benefits. Contributors will explore effective approaches to ecological impact assessment in the marine environment and discuss the required elements of a post-Brexit integrated marine management policy and legislative landscape.

<http://cieem.activclient.com/CIEEM/Events/Event-Listing.aspx>



## Guidance on Delivering Net Gain

Following the publication of the Principles on Achieving Net Gain for Biodiversity in December last year, CIEEM has continued to work with CIRIA and IEMA on drafting practical guidance on this important topic. An author team has been appointed and are busy scoping and researching the guidance. A series of online and focus group consultations will take place over the coming months in order to try and address some key areas where further clarity or decision-making is needed and it is hoped that the guidance will be published early in 2018.

## CIEEM Spring Conference 2017 – Presentations Available

The CIEEM Spring Conference 2017 – Mainstreaming Biodiversity into Future Cities – explored the wider benefits of including biodiversity in designing and planning our sustainable cities of the future. Presentations and videos of the talks are available on the CIEEM website at [www.cieem.net/2017-spring-conference](http://www.cieem.net/2017-spring-conference)

## CIEEM Autumn Conference 2017 – Call for Papers

### **Mitigation, Monitoring and Effectiveness**

**21-22 November 2017, Manchester**

The call for papers for the 2017 Autumn Conference is now open.

The conference objectives are to:

- showcase innovative approaches to monitoring and data capture/use;
- present recent research and emerging best practice regarding the effectiveness of habitat and species mitigation, including in response to climate change; and
- explore the role of the profession in contributing to the evidence base for the effectiveness of mitigation techniques.

For more information, or to submit a paper, please contact [enquiries@cieem.net](mailto:enquiries@cieem.net).

## CIEEM and Brexit

At the time of writing we are in the process of finalising CIEEM's Brexit position papers: one overarching and five topic-specific. We are very grateful to the Brexit Task Groups, who have put in a huge effort to get us this far. We are now working with partners and a consultant to help us get these position papers to the right people so as to have the most influence for the benefit of the natural environment and the sector.

We have also responded to the Great Repeal Bill White Paper.

Keep up to date with CIEEM's Brexit activities: [www.cieem.net/eu-referendum](http://www.cieem.net/eu-referendum)

## Consultation Responses in 2017

CIEEM has responded to the following consultations and inquiries in 2017:

- Environmental Impact Assessment – Joint Technical Consultation (planning changes to regulations on forestry, agriculture, water resources, land drainage and marine works) (Defra, Welsh Government, Scottish Government, DAERA)
- Environmental Impact Assessment: Technical consultation (regulations on planning and major infrastructure) (Department for Communities and Local Government)
- Review of Draft 3rd National Biodiversity Action Plan (National Parks and Wildlife Service)
- Closing the STEM Skills Gap (Science and Technology Select Committee)

To read the full responses please visit: [www.cieem.net/past-consultation-responses](http://www.cieem.net/past-consultation-responses)

## Bat Mitigation Research Project

This research project is well underway but more data is required. The research team are calling for more mitigation monitoring reports and/or licence returns, even where the post-construction monitoring has been incomplete. The researchers are looking for the good and the bad from across the UK and Ireland. Site locations can be anonymised if preferred, provided the broad geographical area (e.g. NW England) is specified. The final report will NOT detail individual case studies; and nor will reports be shared with the Statutory Authorities or CIEEM.

To take part in this research please zip together files relating to a particular case (e.g. original licence application and methods statement, post construction monitoring report) and upload at <http://www.surveygizmo.com/s3/3356395/Bat-roost-mitigation-for-buildings-upload-reports> or email us [batmitigationresearch@cieem.net](mailto:batmitigationresearch@cieem.net)

Time is running out so if you can help us with this important research do please take the opportunity now. Please address any queries to [batmitigationresearch@cieem.net](mailto:batmitigationresearch@cieem.net)



### CIEEM Awards 2017 Finalists and Tickets

We are excited to announce the finalists of our annual Awards ceremony. The judging panel agreed that this was a year where they enjoyed particularly impressive projects and achievements of professionals in the sector. See the list of finalists online using the link below.

The Awards Lunch 2017 will be held at Drapers' Hall, London, on Wednesday 21st June 2017. Tickets for the Awards Lunch, which will be held for the first time in London, are available at <http://www.cieem.net/cieem-awards-2017>

### PSC Update

CIEEM's Professional Standards Committee (PSC) met in March and welcomed two new members (Neil Harwood and Stuart Otway), as well as thanking outgoing committee member Jim Wilson for his six years of service.

One of the items discussed, and which is being progressed over the coming months, is the development of a list of good practice guidelines for the CIEEM website. It is intended that this will signpost members to the most appropriate guidance documents on survey, mitigation and management for a range of habitats and species.

PSC also discussed a draft webpage for the CIEEM website, which aims to define the different types of reports that are produced in relation to planning applications for developments. The webpage is aimed at developers, local authorities, nature conservation consultees and ecological consultants, and tries to standardise the various terms used, explaining when a particular type of report is appropriate. It is hoped that both additions to the website will be available later this year.

Erika Newton from the British Ecological Society gave a presentation on the development of a searchable tool for ecologists to use, for example when looking for evidence of the success of mitigation techniques. The tool will include journal summaries, grey literature and other sources, such as *In Practice* articles. It is hoped that the tool will be available in a beta format by late 2017 or early 2018.

Amongst other things, PSC has also discussed:

- The proposed amendments to the Environmental Impact Assessment (EIA) Regulations, particularly the issue of demonstrating competence of those preparing and those reviewing EIAs.
- A draft guidance document on assessing air quality effects on nature conservation sites.
- Progress on the development of a new habitat classification system, which will align habitat classifications with habitat types of relevance to Ecological Impact Assessment (EclA).
- Progress on the development of an accreditation scheme for Ecological Clerk of Works – the first phase of which has now received funding.

### CIEEM and the UK General Election

In the week that the general election was called, CIEEM wrote to the main political parties (Conservatives, Labour, Liberal Democrats, Greens, Scottish National Party, Plaid Cymru, UKIP, Sinn Fein, Social Democratic & Labour Party, and Ulster Unionist Party) to call on them to include in their election manifestos a commitment to maintaining, or better yet enhancing, the protection of the natural environment following the UK leaving the EU, and to ensuring that environmental legislation and policy is always informed by the best scientific evidence available. Read the full request at [www.cieem.net/news/407/cieem-calls-for-environmental-commitments-in-election-manifestos](http://www.cieem.net/news/407/cieem-calls-for-environmental-commitments-in-election-manifestos).



By the time you read this we will not only know whether these commitments were included in the party manifestos, but also indeed the result of the vote.

### Volunteers Survey

We would like to thank all the members who completed the recent survey regarding volunteering with CIEEM. We are now analysing the results and will report back in the September 2017 edition of *In Practice*.

### In Practice themes 2017

Edition	Theme	Submission deadline
September 2017	One Year on from the EU Referendum	n/a
December 2017	Nature Conservation Approaches with Reduced Resources	28 August 2017

If you would like to contribute to *In Practice* please contact the Editor at [GillKerby@cieem.net](mailto:GillKerby@cieem.net). Contributions are welcomed from both members and non-members.

### UK Government responds to House of Lords Committee report on Brexit: Environment and Climate Change

Dr Thérèse Coffey MP, Defra Under Secretary of State, has responded to the House of Lords EU Energy and Environment Sub-Committee report on Brexit: Environment and Climate Change.

<http://www.parliament.uk/documents/lords-committees/eu-energy-environment-subcommittee/Brexit-environment-climate-change/Gov-response-Brexit-env-climate.pdf>

### Great Repeal Bill plan published

The UK Government has published *Legislating for the United Kingdom's withdrawal from the European Union*. This is the Government's Great Repeal Bill White Paper, which sets out the Government's proposals for ensuring a functioning statute book once the UK has left the EU.

<http://www.cieem.net/news/402/great-repeal-bill-plan-published>

### NBN Atlas now live!

The NBN Atlas and NBN Atlas Wales went live on 1st April. The NBN Gateway was turned off at the same time. This is phase 1 of the project, which means that the NBN Atlas currently has the same functionality that the NBN Gateway had. As NBN moves forward they will be asking for input into how the NBN Atlas is developed further to suit the entire Network as well as potential new users.

<https://nbn.org.uk/news/nbn-atlas-now-live/>

### Natural England launches new Wildlife Licensing Newsletter

The new Natural England Wildlife Licensing Newsletter replaces the previous European Protected Species Newsletter.

<https://www.gov.uk/government/publications/wildlife-licences-european-protected-species-newsletters>

Subscribe to the mailing list by contacting: [EPS.Mitigation@naturalengland.org.uk](mailto:EPS.Mitigation@naturalengland.org.uk)

### Welsh Assembly publishes report on Brexit impact on agriculture

The report by the Climate Change, Environment and Rural Affairs Committee looks at the potential impact that leaving the EU will have on the sector.

<http://www.assembly.wales/en/newhome/Pages/newsitem.aspx?itemid=1700>

### Wales Marine Planning Portal

The marine planning portal for Wales allows anyone to view maps online showing the distribution of human activities and natural resources in Welsh seas. The portal is an interactive planning tool that is intended to support marine planning.

<http://le.gov.wales/apps/marineportal/#lat=52.5145&lon=-3.9111&z=8>

### Land Stewardship Policy in Scotland

The Scottish Wildlife Trust (SWT) has published a draft Land Stewardship Policy. The draft Policy provides a set of solutions for safeguarding and enhancing the natural capital value of land in Scotland in order to address the challenges facing society, the environment and the rural economy: better protecting and preserving our soils; reducing greenhouse gas emissions and adapting to a changing climate; and restoring wildlife habitats and reversing biodiversity loss. The final version is due for publication imminently.

<https://scottishwildlifetrust.org.uk/wp-content/uploads/2017/03/Land-Stewardship-Policy-Consultation-Paper.pdf>

### Scotland's Natural Capital Asset Index published

Scotland's plants, animals, air, water and soils are showing signs of recovery, according to new information. The Natural Capital Asset Index, published by Scottish Natural Heritage (SNH), states that after decades of decline until the 1990s, these 'natural capital stocks' have stabilised or improved slightly.

<https://www.snhpresscentre.com/news/scotlands-natural-capital-asset-index-published-2>

### Scottish Marine Protected Areas Socioeconomic Monitoring

This report provides an assessment of emerging evidence on the socio-economic impacts of Scotland's Marine Protected Areas (MPAs). The report's objectives are to develop a methodology for monitoring the socioeconomic impacts of MPA management measures and to gather and analyse evidence on the ex post socioeconomic impacts of MPA management measures. The report presents evidence from key informant interviews, analysis of fishing activity data and three case studies.

<http://www.gov.scot/Resource/0051/00514589.pdf>

### Peatland ACTION Project 2017-18 open for applications

Since 2013, Peatland ACTION has started the restoration process on more than 10,000 hectares of degraded peatlands. Peatland ACTION is entering a new phase, with £8 million to spend on continuing Scotland-wide peatland restoration in 2017-18. Applications will be accepted until the end of October 2017 (subject to available funds).

<http://www.snh.gov.uk/climate-change/taking-action/carbon-management/peatland-action/information-for-applicants/>

### Agreement between EIB and Natural Capital Financing Facility

The European Investment Bank and the European Commission have agreed on a loan arrangement with Rewilding Europe Capital in order to support businesses with nature-focused initiatives. The Natural Capital Financing Facility will primarily focus on projects regarding biodiversity and climate adaptations, and support them financially.

<http://www.eib.org/infocentre/press/releases/all/2017/2017-102-bank-on-nature-first-loan-agreement-backed-by-natural-capital-financing-facility-signed-in-brussels.htm>

## Scottish deer management report published

The Scottish Government's Environment, Climate Change and Land Reform Committee has published a report on deer management in Scotland.

<https://sp-bpr-en-prod-cdnep.azureedge.net/published/ECCLR/2017/4/3/Report-on-Deer-Management-in-Scotland--Report-to-the-Scottish-Government-from-Scottish-Natural-Heritage-2016/5th%20Report.pdf>

## National Ecosystem and Ecosystem Services mapping pilot for Ireland released

The project report for the National Ecosystem and Ecosystem Services mapping pilot for Ireland was released on 8 May and has been published as *Irish Wildlife Manual No. 95* (2016). It includes supporting documents and an interactive mapping application.

<https://www.npws.ie/research-projects/ecosystems-services-mapping-and-assessment>

## DAERA publishes good practice guides

DAERA has produced a number of good practice guides by topic, for councils and applicants to consider when preparing and assessing development proposals which have environmental impacts:

- Wind farms and groundwater impacts
- Cemeteries, Burials and the Water Environment
- Planning in the Coastal Area

## Solar farm legislation urgently needed in Ireland

Solar farm legislation is "urgently needed" as councils struggle to deal with an explosion in planning applications, says Cork Senator. Fine Gael's Tim Lombard called for national guidelines to assist Local Authorities in dealing with planning applications for solar farms.

<http://greennews.ie/solarfarmlegislationurgentlyneeded/>

## EC acts to improve nature protection

The European Commission has agreed a new action plan to improve the protection of nature and biodiversity in the EU. The Commission is also asking the UK to implement EU environmental laws on the conservation of blanket bogs.

<http://www.cieem.net/news/410/ec-acts-to-improve-nature-protection>

## eDNA in rivers can assess broad-scale biodiversity

Traces of animals' DNA in the environment, known as environmental DNA (eDNA), can be monitored to paint a picture of biodiversity, new research shows. This study used eDNA to assess biodiversity in an entire river catchment in Switzerland. Importantly, the eDNA technique allowed the researchers to detect both aquatic and land-based species in river water, making it possible to assess biodiversity over a broad scale.

[http://ec.europa.eu/environment/integration/research/newsalert/pdf/environmental\\_dna\\_in\\_rivers\\_can\\_assess\\_broad\\_scale\\_biodiversity\\_485na4\\_en.pdf](http://ec.europa.eu/environment/integration/research/newsalert/pdf/environmental_dna_in_rivers_can_assess_broad_scale_biodiversity_485na4_en.pdf)

## Europe should remain focused in the face of Brexit

Europe should remain focused in the face of Brexit and not lose its value for the environment, former Commissioners and leading experts warn. A group of former Commissioners, Ministers, scientists, civil society and policy-makers from around Europe have called on EU leaders to put the environment at the centre of a new vision for Europe's future. A group of 15 high-level signatories including Former European Commissioners Janez Potocnik and Connie Hedegaard are part of a call for strengthening EU environmental action – and not repatriating it to the national level.

<http://www.eeb.org/index.cfm/news-events/news/europe-should-remain-focused-in-the-face-of-brexit-and-not-lose-its-value-for-the-environment-former-commissioners-and-leading-experts-warn/>

## Nature-Based Solutions report published

The report *Nature-based solutions to promote climate resilience in urban areas – developing an impact evaluation framework* is the outcome of a request from the European Commission DG Research and Innovation to develop an assessment framework to evaluate the multiple benefits, disservices, trade-offs and synergies of Nature-Based Solutions (NBS).

[http://www.eclipse-mechanism.eu/apps/Eclipse\\_data/website/EKLIPSE\\_Report1-NBS\\_FINAL\\_Complete-08022017\\_LowRes\\_4Web.pdf](http://www.eclipse-mechanism.eu/apps/Eclipse_data/website/EKLIPSE_Report1-NBS_FINAL_Complete-08022017_LowRes_4Web.pdf)

## MEPs vote in favour of a phase-out of incentives for vegetable oil biofuel by 2020

European politicians have voted in favour of a resolution calling for a halt to incentives for biofuels used in the transport sector that are linked to deforestation and peatland destruction. Groups across the political spectrum in the European Parliament (EP) gave their support to a motion calling on the European Commission to phase out crop-based biofuels in the new Renewable Energy Directive (RED).

<http://greennews.ie/mepsvotefuelincentivephaseout/>

## Study reveals growth of citizen science fuelled by new technology

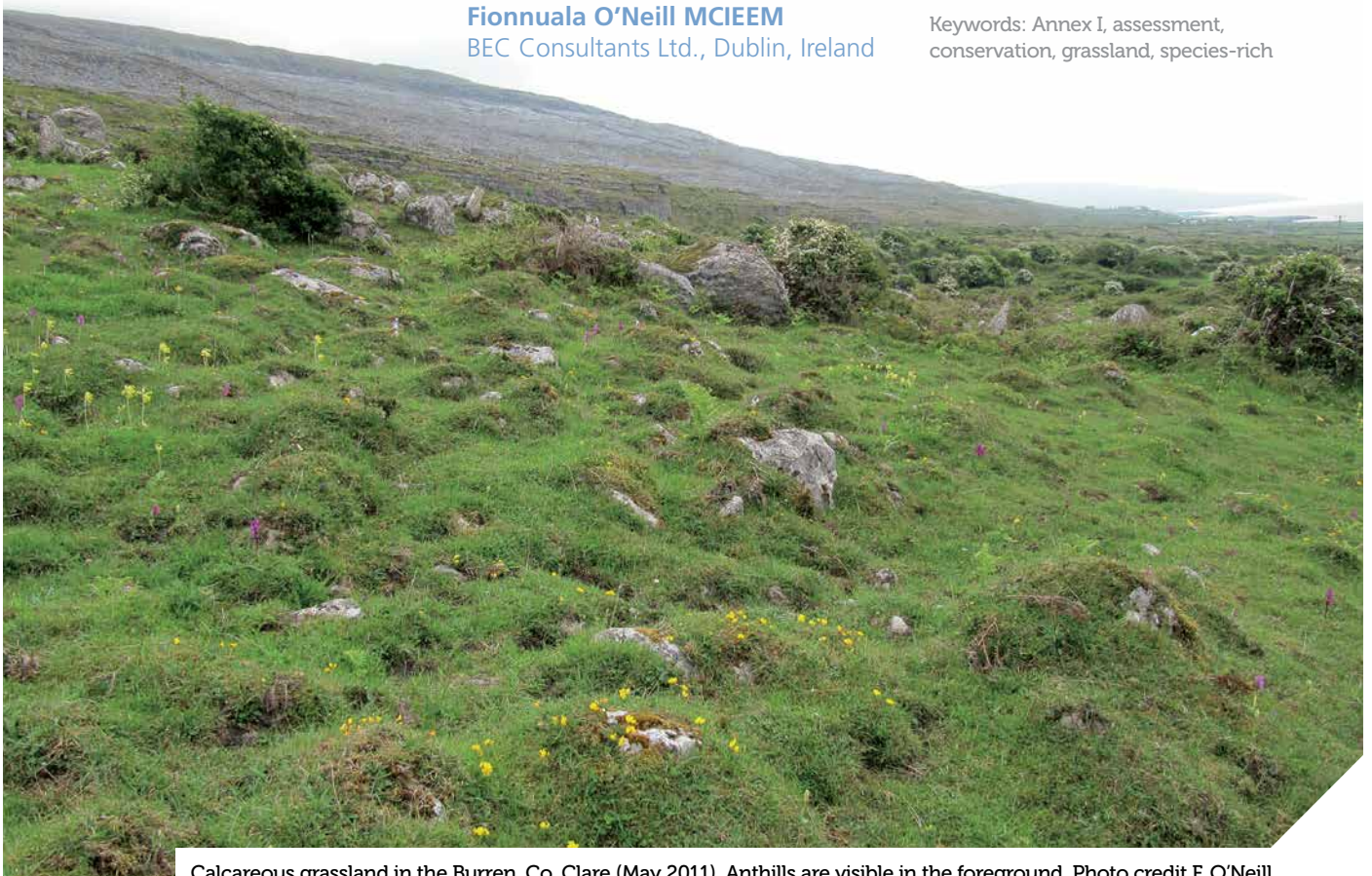
Centre for Ecology & Hydrology (CEH) and the Natural History Museum, London, have revealed the diversity of ecological and environmental citizen science for the first time and shown that the changing face of citizen science around the world is being fuelled by advances in new technology.

<http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0172579>

# Identifying Grassland Habitats of Conservation Interest in Ireland

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Keywords: Annex I, assessment, conservation, grassland, species-rich



Calcareous grassland in the Burren, Co. Clare (May 2011). Anthills are visible in the foreground. Photo credit F. O'Neill.

Grasslands of conservation interest are not always immediately recognisable as such, and this can make them difficult to protect. This article outlines some of the characteristics of ecologically valuable grasslands. Increased recognition and awareness will help to foster an appreciation of species-rich grasslands and contribute to their protection.

## Introduction

Ireland's membership of the EU has been something of a double-edged sword for

Irish semi-natural grasslands. In the early days of our membership of what was then called the EEC, farmers were given financial incentives to intensify production, which encouraged reseeding, fertiliser application and conversion of widespread, low-yield (though often species-rich) farmland to high-yield, species-poor pastures or silage fields. However, in later years the EU's Habitats Directive identified a number of threatened grassland habitats that Member States were obliged to protect, monitor and report on. Comparisons between grassland surveys carried out pre-EEC between 1962 and 1972 (Bourke *et al.* 2007) and others conducted post-accession between 2007 and 2012 (O'Neill *et al.* 2013) show a general transition from semi-natural grassland to improved agricultural grassland. Irish ecologists and

policy makers now need to work together to identify the grasslands most in need of conservation, and the best methods by which to achieve this.

In Ireland we currently report to the EU on six Annex I grassland habitats. Two of these, 6130 Calaminarian grassland and 6430 Hydrophilous tall-herb swamp, are highly fragmented and together cover less than 1 km<sup>2</sup> nationally. The other four are more widespread and are listed below (asterisks indicate priority Annex I habitats):

- 6210 Calcareous grassland (\*important orchid sites)
- \*6230 Species-rich *Nardus* grassland
- 6410 *Molinia* meadows
- 6510 Lowland hay meadows

The Irish Semi-natural Grasslands Survey (ISGS), carried out between 2017 and



2012, was tasked with identifying areas where these habitats occurred, defining the habitats for Ireland and producing descriptions to help ecologists to recognise them. Doubtless the lack of proper descriptions of these habitats as they occur in Ireland contributed to their loss at some sites before they were even mapped. Survey areas were a combination of known sites (some already in Special Areas of Conservation designated for grassland) and previously unknown sites identified from aerial photographs or on the ground while surveys were underway. Habitat definitions and full descriptions, together with characteristic species, can be found in the final project report by O'Neill *et al.* (2013).

This article outlines some of the most important characteristics of an ecologically healthy, species-rich grassland, and describes the four main Annex I grassland habitats listed above. These characteristics and definitions are intended to be applicable in an Irish context only. They were initially developed from a number of sources, including the Interpretation Manual of EU Habitats (CEC 2007) and JNCC Common Standards Monitoring guidance documents (e.g. JNCC 2004). As the ISGS progressed over successive years (2007-2012) to cover the Republic of Ireland (ROI) as a whole, the criteria were refined further from the data collected. While the study was carried out in the ROI, we would expect that its findings could be extrapolated to include similar habitats in Northern Ireland as well.

### Ireland's depauperate flora

One of the challenges for Irish ecologists seeking to use indicator species to help define Annex I habitat is our depauperate flora, compared with the UK and the rest of Europe. One estimate put the numbers of native seed-plant species on the island of Ireland at 815, compared to 1,172 in Britain (Webb 1983). The classification of Irish grasslands proposed by the ISGS and developed further by the Irish Vegetation Classification (<http://www.biodiversityireland.ie/ivc>) highlights the scarcity of specialist indicator species that help to differentiate communities from each other. Potential indicator species relatively common in Britain but absent or very rare in Ireland include *Valeriana dioica* (absent), *Cirsium acaule* (absent), *Helictotrichon*

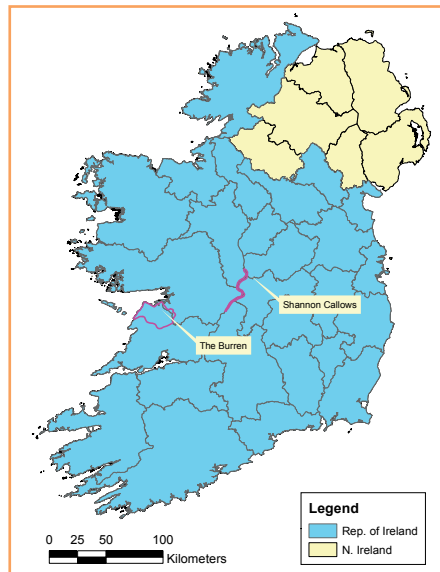


Figure 1. Location of the Burren and Shannon Callows.

*pratense* (absent), *Helianthemum nummularium* (one site in the northwest), *Trollius europaeus* (a few sites in the northwest) and *Alchemilla alpina* (two recent records in the southwest).

### Attributes of Annex I grasslands in Ireland

**6210 Calcareous grassland** is found on shallow, well-drained calcareous substrates (suitable for the formation of ant-hills, which are frequently found in the habitat) and is often associated with eskers and limestone pavement. It is generally maintained by extensive grazing, usually by cattle. The best examples in Ireland are found in the Burren (see Box 1 and Figure 1) and Aran Islands of Clare/Galway and the Darty

#### Box 1: The Burren



Calcareous grassland in the Burren, Co. Clare (June 2011). Photo credit C. MacMahon.

The Burren (from the Gaelic *boireann*, meaning "rocky place") is a region of exposed limestone rock that occurs across northwest Co. Clare and southeast Co. Galway in the west of Ireland, covering an area of approximately 250 km<sup>2</sup>. It is famous for its unusual flora, which features Mediterranean and alpine species growing together at sea level, acid-loving and lime-loving plants occurring side by side, and nationally rare species growing in profusion. The region has a high incidence of 6210 Calcareous grassland. The landscape has been shaped by glacial erosion and deposition, and further maintained by traditional farming practices that were developed over millennia to manage the challenging landscape effectively. One such practice is "winterage", where cattle are moved to the Burren "uplands" (200-350 m asl) to graze in winter. The timing of grazing means that the winter-grazed uplands can flower and set seed without disturbance from cattle. In spring, grazers are moved to the lowlands after floodwaters have receded and the lush growth that results from the winter inundation provides ideal grazing for cattle. (<http://www.burrennationalpark.ie/wildlife/farming>).

**Box 2: The Shannon Callows**



*Molinia* meadows on the Shannon Callows, Co. Roscommon (June 2016).  
Photo credit F. O'Neill.

The River Shannon is the longest river in Ireland and Britain, running 380 km southwards through the centre of Ireland. It is largely unregulated and has retained its natural character. Its floodplain, known as the Shannon Callows (from the Gaelic *caladh*, meaning "river-meadow"), occurs along a 50-km stretch (0.75–1.5 km wide) between two large lakes, Lough Ree and Lough Derg (Maher *et al.* 2014) and largely consists of lowland grassland, much of it managed for hay. The Callows hay meadows have been managed in much the same way for hundreds of years, with farmers typically removing one hay crop from the meadows in late summer (Heery 1993). The region is of national importance for Ireland's two Annex I meadow habitats, accounting for 41% of the national resource of 6510 Lowland hay meadows and 18% of our 6410 *Molinia* meadows. Much of the area is designated as a Special Area of Conservation under the EU Habitats Directive, and as a Special Protection Area for birds under the EU Birds Directive ([www.npws.ie](http://www.npws.ie)).

Mountains of Sligo/Leitrim. The habitat is species-rich, and calcicolous (lime-loving) species such as quaking-grass *Briza media* and lady's bedstraw *Galium verum* are typically frequent. The habitat is threatened by agricultural intensification and the abandonment of pastoral systems.

We found that 6210 Calcareous grassland forms a remarkably consistent community in Ireland: 144 of 149 relevés (97%) placed in the *Briza media* – *Thymus polytrichus* vegetation community defined by the ISGS and Irish Vegetation Classification were deemed to be 6210, and species richness in 4 m<sup>2</sup> plots was usually above 40 species. The presence of limestone rock in the plots can often contribute greatly to the species count due to calcicolous bryophytes.

**6510 Lowland hay meadows** are closely associated with the fertile plains of the larger river systems, such as the Shannon Callows (see Box 2 and Figure 1), although they are also found elsewhere in the country. Typical species are grasses and broadleaved herbs that are tolerant of annual mowing. The habitat has suffered losses from agricultural improvement and abandonment. Areas where mowing has been abandoned become rank and species-poor, eventually succeeding to scrub.

Grasslands that conform to 6510 Lowland hay meadows are always, in our experience from the survey, mown – either for hay or silage. From an ecological point of view, the act of mowing is more important than the eventual use made of the off-cut crop,

although late cutting (usually for hay) is preferable as it allows seed-set, which earlier-cut silage may not. In Ireland, mown fields are often after-grazed by cattle, a practice which can blur the lines between pasture and meadow plant communities. Great burnet *Sanguisorba officinalis* is a high-quality indicator species for 6510 Lowland hay meadows but its extreme rarity in the ROI (only two sites) means that it is not suitable for widespread use. Fortunately, the more widespread yellow-rattle *Rhinanthus minor* is another excellent indicator for this habitat as it quickly disappears from the sward with any attempts at intensification, such as slurry application (Figure 2).

**6410 *Molinia* meadows** in Ireland occur as both fen and grassland communities on nutrient-poor soils. The habitat is managed either as traditional hay meadow or more usually by extensive pasture.

In Ireland the habitat generally has a central to north-western distribution that follows the distribution of meadow thistle *Cirsium dissectum*, one of the key indicator species for the habitat: it was associated with 53% of 6410 *Molinia* meadow plots in the national survey. Purple moor-grass *Molinia caerulea* is usually present within this habitat at low to medium abundance, but dominance can indicate a lack of management. The habitat is threatened by abandonment of pastoral systems and mowing, leading to succession to scrub.

Management of 6410 *Molinia* meadows may be by grazing or mowing. Cutting may not be possible every year, for example if summer/autumn flooding occurs. However, it has been found that hydrological heterogeneity (different flooding duration) and a diversity of mowing regimes (e.g. cutting at different times) are important factors in maintaining biodiversity among a range of taxonomic groups in these complex floodplain meadows (Maher *et al.* 2014).

**\*6230 Species-rich *Nardus* grassland** occurs in the uplands of the country on acid substrates, usually near the upper limit of enclosed farmland. Extensive grazing, usually by sheep, is needed to maintain the habitat. Mineral flushing creates a habitat that supports a more species-rich community, similar to 6210 Calcareous grassland but on an acidic

Figure 2. a) 6510 Lowland hay meadow in June 2009 before application of slurry; b) the same field in June 2016 after several slurry applications. Species diversity is reduced, tussocky species have increased and yellow rattle has disappeared from the sward. Photo credit: a) F. Devaney; b) J. Martin.

substrate. A minimum of 25 plant species per 4 m<sup>2</sup> indicates a species-rich community in this habitat. These grasslands are threatened by losses from forestry planting and agricultural improvement (fertilisation and reseeding) and also abandonment of grazing leading to succession to heath and scrub.

This habitat can be difficult to identify in Ireland's uplands: it is often tightly grazed by sheep, making identification and counting of species difficult, and soil quality is frequently poor, contributing to lower broadleaf cover. Most recent surveys of \*6230 Species-rich *Nardus* grassland in Ireland have been carried out as part of the National Survey of Upland Habitats (see Perrin *et al.* 2014) rather than by the ISGS, which focused more on lowland grasslands. Further work is needed to characterise and map this habitat in Ireland as part of the uplands survey for the entire country.

### Characteristics of ecologically healthy grassland

One of the characteristics to look for in ecologically good quality grassland is **high cover of broadleaf herbs**. These add structure to the sward, providing additional niches for invertebrates and a food source for pollinators. They also often indicate lower fertiliser inputs. The broadleaf-to-graminoid (grasses, rushes and sedges) ratio is one criterion used to assess species-rich or Annex I grassland, with a ratio of around 40% or higher assessed as good. A lower proportion (20-35%) can be acceptable in certain habitats and conditions, such as on poor soil or at higher altitudes. When carrying out full habitat assessments, the proportion is determined by recording relevés. For more informal, indicative purposes, it can be estimated by eye across the habitat.

**Sward height** is another useful characteristic to judge habitat condition. It can, of course, vary depending on time of year, soil characteristics, site exposure and management regime, but in general,



short swards are preferable to tall, rank swards, as taller swards are more closed, tending to be dominated by fewer and more competitive, tussocky species. Shorter swards can be maintained by appropriate grazing or mowing or, in some coastal situations, naturally by exposure.

Agricultural intensification of grassland through slurry application, reseeding or overgrazing is often indicated by the presence of **negative indicator species**,

including agricultural weeds such as creeping thistle *Cirsium arvense*, ragwort *Senecio jacobaea*, white clover *Trifolium repens* and perennial rye-grass *Lolium perenne*. The presence and proportion of these species can shift the balance among species in the sward, with less competitive species being overwhelmed. Tussocky grass species such as cock's-foot *Dactylis glomerata* and false oat-grass *Arrhenatherum elatius* are also regarded

## Feature Article: Identifying Grassland Habitats of Conservation Interest in Ireland (contd)

as negative species in the sward, although their presence is more likely to be due to under-management and abandonment of grasslands rather than intensification.

### Management

The Irish Semi-natural Grasslands Survey data indicate that grazing, mainly by cattle, is the principal form of management occurring on Irish Annex I grasslands, especially in 6210 Calcareous grassland. Non-intensive mowing is the most important form of management of meadows, especially in 6510 Lowland hay meadows. The ISGS found that the top five negative impacts on Annex I grassland habitats were all related to lack of management or agricultural abandonment, with succession to non-grassland habitats occurring at 56% of sites, bracken encroachment occurring at 26%, and abandonment (of either grazing or mowing) recorded at 12% of the sites. Intensification was also a problem. Preliminary results from the current (third) round of Annex I grassland monitoring (2013-2018) indicate that this trend is continuing: 20% of the surveyed area has been lost since the previous monitoring period (2007-2012), over half of this due to abandonment or agricultural intensification; the total decrease represents a loss of approximately 2% of Annex I grassland habitat per year (J. Martin, pers. comm.).

Work continues on the best ways to manage these important habitats. Projects such as BurrenLIFE and the Burren Programme (<http://burrenprogramme.com>), AranLIFE ([www.aranlife.ie](http://www.aranlife.ie)) and RBAPS (Results-Based Agri-environment Payment Schemes; [www.rbaps.eu](http://www.rbaps.eu)) work directly with farmers to find an acceptable management solution that benefits both the grasslands and the farmers. Positive grassland management includes appropriate grazing and mowing regimes that keep swards open and discourage encroachment by non-grassland species.

It is clear that intensification is immediately damaging, as semi-natural habitats can be transformed to improved agricultural grassland in a matter of days or weeks. More insidious, but ultimately as damaging, are the impacts of undergrazing and abandonment, as these lead to reduced sward diversity, proliferation of competitive tussocky species, scrub and bracken encroachment, and eventual succession to non-grassland habitats.

### Concluding remarks

To protect our most valuable grassland habitats it is imperative that we can both identify them and determine what condition they are in. Early-warning systems such as loss of indicator species, reduced sward diversity and increasing sward height may signal a deterioration in ecological health that can be addressed before the situation becomes difficult to reverse. Grasslands are dynamic ecosystems which respond quickly, both to poor and to good management. Without timely intervention we may continue to lose a proportion of our Annex I grassland habitats every year. Knowing the criteria, targets and thresholds that enable rapid assessment of a grassland's ecological condition is a useful tool in the management of these important and often undervalued habitats.

Equally important, and ideally occurring in tandem with habitat monitoring, is dialogue between land managers and ecologists. Engaging with farmers is vital for the conservation of grasslands, as it is they who not only manage the land but earn a living from it. The gold standard for grassland management is a regime that promotes the conservation of vulnerable grassland habitats while maintaining sustainable livelihoods for the farmers who manage them. Examples of such regimes already exist, such as in the projects mentioned above, and these serve as excellent models for further work.

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# Upland Hay Meadows – Applying the Evidence to Improve their Conservation

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Upland hay meadows are a rare habitat restricted to upland valleys in northern England. They have been a focus of successive agri-environment schemes due to their conservation value. Despite this, the most botanically rich meadows have declined in quality. Maintaining appropriate nutrient and grazing management has been found to be critical to maintaining botanical quality and has informed current land management schemes. Increased flexibility of management, within well-evidenced parameters, is likely to result in more successful conservation and greater habitat resilience, as is a greater focus on landscape-scale effort, recognising the importance of other non-meadow refugia for key species.

## Introduction

Species-rich upland hay meadows are confined to the floors and lower slopes of valley heads from Bowland to the Cheviots, with the main strongholds in the Yorkshire Dales and North Pennines. They are found mainly on brown earth soils between 200 m and 400 m in altitude, where hay is routinely made in a sub-montane climate (Pinches *et al.* 2013) (Figure 1).



Figure 1. A species-rich upland hay meadow with field barn, Wensleydale, North Yorkshire. Photo credit D. Martin.



Figure 2. Wood cranesbill *Geranium sylvaticum*, a defining species of upland hay meadows. Photo credit D. Martin.

Whilst the defining National Vegetation Classification (NVC) community is MG3 *Anothoxanthum odoratum*–*Geranium sylvaticum* (Rodwell 1992), this frequently co-occurs with wetter vegetation including MG8 *Cynosurus cristatus*–*Caltha palustris* grassland and M23 *Juncus effusus*/ *acutiflorus*–*Galium palustre* rush-pasture. These meadows support a high diversity of plants, including seven species listed in the Vascular Plant Red List for England as endangered or vulnerable (Stroh *et al.* 2014). They also provide important nesting and foraging habitat for various waders and passerines within the upland landscape.

*Anthoxanthum*–*Geranium* grassland is most typically found in isolated fields or small groups of fields, but also occurs on road verges, riverbanks, and in woodland glades. Indeed, the few Scottish examples of this grassland type occur in largely unmanaged riparian situations. Most stands are less than 2 ha and the extant UK resource may be 600 ha or less.

The conservation value of these meadows is reflected by their inclusion as a habitat of principal importance (for conservation) under section 41 of the Natural Environment and Rural Communities Act 2006, and as an Annex I habitat under the

EC Habitats Directive 6520 (Mountain Hay Meadows - British types with *Geranium sylvaticum*) (Figure 2). Approximately half of the UK resource is designated as Sites of Special Scientific Interest (SSSI) with a significant proportion also Special Areas of Conservation (SAC).

### Traditional management

Historically these meadows were integral to upland hill farming systems providing winter forage for sheep and cattle, and nutritious grazing at other times, especially during spring lambing. The characteristic annual management cycle involves winter and often spring grazing; closure in early May when stock are moved to the open hill; a single, summer hay cut from July when periods of fine weather permit; and aftermath grazing in the late summer and autumn. Most meadows have traditionally been given a light dressing of farmyard manure (FYM) in the spring, with occasional liming.

### Meadow management in agri-environment schemes

The Pennine Dales Environmentally Sensitive Area (ESA) was established in 1987, principally in response to the threat posed to meadow biodiversity from silage

production and associated higher nutrient inputs. Farmers received payments for following management prescriptions that included delaying cutting until after a specified date, closing the meadow for a minimum period, and adhering to fertiliser limits (Tier 1). A higher management tier (Tier 2), which placed further limits on fertiliser application, and set later cutting dates and a longer minimum closure period, was added in 1992. This was similar to Wildlife Enhancement Schemes (WES) in operation on some SSSI meadows. The Higher Level Stewardship (HLS) Scheme was launched in 2005, with more flexible prescriptions that could be tailored to a site, and with a separate restoration option for grasslands. Prescriptions were underpinned by guidance that set out the management parameters likely to achieve the desired outcomes. In this way HLS attempted to address concerns that had been expressed about the ESA's standardised and inflexible management prescriptions. The latest scheme, Countryside Stewardship (CS), introduced in 2015, adopts a similar approach in allowing tailored meadow management based on a site-specific assessment (Figure 3).

### How effective have our conservation efforts been?

Natural England and its predecessor bodies have established and maintained an agri-environment scheme monitoring programme to determine progress against stated objectives, and assess value for money. As part of this, fixed quadrats were established at 500 meadows within the Pennine Dales ESA, either in 1987 or in 1992 when the ESA was extended. Sub-samples of these quadrats were re-surveyed in 2002 (Critchley *et al.* 2007) and 2012, after seven years of HLS (Hamilton 2014) enabling comparison with the baseline. Botanical survey has been allied to soil sampling and farm management surveys.

Analysis of these data revealed that the more species-rich meadows, with greatest affinity to MG3, had undergone a decline in herb richness (Critchley *et al.* 2007). Semi-improved meadows within the samples showed little change, suggesting that their botanical quality had been maintained. Unsurprisingly fields in the Tier 2 ESA management generally fared

better than fields in Tier 1. The more agriculturally improved meadows showed a small increase in species-richness, but were constrained by their relatively high soil fertility. Application of nitrogen (N) and early cutting were found to exert the strongest management effects, whilst the strongest soil gradient was extractable phosphate (P), separating species associated with unimproved and improved grassland (Critchley *et al.* 2007). Long-term climatic change and the effects of atmospheric N deposition were also cited as potentially confounding factors (Hamilton 2014).

Other studies have also reported declines in previously high quality meadows, including a reduction in frequency of wood cranesbill *Geranium sylvaticum* in the Yorkshire Dales (Pacha and Petit 2008). Botanical quality was found to be negatively correlated with fertiliser inputs, grazing intensity and degree of isolation, although the most diverse meadows were more likely to be in an agri-environment scheme. O'Reilly (2010) surveyed 500 meadows as part of the North Pennines AONB Partnership 'Hay

Time' project and compared the results with Nature Conservancy Council (NCC) data from the 1980s. Just 20% of those originally deemed highest quality remained species-rich, with around half of SSSI meadows having declined significantly.

### What is causing decline?

A dedicated programme of research and monitoring has provided important insights into how changes in the various elements of traditional meadow management affect meadow composition. In 2013, Natural England undertook a systematic review of available evidence (Pinches *et al.* 2013) to determine which management regimes maintain the floristic diversity and breeding bird populations of upland hay meadows. This review focussed on aspects of management where there has been particular concern and a degree of disagreement between ecologists and farmers, specifically nutrient inputs and spring grazing regimes.

### Nutrient inputs

The systematic review explored what types, rates, timing and frequency of nutrient

and lime applications sustained the conservation interest of meadows. Low levels of soil fertility are associated with high species diversity in a wide range of semi-natural grasslands, and compared to other mesotrophic grasslands in English ESAs the MG3 community tends to occur on soils with low extractable phosphate and potassium (K) (Critchley *et al.* 2002). The review found strong evidence that nutrient input of  $\geq 18$  kg N ha<sup>-1</sup>yr<sup>-1</sup> led to significant reductions in floristic diversity. Only one study, a 12-year Defra-funded experiment, had examined the impact of agriculturally low rates of nutrients on upland and lowland meadows. This showed that on an MG3 meadow FYM inputs of 12 tonnes ha<sup>-1</sup>yr<sup>-1</sup> (equivalent to inorganic fertiliser rates of 9 kg N, 10 kg P and 69 kg K ha<sup>-1</sup>yr<sup>-1</sup>) maintained vegetation quality on an MG3 meadow where inputs had been at a similar level historically. However, enhancement of botanical quality was achievable under lower nutrient rates of 6 tonnes FYM ha<sup>-1</sup>yr<sup>-1</sup> or less (equivalent to inorganic rates of 4.4 kg N, 5 kg P and 35 kg K ha<sup>-1</sup>yr<sup>-1</sup>).



Figure 3. Haymaking in Swaledale, North Yorkshire. Photo credit D. Martin.

# Feature Article: Upland Hay Meadows – Applying the Evidence to Improve their Conservation (contd)

Furthermore, the 12 tonnes ha<sup>-1</sup>yr<sup>-1</sup> treatment was found to be damaging on a related lowland meadow community with no recent history of inputs (Kirkham *et al.* 2014). The review concluded that nutrient inputs should be tailored to individual meadows based on soil nutrient status, past fertility management and conservation objectives. Evidence of differential impacts of alternate forms of nutrient on floristic diversity was limited and equivocal, though birds were found to benefit from increased availability of invertebrate prey associated with FYM applications.

The review findings suggest that the rates previously allowed under ESA Tier 1 management (up to 12.5 tonnes of FYM ha<sup>-1</sup>yr<sup>-1</sup> plus up to 25 kg N, 12.5 kg P and 12.5 kg K ha<sup>-1</sup>yr<sup>-1</sup>) were too high and even Tier 2 inputs (FYM at a maximum rate of 12.5 tonnes ha<sup>-1</sup>yr<sup>-1</sup>) will have been too high for some meadows. This concurs with evidence from a targeted study of meadows in Teesdale, which found an association between declining botanical quality and higher phosphate levels and long-term use of inorganic fertilisers (Starr-Kedde 2014).

Under Countryside Stewardship, inputs have been limited to 12 tonnes of FYM ha<sup>-1</sup> annually with the option of less frequent application and encouragement to tailor (reduce) inputs on the basis of assessment of trends in botanical quality, yield and on historic nutrient management (Pinches *et al.* 2013).

## Grazing

Grazing is an integral part of upland hay meadow management, but intensity and duration vary considerably. Historically there has been little control of grazing levels within agri-environment schemes, beyond setting closing and cutting dates.

Despite the perceived benefits of grazing, monitoring has shown that spring grazing, especially where prolonged, is associated with declines in herb richness and increases in competitive species (Critchley *et al.* 2007). The review found strong evidence that removing livestock by mid-May, and observing a spring sward height of at least 5 cm, maintained floristic diversity and closeness of fit to MG3 vegetation (Figure 4).

These findings came from a five-year Defra-funded experiment (Smith *et al.* in

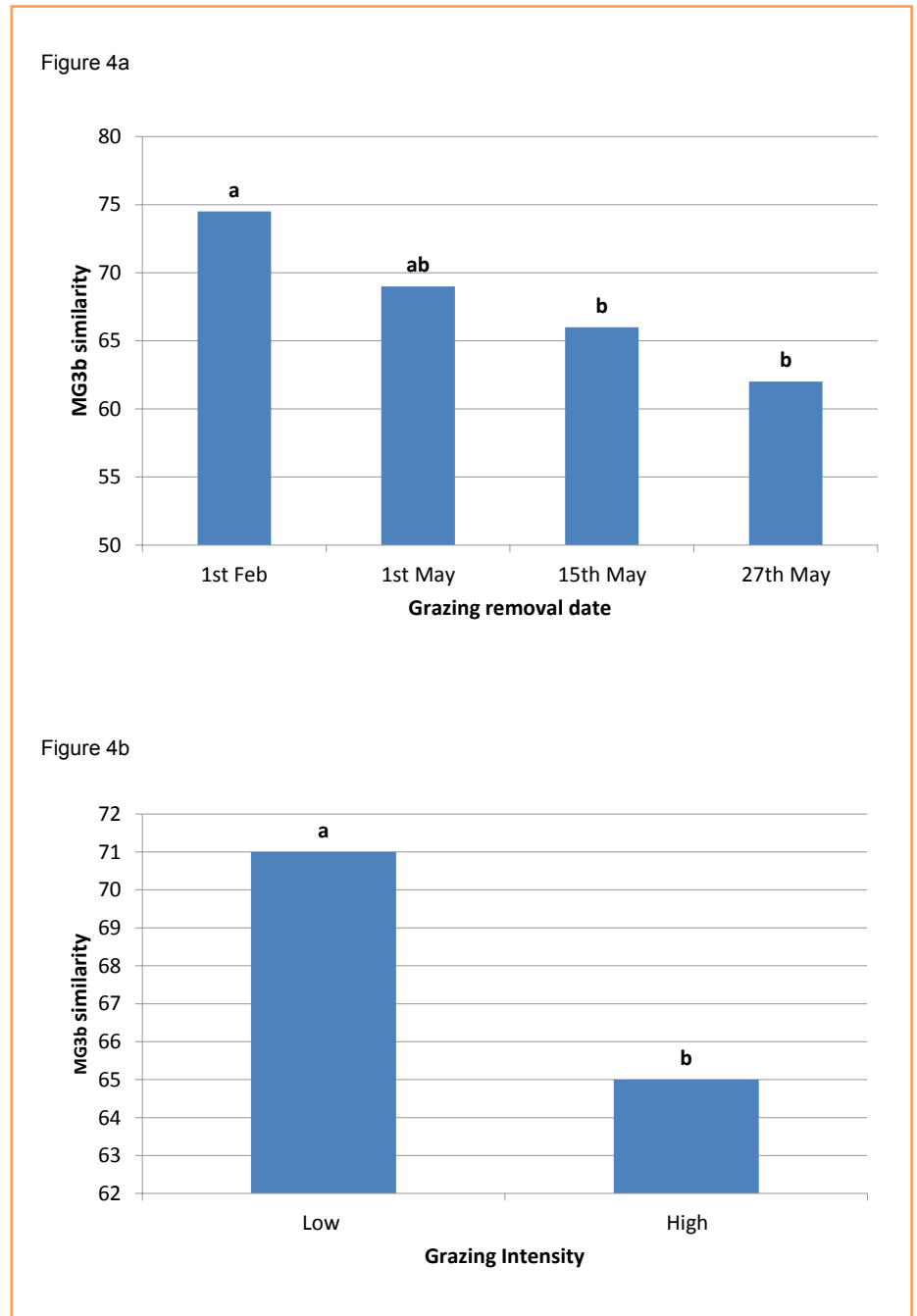


Figure 4. Effects of a) date of grazing removal and b) grazing intensity, based on sward height (low,  $\geq 5$ cm; high, 3-5cm) on similarity of unimproved meadow vegetation to MG3b (from TABLEFIT similarity co-efficient) using 5-year treatment means from a replicated paddock experiment. Shared letters indicate a lack of significant difference from Analysis of Variance.

press) (Figure 5) which postulated that spring grazing is likely to have a greater impact in warm, wet springs, when plant growth and development is more vigorous, than in cooler years. This effect may partly explain the decline in wood cranesbill detected by Pacha and Petit (2008); the stored resources of the plant being run down through grazing in increasingly frequent mild springs.

Earlier closing was, however, shown to result in poorer hay quality when cut at a standardised mid-July date similar to that specified in the ESA. O'Reilly (2010) has suggested that such inflexibility, together with increased mechanisation and silage making, has reduced variation in cutting times, with detrimental effects on the meadow resource. Current agri-environment schemes maintain a minimum



closed period, but allow for greater flexibility in cutting date, where field-dried hay is made. Setting a threshold level of spring accumulated temperature, which farmers could monitor, could provide a way of fine tuning stock removal, with phenological development of key species helping to inform cutting times.

### A landscape approach

The *Making Space for Nature* report to government (Lawton *et al.* 2010), identified the need for “more, bigger, better and more joined-up” areas for wildlife that help habitats and species adapt to climate change. Given their limited geographic and climatic extent, upland hay meadows are particularly vulnerable to climate change and its interaction with other aspects of management.

So, what can we do to increase their resilience? Evidence suggests that species-rich meadows have become scarcer and more fragmented in a matrix of

semi-improved and improved meadows. Geographic and genetic isolation may contribute to floristic impoverishment, for example the observed losses of wood cranesbill (Pacha and Petit 2008). A truly landscape approach to upland hay meadow conservation should concentrate less on meadows delineated by the characteristic stone walls, and more on the dynamics of the constituent species. Low intensity management of areas that provide links between other refugia of ‘meadow’ species such as road verges, riverbanks and woodland margins could maintain and enhance species meta-populations at the landscape scale.

Conservation management should aim to maintain low soil fertility, so limiting competition and facilitating colonisation by more stress-tolerant species, and to reduce inputs on more nutrient-rich soils, thereby promoting restoration. There may be scope to use grazing animals to proactively move seed from pockets of

species-rich vegetation to meadows that have identified restoration potential.

As part of the farm system, hay meadows are affected by management changes on other parts of the holding. Reducing grazing pressure on the fells in winter and spring to restore moorland habitats and breeding bird populations has resulted in increased grazing pressure on meadows. Greater integration of management of different aspects of the upland farmed environment is needed, to achieve better conservation and ecosystem service outcomes.

### The future

Despite the considerable conservation effort expended on upland hay meadows, we still face a number of challenges. As Britain prepares to leave the EU and Common Agricultural Policy, there is much to be determined in how farmers should be supported and incentivised, and which goods and services should be paid for from the public purse. The evidence suggests



Figure 5. Natural England staff and research contractors discuss the spring grazing experiment in Wensleydale, North Yorkshire. Photo credit D. Martin.

# Feature Article: Upland Hay Meadows – Applying the Evidence to Improve their Conservation (contd)

that there is a need for greater flexibility and more meadow-specific tailoring to improve the effectiveness of conservation measures within management agreements (Pinches *et al.* 2013).

The Payment by Results model, currently being piloted in Wensleydale, may offer an alternative and more flexible approach to scheme delivery (RBAPS, [http://ec.europa.eu/environment/nature/rbaps/index\\_en.htm](http://ec.europa.eu/environment/nature/rbaps/index_en.htm)). This EU-funded project is exploring the effectiveness of linking payments directly to delivery of environmental outcomes. Participating farmers have greater autonomy in decision making, and the ability to self-assess their progress against a range of indicators, including botanical diversity. The pilot includes provision of training and support and has been well received by farmers taking part. The findings of this and other similar European projects will inform the development of new European agri-

environment schemes, and post EU-exit measures for the UK.

## Conclusions

It is impossible to replicate fully the farming system that first gave rise to species-rich meadows given the markedly different socio-economic backdrop. However, research and monitoring has identified the management interventions most likely to maintain these grasslands and their component species. We may need to focus less on replicating annual management cycles and more on increasing the resilience of the remaining species-rich grasslands. This is likely to entail reducing pressures from nutrient loading and grazing intensity in the wider landscape, thereby making the entire system more environmentally sustainable. The challenge for conservation bodies is in working with farmers to develop, test and deliver these new approaches.

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# Managing Roadside Grasslands Along the Trunk Roads of Southwest England

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Keywords: grassland management, roadside biodiversity, roadside management, transport corridors



Early purple orchid *Orchis mascula* on a road cutting in Devon. Photo credit Leonardo Gubert.

An effective management programme is imperative for roadside grasslands. It should highlight habitats of conservation value, prioritise plots for management and provide detailed prescriptions for individual plots, helping Highways England and other highway authorities to fulfil biodiversity commitments. This article is based on evidence from practical implementation of a grassland management programme over a 14-year period along trunk-road verges in Devon and Cornwall.

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## Introduction

Roads and traffic have become a permanent part of our physical, social and cultural environment. Traditionally, roads have been symbolically linked to progress and prosperity due to their economic and social significance as transportation and utility corridors. However, studies have demonstrated that many of the most pervasive threats to biological diversity – habitat loss and fragmentation, barrier

## Feature Article: Managing Roadside Grasslands Along the Trunk Roads of Southwest England (contd)

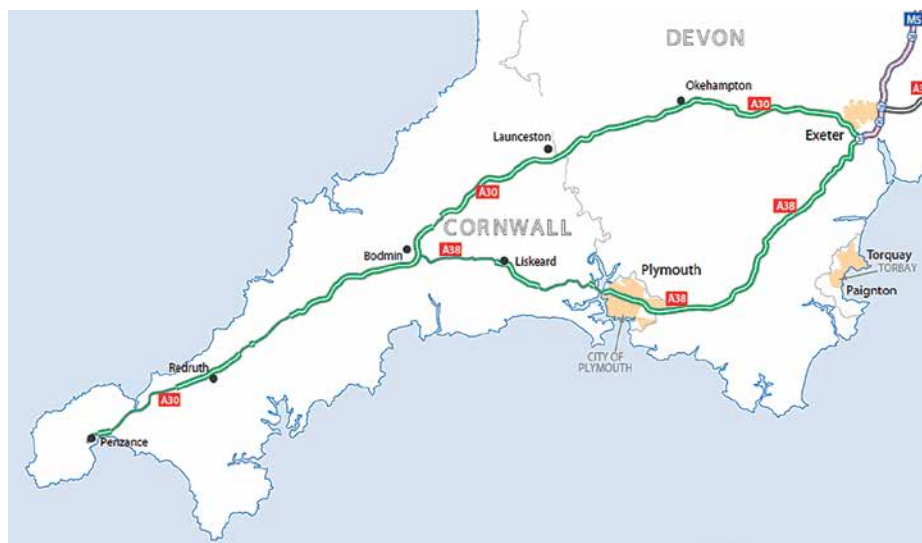


Figure 1. Map of Highways England Area 1.

effects, invasion of exotic species, pollution – are aggravated by roads (Trombulak and Frissel 2000, Spellerberg 2002, Forman *et al.* 2003). Road density throughout the world has drastically increased in the past century and roads now represent one of the most widespread forms of modification to the landscape (Smith 1990); it has been suggested that over 20% of the United States is directly affected by roads (Forman 2000).

Nevertheless, roadsides are often regarded as areas of conservation value, acting as important wildlife corridors through the landscape and providing refuges for species no longer able to survive elsewhere (Wilkie

*et al.* 2000). In the UK, the total area of road verge habitat, or 'soft estate', is considerable, occupying around 178,000 ha in England and Wales. In England, the area of soft estate managed by Highways England along motorways and trunk roads (often referred to as the strategic road network) covers an area of approximately 30,000 ha and includes a wide range of habitats and plants. The importance and diversity of plants on roadside verges in the UK was described by Way (1977) who reported that 870 of the nearly 3000 species described in the New Atlas of the British and Irish Flora (Preston *et al.* 2002a) survive on road verges.



Figure 2. Species-rich grassland along a trunk road. Photo credit Leonardo Gubert.

This article describes how roadside biodiversity can be conserved and managed using a Grassland Management Programme based on experience from verges along the A30 and A38 trunk roads to the west of Exeter, Devon, within current Highways England maintenance region Area 1 (Figure 1). Here, grasslands account for nearly half of the total area of soft estate covering an area of around 450 ha, including amenity grasslands (areas typically seeded with grasses such as lay-bys and rest areas) and visibility splays. Species-rich grassland (>15 species/m<sup>2</sup> including grasses) makes up a fifth of the grassland area with some 85 ha distributed across a 373-km trunk road network (Figure 2).

A Grassland Management Programme was adopted by the (then) Highways Agency in 2002 to aid the management of the grassland resource within Area 1. Since then, with regular monitoring, advances in technology (such as GIS-mapping and enhanced grass cutting equipment), changes in traffic management requirements and budget fluctuations, the Grassland Management Programme has evolved gradually as lessons are learned. This process of adaptive management allows the Highways Agency to meet local biodiversity targets and contribute to its broader Biodiversity Plan (Highways England 2015) as well as DEFRA's National Pollination Strategy (DEFRA 2014).

### Management of trunk road verges in the southwest

In the last ten years, the conservation potential of roadside verges in the UK has been recognised but enhancing their biodiversity value can only be achieved under effective management by road authorities. This is particularly true for grasslands within these mostly artificial, man-made habitats. In the UK, the reduced frequency of mowing since the economic downturn in 2008 and, historically, the abandonment of roadside grazing, has potentially given taller plant a slight but nonetheless statistically significant advantage over short plants, which are favoured in short swards. This pattern along roadside verges may be contributing to changes in the British flora as described by Preston *et al.* (2002b).

Roadside grassland management is a critical, laborious, expensive and time-



Figure 3a. Southern marsh orchids at A30 St Erth roundabout in Cornwall. Photo credit Leonardo Gubert.



Figure 3b. Early spring primroses *Primula vulgaris* on road verge along A38 Devon. Photo credit Leonardo Gubert.

consuming operation for most road maintenance authorities. Most intentional planting is designed to fulfil a specific function, such as screening, improved road safety, integration with the wider landscape, biodiversity enhancement and aesthetics. The use of imported topsoil (a practice widely used during construction of strategic roads from the 1970s to early 2000s), underlying soil type and geology will determine which seed mixes and plants are used, and seed sources in the area will also influence how the verges develop over time. Effective management is not just a matter of mowing the grass; it is an integrated approach incorporating biodiversity, road safety, forward and sign visibility, road structures and technology, design of road improvements, construction operations and maintenance activity, as well as addressing the needs of road users and compliance with government statutes.

### Botanical survey

The first step for an effective management approach to roadside grasslands is to know what there is and where it is. When travelling at speed along roads, it may appear that roadside grasslands are mostly continuous stands of false oat grass *Arrhenatherum elatius*, common ragwort *Senecio jacobaea* and thistles *Cirsium* spp., all under the imminent threat of scrub encroachment. Whilst this may be true for many road verges, the diversity of species can be surprising under closer examination. In Highways England Area 1, over 300 grassland and heathland plant species

have been identified since 2010 following targeted botanical surveys by consultant ecologists. Several 'prime' sites of species-rich grassland were validated by the surveys and new ones identified; some verges supporting threatened and notable plants have been designated as County Wildlife Sites. The best verges tend to be those where local soil structure (pre-road construction) has been maintained or exposed (Figure 3). Some road cuttings along the A30 in Cornwall have proved to be ideal habitat for thousands of southern marsh orchids *Dactylorhiza praetermissa*, common spotted orchids *Dactylorhiza fuchsii* and pyramidal orchids *Anacamptis pyramidalis* (Figure 3a). In Devon, a single trunk road junction is home to thousands of orchids: ten different species have been

recorded, which, together with a number of other notable species, make the site unique in a local and regional context. Other important plants such as mezereon *Daphne mezereum* and Deptford pink *Dianthus armeria* can be found on exposures created by road construction (Figure 4).

The diversity of plants and habitats within Area 1 supports a varied invertebrate assemblage. In a recent pilot survey of 41 roadside grassland (both aesthetic and species-rich) and heathland plots, 864 different species were recorded by entomologist consultants. The list is dominated by flies (361 taxa) but also includes beetles (177), butterflies and moths (109), bugs (82), bees, ants and aculeate wasps (53), spiders and harvestmen (50), grasshoppers and



Figure 4. Deptford pink on roadside verge. This plant has reacted positively to consistent management efforts aimed at reducing scrub cover and its range has expanded eastward along this verge following the direction of moving traffic. Photo credit Leonardo Gubert.

## Feature Article: Managing Roadside Grasslands Along the Trunk Roads of Southwest England (contd)

crickets (11) and dragonflies and damselflies (11), 5 woodlice (Isopoda), 2 scorpion flies (Mecoptera), 2 earwigs (Dermaptera) and 1 lacewing (Neuroptera). Pitfall trapping (which was not carried out) would undoubtedly have extended the beetle and bug lists. The list includes a number of rare and scarce species (notably the tachinid fly *Policheta unicolor* and lygaeid bug *Trapezonotus ullrichi*) and seemingly the first SW England record for the southern oak bush-cricket *Meconema meridionalis*, which is a recent British colonist. Pollinators are very well represented and the species list revealed that flies (Diptera, adults of which are amongst our most important pollinators) constituted the most diverse group, encompassing a tremendous variety of life cycle strategies and ecological relationships.

### Grassland Management Programme in Devon and Cornwall

An effective and costed Grassland Management Programme (GMP) has been implemented by Highways England across its road network in Devon and Cornwall since 2002. The GMP is reviewed each year, enabling biodiversity and landscape commitments to be met whilst at the same time providing best value for money.

The Area 1 GMP is now fully GIS-based. The GMP identifies all aesthetic and species-rich grasslands within the soft estate that require specific management and provides cyclic, prescriptive management recommendations for individual grassland plots based on previous

surveys and habitat mapping exercises. Grasslands that form the 1.2 m width of 'swathe cut' adjacent to carriageways are not included because they are managed primarily for safety requirements.

Grassland verges are classified either as aesthetic plots (open grassland) or conservation plots (species-rich grasslands). Conservation plots are assigned to Level 1 (top priority), receiving prescriptive management annually, or Level 2 (lower priority), managed every three years. Arisings that originate from both levels of species-rich grasslands are collected and removed off-site or stacked *in situ* where suitable.

Aesthetic plots receive no specific conservation management but were initially cut every five years with the aim of simply maintaining them as grassland. However, when two full cycles of the GMP were complete (e.g. 10<sup>th</sup> year of implementation), it became evident that the five-year management interval was insufficient to maintain aesthetic grasslands in favourable condition, as it allowed enough time for woody vegetation to establish and encroach into the open grassland areas. The result was that 'grasslands' had to be managed with chainsaws, rather than normal grass cutting equipment, to clear scrub covering between 30% and 100% of aesthetic plots. This was not only detrimental to species and the habitat but was also an expensive and time-consuming operation that cost around 6.5 times more than normal mechanical grass cutting.

In order to address this, the original five-year GMP cycle for aesthetic plots was reviewed and reduced to three years. Close monitoring of each section and its development over the growing seasons has shown that the three-year interval is sufficient to keep scrub encroachment in check with the use of normal roadside grass cutting equipment, without the need for chainsaws, wood chippers and associated traffic management. The revised approach has also reduced the amount of green waste generated and the costs of removing this material off the site.

It is important that management plans are regularly reviewed and critically analysed to ensure they are fulfilling their purpose; two full cycles are generally sufficient to detect trends and identify areas where increased (or relaxed) intervention is required. Although the initial switch from cutting every five to every three years proved to be slightly more expensive, it will save money and resources in the long term. At the same time, it reduces the time needed on-site and therefore also lessens the safety risk to operatives working at the roadside (chainsaw operations take considerably longer than mechanical grass cutting carried out by tractor or specialist self-propelled grass cutting equipment). It also reduces the associated disruption to the road network caused by traffic management. Furthermore, it makes scrub control more manageable and may reduce the need for chemical control in the long term.

### Future management

Through their Biodiversity Plan, Highways England (2015) have committed to the creation of large areas of species-rich grassland on their soft estate across the country, in support of DEFRA's National Pollinator Strategy (DEFRA 2014). Whilst this has been seen by some conservation organisations and government bodies as an ambitious aspiration, it is often simply a matter of managing grasslands actively and increasing plant diversity using methods such as seeding with locally sourced material, hay strewing using green hay (Figures 5, 6) and plug planting (Figure 7). In some cases, particularly on neglected sites, blanket chemical treatment and/or topsoil stripping are required to remove scrub and non-target species and to reduce soil fertility.



Figure 5. Species-rich grassland being cut, timed to avoid main flowering season and to capture most seed material. Photo credit Leonardo Gubert.



Figure 6. Spreading seed material (green hay) on prepared ground along the road verge. The use of additional, locally sourced wildflower seeds can also be used as part of this process. Photo credit Leonardo Gubert.

Unfortunately, by nature of their location alongside roads, verges are under constant threat. From erratic vehicles to litter and fly-tipping, spillages and the accommodation of a myriad of underground services, together with constant soil fertilisation from traffic emissions and road maintenance operations, there seems to be little scope for conservation. However, with careful control and communication, an up-to-date habitat inventory, knowledge of grassland management, reliable contractors and sound financial planning, it is possible to maintain and progressively enhance roadside grasslands.



Figure 7. Devil's bit scabious *Succisa pratensis* plugs being planted alongside a slip road to create habitat for the marsh fritillary butterfly *Euphydryas aurinia*. Photo credit Leonardo Gubert.

## Conclusion

With the increasing worldwide loss of biodiversity, road verges are important conservation areas, especially when they support remnant populations of ancient natural habitat. In some urban situations, road verges are the only green spaces remaining and for some people road verges offer their only connection with nature. Their value is underlined by the existence of local nature conservation organisations and voluntary groups who manage otherwise neglected road verges for biodiversity at their own cost and through their own hard work.

If biodiversity is to be conserved for future generations, making the most of roadside habitats, including the design, functionality and management of roads and road networks, is crucial. Roadside verges must accommodate the needs of natural communities and ecosystems just as efficiently as the roads themselves accommodate our need for transport routes. The soft estate is an important part of any road network but fundamental changes are required to road transport systems in general. We should look not only at the benefit they bring to humanity as transportation corridors, but also at the biodiversity they support and the value of the associated habitats and ecosystems. Roads and road verges must be treated by highway authorities as important assets instead of liabilities. By using tools like the Grassland Management Programme, action plans can be implemented efficiently and biodiversity targets can be met for mutual benefit.

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# Grazer Selectivity: Benefits for Livestock, Habitats and People

**Bill Grayson**  
Morecambe Bay Conservation Grazing Company

Keywords: conservation grazing, dietary preference, grassland management, livestock behaviour, selective grazing, species-rich forage



Unimproved limestone grassland. Photo credit Bill Grayson.

Conservation grazing seeks to deliver positive outcomes for habitats that require grazing livestock to maintain or enhance their ecological value. These animals graze selectively, ingesting some plants in preference to others but in ways that are difficult to interpret or predict. Observations of one conservation grazing system that has operated over the last

25 years are used to illustrate some of the key principles and issues influencing the results it has achieved. These experiences are reviewed in the light of some recent research findings.

## Introduction

Selectivity is one of the most important adaptations of grazing animals, even when they are farm livestock grazing an improved grass sward of uniform appearance and containing few plant species. Dietary choice allows them to maintain fitness

and boost performance, helping lift farm profitability. Much less is known about how grazer selectivity operates in the context of conservation grazing, where species-rich habitats provide a much wider choice of plant species to eat but where little is known about the palatability and nutritional value of these plants, despite the obvious significance this has for determining the outcome of whatever grazing prescriptions are applied.

The Morecambe Bay Conservation Grazing Company (MBCGCo) is a specialist farming business that has provided dedicated conservation grazing regimes to nature reserves across north-west England for the

# Feature Article: Grazer Selectivity: Benefits for Livestock, Habitats and People (contd)

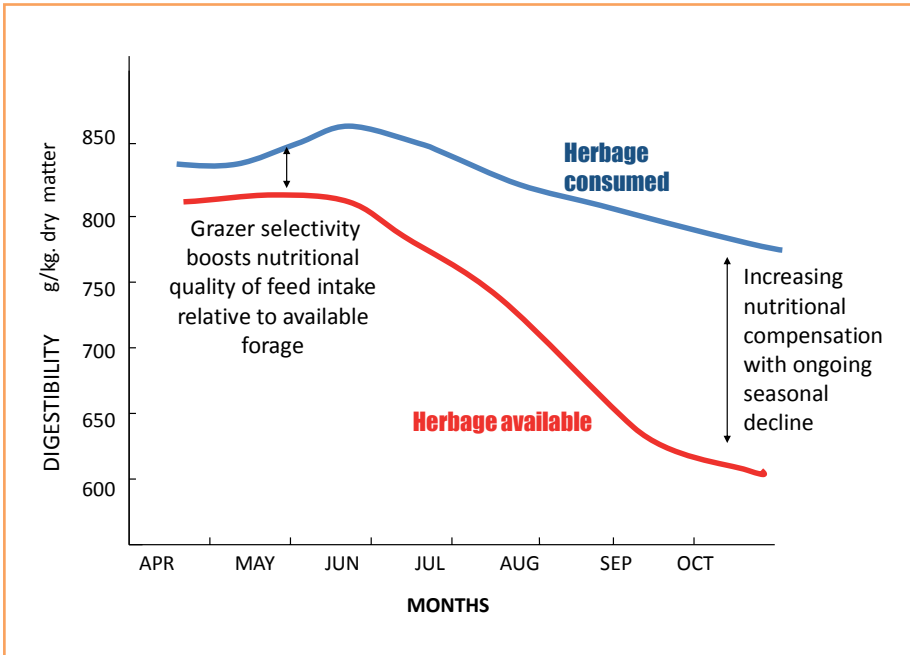


Figure 1. Effects of dietary selection on energy intake by dairy heifers grazing improved pastures through the growing season (reproduced from: Le Du et al. (1981). *Grass and Forage Science*, **36**: 307-318).

last 25 years, using native British breeds of beef cattle. Throughout this time the grazing behaviour of the cattle, in sustaining themselves throughout the year on a variety of unimproved, semi-natural habitats, has been closely observed. The purpose of this article is to review this experience in the light of recent research findings about the nature of grazer selectivity and its implications for livestock production, ecological diversity and human health.

## Livestock grazing behaviour

Selectivity is a fundamental trait of grazing animals, enabling them to choose elements from the available herbage that contain higher concentrations of particular nutrients that they need at different times. This is true even for commercial animals, reared intensively on improved grassland containing very few species, often dominated by just one species, perennial ryegrass *Lolium perenne*. Even when restricted to this type of pasture, dairy heifers can still locate and ingest elements of the vegetation that contain significantly more digestible energy than is available across the field as a whole. The nutritional advantage actually increases throughout the season despite the continuing decline in digestibility with ageing of the sward, overall (Figure 1).

Unimproved pastures, such as the limestone grassland pictured above, contain a much richer mix of plant species than can be found in most farming situations. They usually include a range of colourfully flowering dicotyledonous species, here termed herbs, which often make up a larger proportion of the

total sward biomass than can be found in conventionally farmed grassland; maintaining or enhancing the richness of this herb component is usually the main objective for conservation grazing regimes. The grazing intensity prescribed for nature reserves is usually much lower than for commercial farms of corresponding land quality, to allow more flowering and seed production, which provides nectar and other food sources for animal species.

Livestock reared on this type of grazing therefore have much more choice about what to eat, both in terms of the range of species and the variation in their growth stages. Conservation managers, however, sometimes perceive grazer selectivity as a problem, expressing concerns whenever the animals are seen consuming desirable species of plants or avoiding those species that are considered undesirable.

Although considerable effort has been invested in researching the dietary behaviour of commercial livestock, little is known about what drives diet selection of livestock in a conservation grazing setting. One study monitored the movements of a group of MBCGCo cattle using a GPS collar attached to one individual within a group of 18 animals whilst grazing on Ingleborough National Nature Reserve (NNR), Yorkshire Dales (Figure 2).

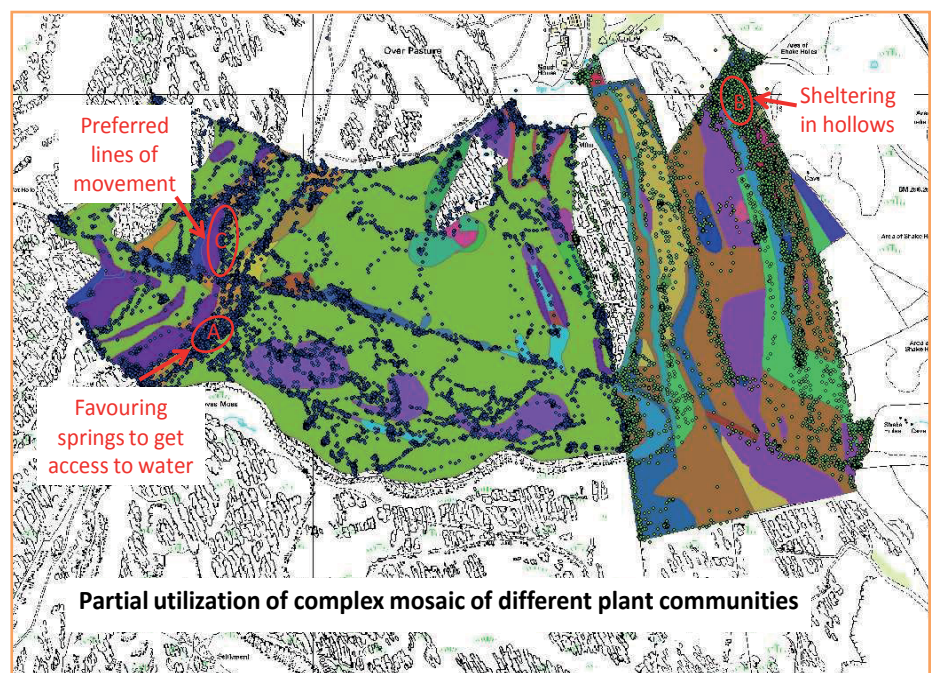


Figure 2. Records of cattle movements using a GPS collar at Ingleborough NNR in 2007. Photo credit Bill Grayson.

Figure 2 maps the locations, shown as small dark-coloured dots, recorded by the GPS collar at 30-minute intervals over two 2-week periods during the 2007 grazing season (July – December) during which the cattle moved around two separate parcels of upland limestone grassland and heath, of area 113 ha and 75 ha respectively. The areas of solid colour indicate the different plant communities, as recorded by National Vegetation Classification methodology, in which variants of upland limestone grassland were the most widespread vegetation type. Unsurprisingly, with such a low stocking rate, much of the area available for grazing was not utilized, indicated by dot-less expanses. The cattle did visit all the various plant communities to some degree but largely avoided areas of limestone pavement, where the terrain was too uneven. There were noticeable concentrations of activity in a few locations some of which corresponded with the availability of spring-fed water on warmer days (circle A in Figure 2) or shelter from low-lying hollows when the weather was stormy (circle B).

Direct observations indicated that the cattle often grazed on the move, walking slowly forward whilst taking mouthfuls of vegetation on either side. A number of such grazing ‘sequences’ appear on the map, marked by closely spaced lines of dots, coinciding on the ground with the animals’ footmarks and droppings (e.g. circle C). The turf in the vicinity of these grazing routes was usually shorter and greener relative to the rest of the site, with a noticeably greater abundance of herbs. Much less evidence of grazing was noted in adjoining areas where the sward was taller and more grass-dominated. Samples sent for analysis indicated that material collected from the areas of short-sward that the cattle preferred to graze contained one third more crude protein compared with that collected from the taller areas. Shorter turf usually contains a richer variety of plant species than taller grassland because grazing reduces the competitive advantage that grasses enjoy when allowed to grow unchecked; often it is the herb component that benefits most conspicuously from this relaxation. The cattle seem to be drawn back to repeatedly graze these same areas, indicated by heavy

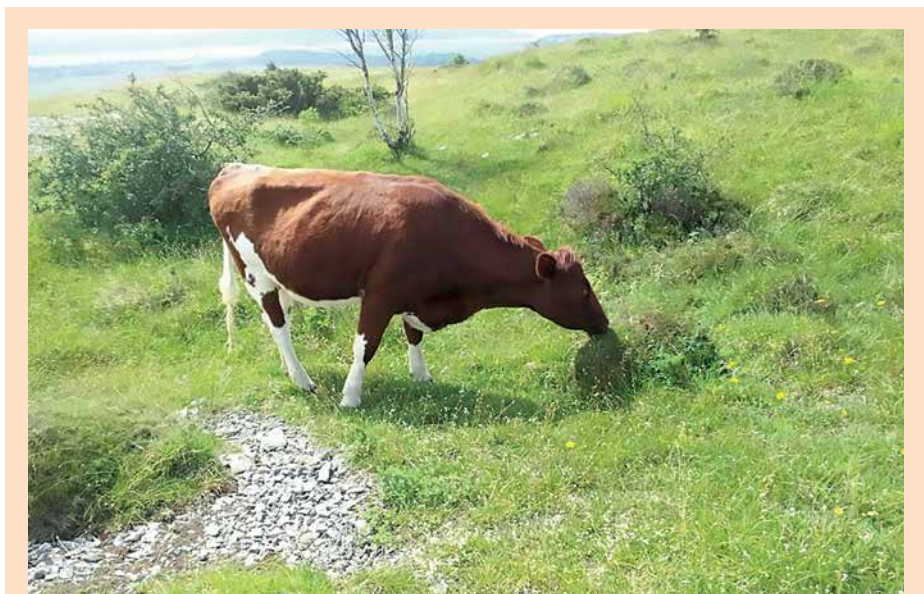


Figure 3a. Cattle appear to favour more diverse and herb-rich swards. Photo credit Bill Grayson.



Figure 3b. Removing grazing results in the loss of ant colonies and reduced species richness. Photo credit Bill Grayson.

accumulations of dots on the map that coincide with these areas of closely-grazed, herb-rich turf. This association between the grazers’ dietary preferences and their tendency to generate the herb-rich pasture that is conservation grazing’s main focus is a crucial synergy, although fully realising its potential does depend on establishing the right grazing regime in terms of timing, duration and intensity. The habit livestock have of favouring the most herb-rich areas of sward can be a cause for concern amongst site managers if it results in a reduction in the intensity of flowering of the herbs. But this has to be balanced against the risk of relaxing the grazing too much, which might allow the grasses to smother the smaller herb species.

This conundrum is exemplified by the relationship between the MBCGCo cattle and ant-hills of the meadow ant *Lasius flavus*. The cows clearly relish the vegetation that covers the ant-hills, investing considerable time and effort to ingest small mouthfuls of the very short, herb-rich turf that covers them (Figure 3a). These ant colonies actually depend on the grazing for their continuing survival, which maintains the overlying turf in a suitably short condition to ensure a correct internal microclimate for the nest. Abandoning grazing on a site usually results in death of most of its ant colonies, as the herb-rich mounds are soon overwhelmed by coarse grasses (Figure 3b). This particular set of inter-relationships appears to embody much of the ethos of conservation grazing.

### Nutritional quality

MBCGCo's winter feeding routines provide additional evidence of the cattle's preference for herbs. When presented with samples of hay or haylage scattered in piles across a field (a technique MBCGCo has developed to facilitate introduction of new species into species-poor meadows), the cattle show their dislike of piles that consist mainly of grasses by moving quickly on to check if the next heap contains more herb-rich material. Once they have found something containing plenty of herbs they stop searching for alternatives while they finish the rest of that pile. These different reactions originate from the mix of species in the particular fields where the different forages were made. Appearance, smell and taste probably all help the cattle assess the proportion of herbs in the forage. Herbs tend to turn dark brown on drying or ensiling, giving the herb-rich fodder a distinctly darker colour, whilst also producing a sweet-smelling fragrance compared with the sharper tang of grass-only forages.

Laboratory analysis of sub-samples of herb and grass components separated out from within the same bale showed that the herb-only portion contained more than twice as much protein and a third more energy compared to the grass-only constituents. It also contained higher amounts of all the major minerals and trace elements, demonstrating in no uncertain way that in preferentially selecting herb-rich fodder, these cattle know what is best for them, nutritionally.

Cattle allowed to graze on species-rich pastures on nature reserves obviously are much freer to express dietary choice than those confined to a winter-feeding regime in which they depend on whatever ration the stock manager is able to supply them with. Most commercial farmers rely on improved, ryegrass-dominated grassland to feed to their livestock because it responds well to inputs of soluble nitrogen fertilizer, producing reliable yields of recognized and measurable quality. So, whilst conservationists are naturally keen to encourage farmers to establish more herb-rich grassland, it will not be easy to convince them of the commercial advantages of including more herbs within their species-mix without some hard, supporting evidence.

One issue that may arise when seeking to inform farmers' decisions about the role of herbs in their grassland concerns the range of defensive chemicals they contain, many of which can be toxic if consumed in large amounts. This is unlikely to increase their appeal for any self-respecting livestock farmer. The fact that each species of herb has its own specific set of chemicals, however, means that grazing livestock can still eat them safely, by restricting the amounts of any one plant to levels that can be safely de-toxified. This is achieved more reliably if the mixture contains more species, another very persuasive argument in favour of diversity.

It would seem paradoxical for grazing livestock to prefer herbs if they can suffer harm by over-eating them. It is, however, a situation that bears comparison with our own fondness for culinary herbs and spices, food supplements that are packed with plant-defence chemicals but which, in moderate amounts, contribute to our overall sensory experience. Diversity therefore seems to offer the safest protection for livestock that graze flowery pastures (and people eating spices too perhaps!). By limiting the intake of any single plant, grazing animals are able to de-toxify the specific chemicals it contains, without their liver being overwhelmed, something that also applies to all the other compounds in the herb species in a mix. So, large amounts of herb material can still be safely ingested, overall, affording enhanced levels of nutrition, as long as they are part of a mix – and the more diverse the mix, the better.

### Conservation grazing

Such a positive association connecting the dietary preferences of our native-breed cattle with the rich diversity of herbs in Britain's semi-natural grassland is probably no coincidence; the two have co-evolved over millennia. Conservation grazing, despite being a relatively new management practice, is founded on this age-old relationship, employing its principles and processes to deliver ecological objectives for grasslands and other semi-natural habitats. Animal production and economic performance are considered as secondary objectives, somewhat in contrast to the primacy given them in commercial livestock farming. Despite their different agendas, however,

the two grazing disciplines share many operational similarities, something that should allow them to learn from each other's experience. Certainly, the benefits that herb-rich swards can provide for individual animal performance might be something that conservationists might wish to use to help promote the case for greater diversity in grazing regimes within farming circles.

Browsing is another aspect of livestock behaviour that is especially significant in the management of many reserves, where less intensive grazing regimes, intended to favour flower abundance, make it easier for trees and shrubs to encroach on grassland and other open habitat. Browsing behaviour varies considerably according to species, breed and individual history. Young calves have to learn what plants to eat, acquiring an aptitude for browsing by copying their mother. This is shown in Figure 4 where one of MBCGCo's cows and her calf are both eating sprigs of ivy *Hedera* spp. provided as part of their winter feeding routine when little other browse is available. The pair obviously enjoy it, instantly leaving whatever other activities they are doing to come and eat it. This kind of early experience is especially important in shaping the dietary preferences of each new generation of conservation grazers.

The best way to ensure that the most suitable animals are available for grazing nature reserves is therefore to breed and rear them within the same conservation grazing system that will eventually benefit from their activities. MBCGCo has been doing just this for 25 years so that calves begin acquiring the necessary attributes from birth, growing up within a herd culture already adapted to the more challenging diet.

Maintaining these inter-generational links connecting grazing animals with the particular range of plant communities that they will have to cope with throughout their productive years is an important way of enhancing their grazing abilities and developing their resilience. Successive generations of breeding animals can be selected on the basis of how well they have performed in meeting the specific set of challenges during their early years. The herd should, over time, become ever better adapted to its environmental challenges, in



Figure 4. Learning to browse: cow and her 4-week-old calf eating ivy.  
Photo credit Bill Grayson.

a manner entirely consistent with selective ecological principles. This ‘naturalistic’ strategy has undoubtedly played a large part in MBCGCo’s continuing success.

Inclusion of woody plants provides a significant added benefit within the specific context of a conservation grazer’s diet, where the available pasture is more likely to be rich in herbs. The leaves of trees and shrubs contain high concentrations of tannins, defence compounds that bind with other constituents and make them less available for digestion. Crucially this also provides a buffer against the toxins that grazing animals routinely ingest as part of a herb-rich diet. This association seems especially serendipitous for reserve managers, combining as it does the two main targets for conservation grazing – herbs and shrubs – in such a mutually reinforcing way. Although, again, on further reflection this should not come as any surprise, given that, for millennia, cattle in Britain have thrived amongst very similar circumstances, on a diet combining a wide mixture of different plant species, both woody and herbaceous. Given this history, it would be surprising if they had not long since found ways of utilizing the best nutritional synergies available to them. MBCGCo cattle are certainly enthusiastic browsers; they usually have access to

trees and shrubs alongside the herb-rich material from semi-natural, unimproved grassland that makes up the bulk of their diet. During the summer months, for example, cows can be seen routinely spending minutes at a time browsing the in-leaf blackthorn *Prunus spinose* hedges that surround their pastures at Gait Barrows NNR, Lancashire, with their calves by their sides (Figure 5). Carefully picking off such small and well-defended foliage cannot be the most efficient way of taking in energy or other major nutrients, but this behaviour is so habitual that it must be of more than passing significance in their overall feeding strategy. The younger calves usually participate alongside their dams, presumably learning the technique by copying the adults. As the season progresses, they are increasingly seen to initiate their own bouts of browsing behaviour, demonstrating very clearly how grazing behaviour gets passed on from one generation to the next.

Such reliable patterns of behaviour lend weight to the conclusion that browsing is more than just a casual diversion and, given the specific context here, seems likely to be part of these cows’ detoxification strategy. The sward at Gait Barrows has become especially rich in herb species over the last 20 years under

its current grazing regime, which was designed to achieve this very result. The history of this one site illustrates many of the key principles of interconnectedness and synergy that are emerging from some of the latest grazing research.

### Human dietary impacts

Although it is reassuring to know about synergies linking the health of grazing livestock and the richness of the habitats that they graze, they are not altogether surprising, given everything we now understand about the dynamics of diversity. However, there is increasing evidence for another, higher tier of mutually beneficial feedback, through which the meat and milk from animals reared in this special way provide healthier food for the human consumer. A growing body of knowledge suggests that such products have enhanced profiles of essential fatty acids, anti-oxidants and micro-nutrients compared with samples taken from animals reared on a more calorie-intensive but ecologically less diverse diet of grass and cereals. The situation might best be summed up by extending that old adage, ‘You are what you eat’ to become ‘You are what you eat *has been eating*’. A review of the latest research raises possibilities for establishing a health-boosting ‘conservation brand’, backed up by a substantial evidence base (Provenza *et al.* 2015; <https://www.researchgate.net/publication/280774993>).

### Conclusion

Conservation grazing is able to deliver three inter-related ‘public goods’: i) richly diverse semi-natural habitats, ii) healthy, productive, unstressed livestock, and iii) human food that is full of distinctive flavour and essential health-promoting nutrients. Producing the optimum combination of all three of these benefits may be most reliably achieved by providing situations where the selective instincts of the livestock can be given full play, allowing them to graze in a manner that best reflects their ecological origins. Such a naturalistic approach emphasises the win-win character that links all of these outcomes, expressing itself through strongly re-enforcing synergies that accord well with ecological principles and the conservation ethic.

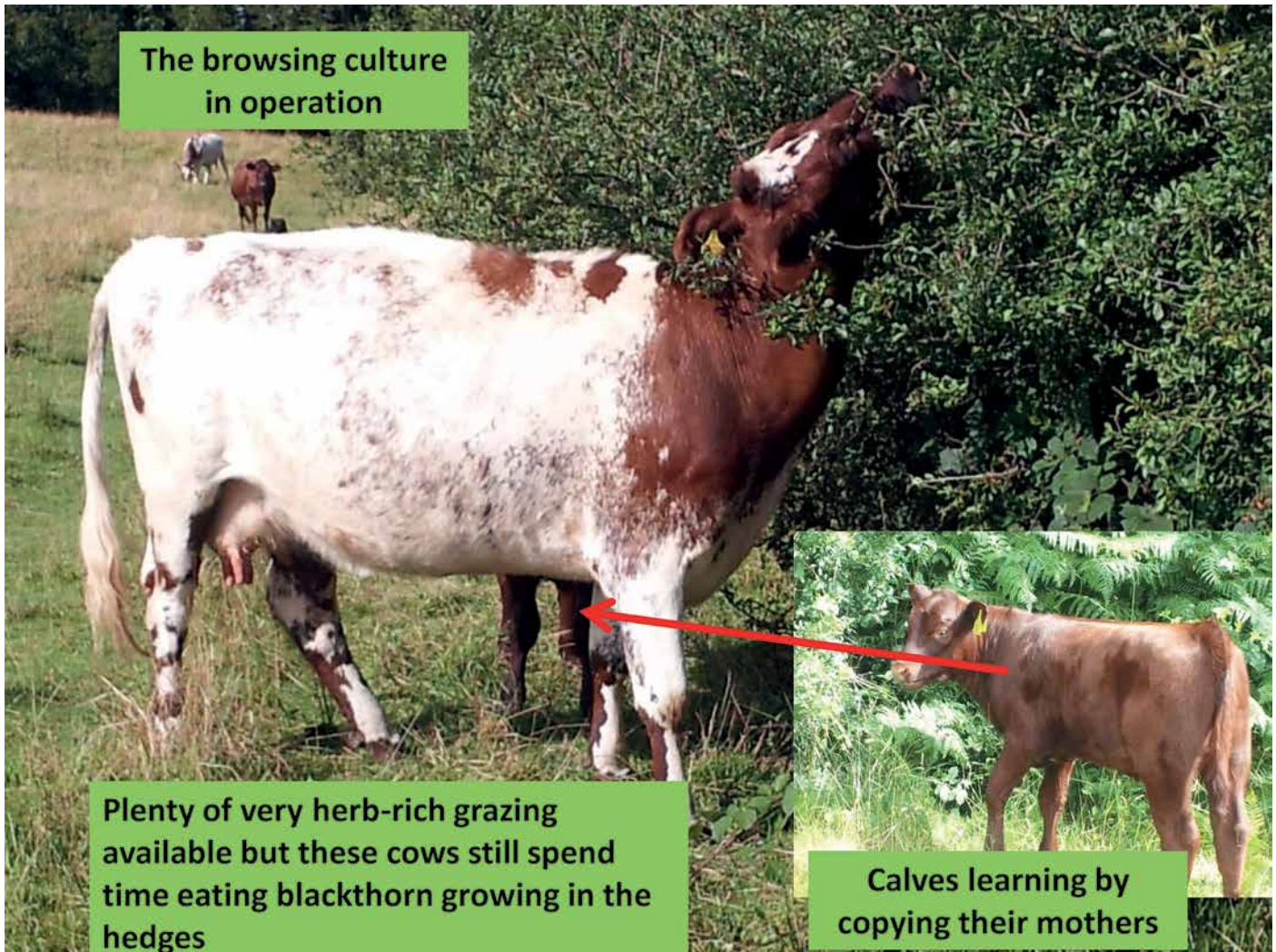


Figure 5. The browsing culture in operation. Photo credit Bill Grayson.

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#### About the Author



With a PhD in grazing ecology from UEA (1987), Bill worked as a field studies tutor before becoming reserve manager with Somerset Wildlife Trusts. Having gained day-release

agricultural qualifications, he took a farm tenancy with the National Trust in 1992 which has since developed into a full-time conservation grazing business. He was a coordinator for the Grazing Animals project from 1999 till 2005.

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# Northumbrian Water's Partnership with Flexigraze – Helping to Get Hooves onto the Ground for the Benefit of Wildlife

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Keywords: business, Flexigraze, grazing, sheep

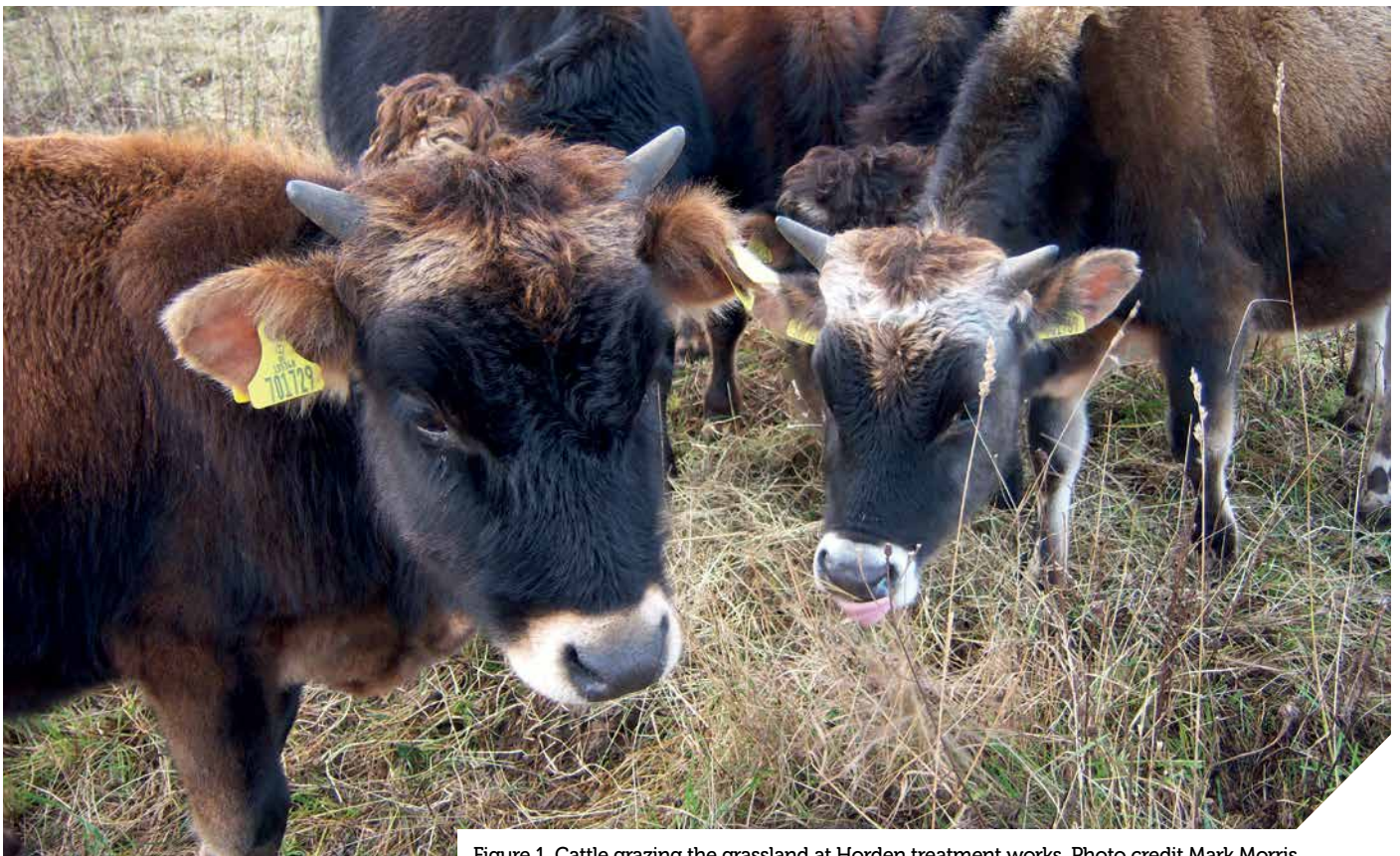


Figure 1. Cattle grazing the grassland at Horden treatment works. Photo credit Mark Morris.

The wildlife benefits of managing grasslands by grazing are well recognised but this kind of site management can be complicated so why would a utility company be involved in it and how would they go about it? Since 2007, Northumbrian Water has worked with a local conservation grazing service called 'Flexigraze' and the benefits for nature and business are clear to see. This article outlines our experience with conservation grazing and how this has provided benefits for biodiversity.

## Introduction

As a landowner, resources manager and environmental champion, Northumbrian Water works to improve biodiversity in its operating region. We regularly review our Biodiversity Strategy and we have a dedicated Conservation and Land Management team providing ecological expertise across a wide range of sites, habitats and species. We work with a range of partners including Flexigraze.

## Viewpoint: Northumbrian Water's Partnership with Flexigraze – Helping to Get Hooves onto the Ground for the Benefit of Wildlife (contd)

### Why Flexigraze?

What do you do when you need to manage numerous grassland sites of conservation interest but have a limited budget and a small team of people? Clearly, some help is needed and, in the case of Northumbrian Water, this came in the form of a sheepdog called Jess and her faithful owner and well-connected, modern-day shepherd, Stephen Comber, who manages Flexigraze.

Flexigraze is an innovative social enterprise, hosted by Northumberland Wildlife Trust but supported by a wide range of organisations. The scheme specialises in grazing nature reserves and other important grasslands throughout North East England. Flexigraze aims to make it easier for land managers to graze more difficult sites as well as providing a full backup and advisory service.

The customer pays a small annual fee and buys grazing credits for a range of animals, which may include Flexigraze's own flock of sheep, or cattle and ponies provided by local farmers. Flexigraze, acting as a broker, finds reliable stock owners who have the correct type of stock and negotiates an agreement with the grazier. This is designed to be as simple and flexible as possible but also inclusive of important issues such as compensation for loss of animals, transport to site and payment of vet's bills. The animal owners benefit both financially and through access to additional sites to graze their stock; the long-term aim is to give farmers the confidence to develop a livestock system based around conservation grazing.

The benefit to Northumbrian Water of partnering with Flexigraze is access to different grazing animals and the ability to use proven grassland management

methods without having to invest in stock ownership. The scheme has been remarkably successful and helps us to plan ahead when looking at site management over the medium- to long-term, providing reassurance that we will be able to get sites grazed as and when necessary.

The fundamental basis of the scheme is connecting owners of livestock who are looking for grazing land with people like Northumbrian Water who need animals to graze particular sites. This provision of 'natural lawn mowers' aims to promote conservation grazing, support farmers and produce ethically reared meat which is sold and used to support the initiative.

### Conservation management by Northumbrian Water

With an operational area extending from the Scottish border to North Yorkshire and from the Durham Coast to the



Figure 2. West Cornforth sewage pumping station (formerly a sewage treatment works) – one of our sites grazed with ponies. Photo credit Mark Morris.



Cumbrian border, a number of sites owned by Northumbrian water require tailored management. Past experience has demonstrated that protection of the environment, conservation management and maximising natural capital are good for business as well as for biodiversity.

The company's core values underpin our conservation work alongside our vision of being a national leader in the provision of sustainable water and waste water services. These values include creativity, being ethical, being results-driven and customer-focused. Our Biodiversity Strategy focuses on these values, helping us to fulfil our legal obligations under the NERC Act (Natural Environment and Rural Communities Act 2006), the Habitats Regulations (The Conservation of Habitats and Species Regulations 2010) and our duty to conserve biodiversity as a public authority running a responsible business.

Northumbrian Water's landholding is extensive and varied, and often includes infrastructure from historical operations, which can preclude the sale of the land. Where these sites are no longer operational, the Conservation and Land Management team manage them to promote biodiversity.

The species-rich grasslands vary in size from less than half a hectare to more than four hectares, and all require specific management to maintain their conservation interest. Some include calcareous flushes, magnesian limestone and unimproved meadows. Botanical surveys are carried out routinely and management plans drawn up, with input from our environmental partners such as the local wildlife trusts.

Grassland management in the past has relied on mechanical cutting which, although perfectly acceptable, has its flaws, not least the financial cost and the dramatic impact from a single cut compared to gradual grazing by animals. Lacking the resources and expertise to manage our own livestock, Northumbrian Water turned to Flexigraze as a way of improving grassland site management. The support provided in getting the right livestock onto the ground, then assisting with routine monitoring and care, has been invaluable and we now have livestock on more sites than ever as well as good working relationships with local graziers.

## Plain sailing or a grazing headache? Challenges and lessons learnt

The sites managed by Northumbrian Water are extremely varied and two examples illustrate the challenges we have encountered and some of the lessons learnt.

At Horden sewage treatment works on the Durham coast, we manage part of a local wildlife site which is designated for the regionally unique magnesian limestone grassland. Through Flexigraze, we have grazed the site over a period of eight years with Highland and then Dexter-cross cattle to control scrub cover (Figure 1). The two breeds have had different impacts on the ecology of the site, which we have monitored carefully. The larger Highland cattle have opened up the scrub well and tend to eat a wide range of vegetation while the Dexters have proved to be very hardy. Surveys have shown an increase in the botanical value of the site, which in turn should lead to an increase in invertebrate diversity. However, the site is not without its challenges, with illegal grazing by horses and occasional vandalism of fences necessitating regular inspections.

On one of our heathland sites on the shores of Derwent Reservoir within the North Pennines Area of Outstanding Natural Beauty, rare breeds of sheep have been used to graze the site in a bid to tackle a prolific growth of bracken *Pteridium aquilinum*. Although lightfooted Manx loaghtan and Soay sheep are well suited to the undulating landscape, which is also a local wildlife site and supports a notable adder *Vipera berus* population, they avoided the bracken altogether. Furthermore, maintaining the fencing in excellent condition to keep the site stock-proof has proved to be a constant task.

Whilst we are now having to rely on mechanical bracken rolling at this site, with horses pulling a metal roller over the bracken to weaken and slow down its growth, our partnership with Flexigraze has allowed us to test the efficacy of using different breeds in challenging environmental conditions. Not least of the difficulties has been the changeable weather, which reached a peak in the snow storms of 2010 when our conservation partner, Durham Wildlife Trust, had to carry out a rescue of the sheep who were stuck in snow drifts.

Regardless of these challenges, the benefits of grazing outweigh the logistical difficulties and need for regular supervision. This is illustrated in Figure 2, showing a former sewage treatment works, now a pumping station, that has been grazed with ponies at a low stocking density for the last five years with occasional cuts for hay. The site clearly demonstrates the tangible benefits that grazing can deliver. Our partnership with Flexigraze has made conservation grazing a viable management tool in our Biodiversity Strategy helping us to manage Northumbrian Water's sites to maximise their conservation potential.

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### About the Author



Mark Morris is a Conservation Advisor at Northumbrian Water. He is involved in the environmental screening of projects, advises on ecological issues and also assists with the management

of landholdings for the benefit of biodiversity. Other work includes managing the invasive species present on operational sites and co-ordinating the annual wildlife survey programme.

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# Sheepwrecked, Sheepracked or Sheepwrought? – Thoughts on Sheep and the Future of the British Uplands

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(retired)

Keywords: breeds of sheep,, fleece,  
grazing, shearing, shedding, uplands

One of the pleasures of retirement has been the opportunity for more hill-walking and last August I found myself on the dramatic central section of Hadrian's Wall where it follows the tops of the crags across the wide open 'wastes' of west Northumberland. Contemplating the livestock scattered over the landscape below and pondering on the life of the people of the area before, during and after the three hundred and fifty years of the Roman occupation, it struck me that in its economic and ecological fundamentals life hasn't changed that much in the British uplands for the last six thousand years – our Neolithic ancestors introduced cattle and sheep four thousand years before the Romans turned up, and they've continued to be the mainstay in the sixteen hundred years since the Romans abandoned us to our fate.



Some individuals of more primitive sheep breeds, such as these Manx Loaghtans, shed their fleeces naturally in spring. Photo credit Hugh Watson.

We had our own native species of cattle, the aurochs *Bos primigenius*, before the introduction of livestock farming, but it seems remarkable that our ancestors were able to take the sheep, a creature that evolved to live in the dry hills and mountains of the Middle East, and persuade it to live in the cold, wet, boggy uplands of north-west Europe. What, I wonder, filled the ecological niche of a close-nibbling, short-sward-creating herbivore in Britain before we brought them in? Was it water voles *Arvicola amphibius*, the bones of which are abundant in Mesolithic archaeological sites? Were water voles once as widespread on dry land in Britain as they still are in

parts of mainland Europe, and were they driven to the wetlands and streamsides by competitive pressure from sheep (Strachan and Jefferies 1993)? Or was there once a lowland British version of the mountain hare *Lepus timidus scoticus*, just as there still is an Irish one *Lepus timidus hibernicus*? Or did we simply not have extensive short-sward habitats until the sheep arrived? Did they arrive just in time to ensure the survival of relict, post-glacial, open-grassland species before these were smothered by trees? The British uplands are currently derided by some as 'sheepwrecked' (Monbiot 2014); perhaps, though, it would be better to think of these landscapes and habitats produced

by the interaction of nature and human culture as 'sheepwrought'.

Not that human culture has remained any more static than the climate. Although sheep as a species have been part of British ecology for six thousand years, modern breeds are very different from those that grazed our land for most of that time. Burdened as they now are by unnaturally long and heavy fleeces that they can't usually shed for themselves (essentially rampant undercoats, over-developed at the expense of outer guard hairs), short little legs that leave them lumbering and unbalanced, and hooves that are prone to footrot, they need a lot of human help to survive. They are also bigger, heavier and more prolific than their predecessors. So, although their numbers are now falling, particularly in Scotland, their ecological footprint is still a very heavy one. They hinder the regeneration of trees and shrubs and the flowering of herbs and grasses, thus impoverishing biodiversity and reducing the carbon-sequestration and water-holding capacity of upland soils with adverse consequences for climate change amelioration, flood control and other ecosystem services. The hills are certainly 'sheepracked' even if not 'sheepwrecked'.

The market for sheep products has changed utterly in the last fifty years. Wool is no longer a valued product (except for very fine merino-type fleeces that UK sheep breeds do not produce) yet each sheep must be sheared annually for welfare reasons, the sale of the fleece barely covering the cost of the shearing. There seems little realistic prospect that the wool market will ever recover despite the rear-guard efforts of the Campaign for Wool (<http://www.campaignforwool.org>). Sheep meat production is cyclically profitable – but would not be if there were no subsidies available. Currently, this is an industry entirely dependent on public subsidy. Despite this, sheep meat is not cheap and consumer demand for it is static. Also, the average age of upland farmers in the UK is over 60 and rising, and average upland farm incomes are very low. In its current form, upland livestock farming is therefore socially and economically as well as environmentally unsustainable.

In the debate about what we should do once we leave the EU Common Agriculture



**Herdwick ewe and lamb in uplands. Photo credit Hugh Watson.**

Policy (CAP) behind us there is a growing tension between those who wish to see public money continuing to support traditional sheep enterprises and those who wish to see the uplands rewilded. I would like us to find a middle way that would allow us to maintain sheep (and cattle) farming as an integral part of the management of much of our uplands, particularly those with valued grassland habitats that need grazing if we wish to retain them. We need to find a way of reducing the number and increasing the scale of upland sheep enterprises so that upland farmers can make a sustainable income from the supply of sheep meat, and of enabling them to do so without the current level of reliance on public subsidy. This needs much lower average stocking densities and sheep that require much less care and attention from shepherds so that management is minimal and one person can look after many more sheep without undue adverse effects on animal welfare.

To do this we will need new and more robust breeds of sheep with short fleeces that are shed naturally in the spring, more like those of wild sheep. Forward-thinking animal breeders have already gone a long way with the first of these requirements. Back in the 1960s Iolo Owen on Anglesey started cross-breeding experiments based on a short-fleeced 'meat' breed called the Wiltshire Horn. The result, now hornless as

well as having a short, naturally shedding fleece, is the 'Easycare' sheep, which is growing in numbers faster than any other breed in the UK. Cumbrian shepherds I have talked to admire them as meat animals needing little attention on the lower ground, but reckon they are 'too soft' for the high, wet Lake District fells where only the iconic Herdwicks can cope. Another self-shedding breed, the Exlana, has been developed in Devon, and some farmers are trialling another breed from South Africa, the Dorper, but it is unclear whether these animals are tough enough for the hills. So how could we produce a breed that is?

It appears that the ability of sheep to shed naturally is controlled by a single dominant 'switch' gene (Pollott 2011) so, in principle, we could use genome editing to revert any hill breed to a more natural shedding form. Alternatively, we have a rich genetic heritage of sheep breeds, many developed in a relatively short period of selective breeding during the 18<sup>th</sup> and 19<sup>th</sup> centuries. Surely we should be able quite quickly to produce appropriate breeds that match the economic, social and environmental requirements of the post-CAP 21<sup>st</sup> century uplands. Probably the toughest and most ancient breed of sheep we have is the little Soay from the now uninhabited islands of St Kilda far out in the cold, wet and windswept Atlantic. The Soay lives in a

## Viewpoint: Sheepwrecked, Sheepracked or Sheepwrought? - Thoughts on Sheep and the Future of the British Uplands (contd)

self-sustaining, completely feral colony on the precipitous island of Hirta. Perhaps we could try crossing them with Easycares and Herdwicks? (We could call them Easyherdoays!)

To get the optimum benefits from our low-maintenance sheep we will also need more flexible patterns of grazing than are possible with the regular annual management regimes that currently prevail. Two sites in the North Pennines illustrate the challenge well. The removal of livestock from the Cross Fell area in 2001-2002 following the last foot-and-mouth disease outbreak led to a spectacular flowering of perennial plants that had been suppressed by grazing pressure for decades, and that have been suppressed once more

with the restocking of the area (Roberts 2010). Meanwhile, in nearby Upper Teesdale the outstanding assemblage of light-demanding, arctic-alpine relict plant species is suffering from undergrazing (Bradshaw 2012). In the last issue of *In Practice* Keith Kirby pointed out parallels in our woodlands (Kirby 2017). With larger and more extensive livestock enterprises one could attempt to address such issues through greater variation in grazing intensity, for example a multi-year rotation of non-grazing, followed by cattle grazing then sheep grazing, and through that drive the evolution of our uplands so that they are still cultural landscapes, but ones with much more varied vegetation and much greater biodiversity.

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Herdwick ewe. Photo credit Hugh Watson.

### About the Author



Hugh Watson  
FCIEEM has retired from consultancy and is enjoying the freedom to think about things other than bats and newts. He posts periodically on LinkedIn.

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Positive evidence within a building of high roost suitability. Brown long-eared bat *Plecotus auritus* roost. Photo credit Lisa Kerslake.

# The Bat Roost Trigger Index – A New Systematic Approach to Facilitate Preliminary Bat Roost Assessments

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Keywords: bats, decision-making process, evaluate, good practice guidance, objective, roost suitability

This article describes an Excel-based tool called the **Bat Roost Trigger Index**, developed to help evaluate the suitability of buildings and structures to support summer roosting bats in a more systematic way. The tool provides a numerical basis for roost suitability allowing comparison of different structures along a defined scale. This should enable bat surveyors to maintain a consistent approach to their assessments across a range of building types, characters and ages.



Figure 1. Buildings assigned low, moderate and high roost suitability – which is which? Initial impressions are not always accurate.

The tool's function is to introduce a higher level of objectivity into the decision-making process with the aim of strengthening and rationalising professional experience and judgement. It is not intended to replace the experience of bat surveyors, but to assist in making evidence-based recommendations and providing consistency of assessment. The tool is very much a working prototype; therefore, we would welcome feedback to help refine the tool and support further development.

### Introduction and Rationale

The Bat Roost Trigger Index uses a suite of environmental and habitat features known to influence roost selection in order to generate a numerical score, from 0 to 1, and assign a corresponding roost suitability class. We tested the tool over a two-year period on more than 160 buildings to compare its output to subjective observations across a range of different structure types, ages and conditions. We believe the tool can help to augment professional decisions regarding roost suitability by recording evidence more objectively, which will help bat consultants to maintain a consistent and robust approach to Preliminary Bat Roost Assessments.

Preliminary Bat Roost Assessments (PRAs) form the foundation of bat consultancy work, comprising surveys of buildings and structures to look for the actual or likely presence of bats, and to assess the building or structure's suitability to support bat roosts. Based on this information, and considering the potential impacts of the development proposal in question, and the associated legal risks, recommendations are usually made for one or more of the following: further presence/absence or roost characterisation surveys, mitigation,

reasonable avoidance measures or no further action.

When assessing roost suitability, we may fall into the trap of becoming complacent, relying on subjective observations or instinctive cues rather than objective and systematic inspection. Our judgement can be influenced by a variety of factors, such as the weather, the experience of the surveyor, and time pressures. Assessing roost suitability may be more difficult for less experienced consultants, who are not familiar with suitable roost features; the Bat Conservation Trust provides good practice guidance on survey methods, and suggests features that should be inspected during surveys (Collins 2016). Even so, how do we rigorously assign roost suitability when faced with a lack of evidence of bat presence?

Part of the problem, notwithstanding unusual roost locations, lies in the fact that 'suitability' of roost sites, according to good practice guidance, is categorised into only four descriptive terms: 'negligible', 'low', 'moderate' and 'high'. Although the Bat Conservation Trust guidelines provide definitions for these terms, they remain open to interpretation without any evidence-based quantification.

The boundaries of the definitions are indistinct, with each category merging into the next (Collins 2016). How do we decide if a structure is on the upper end of 'low suitability' or on the lower end of 'moderate suitability' (Figure 1)?

Following good practice guidelines, the assigning of roost suitability prompts the level of further survey effort required to determine presence/absence or roost characterisation; this will influence costs and scheduling of the proposal, and may be questioned or challenged by the client.

Alternatively, local planning authorities lacking ecological expertise may ask for bat activity surveys that are not necessarily required. One of the new statutory policies from Natural England is to 'reduce the need for surveying where the impacts on EPS can be confidently predicted' (Carter and Morton 2016). This may be interpreted by some as a lowering of the requirement for



further surveys, and thus it is imperative that bat consultants form robust, evidence-based arguments to justify their recommendations, particularly where the need, or not, for further survey is challenged.

### Development of the Bat Roost Trigger Index

The Habitat Suitability Index (HSI; Oldham *et al.* 2000) was developed to evaluate the suitability of ponds to support great crested newts *Triturus cristatus*, and is based on a numerical index, from 0 to 1, derived from ten key habitat criteria of diagnostic importance for the species. HSI numerical scores are divided into five categories reflecting pond suitability, with each category correlated with 'predicted presence' for the species, based on sampling of 248 ponds (ARG UK 2010). HSI scoring is routinely used to evaluate the likely occurrence of great crested newts and, while not without

assumptions and limitations, provides a quick and demonstrable screening method for assessing presence/absence and identification of potentially important great crested newt breeding habitat.

The tool described here is a first attempt to produce an index for bats that can be used to trigger further survey, or not. The UK supports 17 species of bats, each with their own specific habitat and roost requirements, and thus 'diagnostic' features included in the tool are those recognised to influence roost selection of multiple bat species more generally, rather than any particular species (although flying access for horseshoe bats *Rhinolophus* sp. is considered). As the tool cannot account for, or incorporate, the full range and differences of roost preference for all UK bat species, it cannot be used as a 'suitability index' for a single species. However, we plan to investigate whether quantitative relationships exist between

habitat features, roost suitability and predicted presence of bat roosts. Currently, as for several of Oldham *et al.*'s (2000) diagnostic variables, features used here are expressed qualitatively and assigned a value between 0 and 1 on a three- or four-point scale. No attempt has been made so far to weight features according to their importance; we will explore this possibility for future versions of the tool (Figure 2).

### The Trigger Index in practice

The Trigger Index (TI) is based on a list of 28 features (Table 1) that reflect: A) the location, habitat and environmental context of the structure or building being assessed, B) the exterior features and characteristics, and C) the interior features and characteristics, particularly those comprising, or within, the roof void.

Each feature is sub-divided into several descriptive categories that summarise



Figure 2. The presence of deep crevices are important features for crevice-dwelling bat species, such as this Natterer's bat *Myotis nattereri*, and could be weighted accordingly within the Trigger Index.

# Feature Article: The Bat Roost Trigger Index – A New Systematic Approach to Facilitate Preliminary Bat Roost Assessments (contd)

the feature 'condition', while indicative descriptions, based on known habitat preferences of bats, define each category; these are used as a prompt to assign a numerical TI score to the feature from a selectable drop-down menu. Scores are chosen that best reflect the category/condition of the feature being assessed. A geometric mean TI score between 0 and 1 is generated automatically as feature scores are populated.

The theoretical maximum mean TI score, if 1.0 is selected for all features, is 1.0; the theoretical minimum, if the lowest score is selected for every feature, is 0.29; however, in our experience, most structures fall somewhere between 0.4 and 0.9. The full numerical range for roost suitability has been split into four categories, NEGLIGIBLE, LOW, MODERATE and HIGH (Table 2), in line with categories given in the Bat Conservation Trust guidelines (Collins 2016). The roost suitability descriptor is also generated automatically in the spreadsheet. Selection of the most appropriate TI score, and consistency of approach between structures, requires familiarisation with the descriptions, and some basic knowledge of bat ecology and roost selection. Use and interpretation of descriptive terms are an inherent weakness of suitability models; the Trigger Index cannot use strict criteria since most relationships between roost presence/absence and features have not been statistically correlated. Also, an assumption has been made that relationships between feature condition and roost suitability are linear. In reality, such relationships are unlikely to be linear; however, as they become quantitatively defined by empirical studies, the use of strict criteria in the Trigger Index may help to reduce the weakness of the approach.

Table 2 also shows the recommended minimum number of survey visits for presence/absence of bat roosts for each suitability class, as recommended in the Bat Conservation Trust guidelines (Collins 2016). However, recommendations will ultimately depend upon the works being proposed and on the type and scale of impacts. It should be stressed that the TI score and derived roost suitability class is only a rough guide over a sliding scale and does not reflect a rigid category.

**Table 1. The three sets of features used in the Bat Roost Trigger Index, and which are known to influence roost selection.**

A) Location, habitat and environmental context of structure	B) Exterior features and construction of structure	C) Interior features and construction of structure
General location	Structure/building age	Character of roof void/roof space
Foraging opportunities in immediate vicinity (within 250 m)	Structure/building size and complexity	Character and condition of roof timbers or supports
Foraging opportunities in wider landscape (within 5 km)	Main wall construction material	Presence and extent of cobwebbing
Commuting opportunities giving access to semi-natural habitat	Condition of wall and roof pointing/render or timbers	Presence and condition of roof lining
Cover in vicinity of structure/building	Presence and condition of lintel and/or door frame features	Light levels in roof void/roof space
External lighting in vicinity of structure/building	Construction and condition of eaves, soffits and bargeboards	Protection from weather/wind
Number and character of nearby structures/buildings	Presence and condition of weatherboarding, hanging tiles and/or cladding	Temperature regime
Structure/building exposure: altitude, elevation and direction	Presence and condition of lead flashing	Level of (human, animal) disturbance of potential roost
	Roofing material characteristics	Flight space (e.g. long-eared, Natterer's and horseshoe bats)
	Bat access potential into structure/building	Flying access (horseshoe bats)

**Table 2. Bat Roost Trigger Index (TI) scores, Roost Suitability Class and Bat Conservation Trust (BCT) survey recommendations (Collins 2016).**

Bat Roost Trigger Index	Bat Roost Suitability Class	BCT survey recommendations for presence/absence <sup>1</sup>
> 0.7	HIGH	Three separate survey visits. At least one dusk emergence and a separate dawn re-entry survey. The third visit could be either dusk or dawn.
0.6 – 0.7	MODERATE	Two separate survey visits. One dusk emergence and a separate dawn re-entry survey.
0.5 – 0.6	LOW	One survey visit. One dusk emergence or dawn re-entry survey.
< 0.5	NEGLIGIBLE	No further surveys required. Reasonable precautionary measures applicable.

1. Note that, in practice, the requirement for further survey may sometimes vary from that stated here depending on specific circumstances.



## First Impressions – Evaluating the Tool.

During 2015/16 we tested the Trigger Index on 162 surveyed structures across the West Midlands using information gathered during PRAs. The process of inputting 28 feature scores into the tool takes no more than about five minutes per structure.

The range of structures surveyed included residential dwellings, outbuildings, garages, workshops, farm buildings, industrial buildings, offices and commercial outlets, schools, recreation centres and other public buildings, churches, cathedrals, castle ruins and various other derelict buildings. The structures reflected a very wide range of designs, materials, features, uses, characters and ages, and generated a spread of mean TI scores from 0.38 to 0.97.

During this testing phase, the TI scores were reviewed to see how they compared to professional judgement and evidence of bats found (or lack of) during the PRA or further surveys. Figure 3 shows mean TI scores versus roost suitability class (as numerically defined in Table 2); the number of structures is spread roughly evenly across the roost suitability categories.

Evidence of bat presence (e.g. droppings, feeding signs, dead bats) was detected in 98% (n=39) of structures assigned a high roost suitability, 56% (n=23) of structures assigned moderate roost suitability, 31% (n=13) of structures assigned low roost suitability and 3% (n=1) of structures with negligible roost suitability (Figure 4). The presence of a false negative is a potential limitation of the tool, but one that is also applicable to professional judgement. However, the Trigger Index is designed to augment professional judgement and reduce the likelihood of missing suitable roost sites.

In structures of high roost suitability, bat presence was more often evident from large numbers of scattered or localised droppings (often in several areas), and sometimes direct observations of one or more roosting bats. These structures were much more likely to contain multiple roosts of several species, with larger numbers of bats and roosts of moderate or high conservation status (with respect to roost type only).

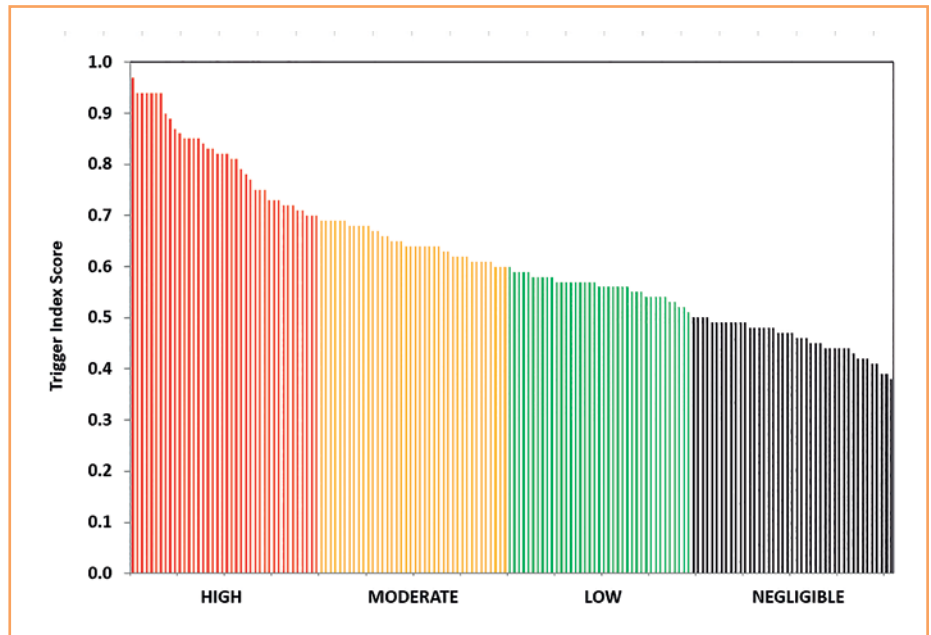


Figure 3. Bat Roost Trigger Index scores in each Roost Suitability Class (shown in different colours) for a sample of surveyed structures (n=162).

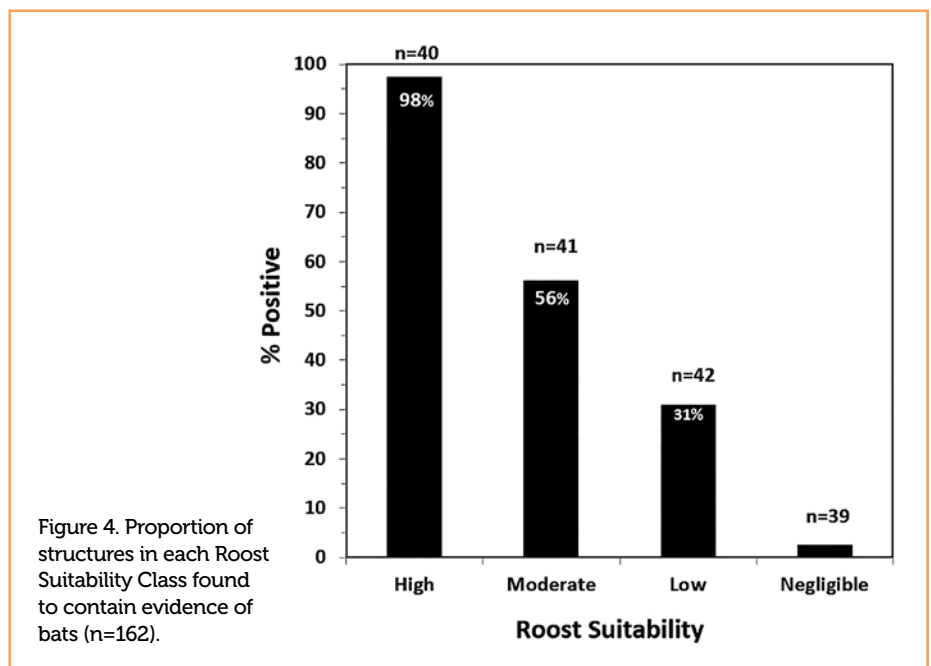


Figure 4. Proportion of structures in each Roost Suitability Class found to contain evidence of bats (n=162).

Conversely, low roost suitability was evident mostly from few or a single dropping, and often included older evidence indicating occasional or historic use of the structure or more recent use by an individual or low number of bats. Where no evidence of bats or bat roosts is found, the Trigger Index should help surveyors to assign roost suitability more confidently, as features important for roost selection are considered more systematically.

Currently, in our experience of using the tool, the Trigger Index score matched well with professional judgements of roost suitability; however, there will almost certainly be exceptions and unknown factors, not least bats roosting in sub-optimal locations, roosting opportunistically, or in low suitability buildings close to other nearby roosts (e.g. a satellite roost). As more structures are assessed, the tool will be tested, revised

# Feature Article: The Bat Roost Trigger Index – A New Systematic Approach to Facilitate Preliminary Bat Roost Assessments (contd)

and validated with the aim of generating more confidence in the numerical output and assigned suitability class. However, as with any assessment method, it is accepted that it will never be entirely accurate.

## Conclusions

The tool described here is a first attempt to provide a checklist of factors that influence bat roost selection, and to rank roost suitability of likely structures using a numerical index. The tool is currently a working prototype, and requires extensive testing and associated critical appraisal. The standardised approach demonstrates that each feature has been considered systematically, although there is scope to incorporate additional features to expand the current list, for example the presence and condition of cellars. The importance of each additional feature will need consideration prior to inclusion so that features of minimal importance in roost selection do not skew the numerical output. Also, some structures, such as bridges, have not been tested but could be included in future versions.

The results can be easily tabulated and the Trigger Index may therefore be useful to Local Planning Authorities in place of lengthy and overly detailed descriptions of building features.

Although the roost features included in the Trigger Index are generally recognised to influence roost selection, the condition or suitability of the feature will depend upon the bat's requirements at a given time; for example, cold stable temperatures are preferable to bats needing to conserve

energy during hibernation but detrimental to the development of young bats in maternity roosts. Additionally, the elevation and orientation of a structure could be beneficial in some circumstances but not others. Clearly, the 'condition' of some of the features can be context and roost-type specific, and thus assessment of such features in the metric may depend upon the objective; the tool has been designed mostly with summer roosts in mind, but future versions of the tool could target all roost types.

Indicative descriptions may need to be better defined, particularly where further research is able to establish new correlations between roost conditions and roost selection; it may also be possible to introduce weighting of some features. Lastly, the numerical ranges of each suitability class must be monitored and, if necessary, revised to better correlate with roost presence/absence, to minimise the potential for false negatives.

We will continue to validate and refine the Bat Roost Trigger Index in the hope that it will become a useful aid for bat roost assessments. We would welcome feedback and critical appraisal, particularly from bat consultants and surveyors undertaking Preliminary Roosts Assessments, based on your experience of using the tool. If you would like to test the tool, please visit <http://swiftecology.co.uk/trigger.php> where it can be downloaded. If you use the tool, we would ask you to provide feedback so that the tool can be improved; please contact the author for further information and/or to provide feedback.

## Acknowledgements

I am very grateful to my colleagues at Swift Ecology who have trialled the Trigger Index. I would also like to extend my thanks to those who have provided generous and constructive feedback, including Cody Levine, Richard Crompton, Penny and Dave Lewns and Meryll Gelling.

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## CIEEM Training

### Introduction to Bats and Bat Survey

London, 19 September 2017

Dunblane, 20 September 2017

### Bat Impacts and Mitigation

Dunblane, 21 September 2017

[www.cieem.net/training-events](http://www.cieem.net/training-events)

## About the Author



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ecology, conservation, survey and mitigation techniques.

### Contact Nick at:

[nick.underhill-day@swiftecology.co.uk](mailto:nick.underhill-day@swiftecology.co.uk)

# Featured CIEEM Training Events

## Beginner's Guide to the National Vegetation Classification (NVC)

**8 June, Carlisle / 27 July, Skipton**

*Trainer: Stuart Colgate MCIEEM*

Classroom and field-based sessions are used to explore the background and use of NVC methods, demonstrate the principals involved and practice recording and sampling plant communities.

*Level: Beginner.*

## Preliminary Ecological Appraisal: An Applied Approach

**14 June / 13 September, Lewes**

*Trainers: Ben Kimpton MCIEEM and Giles Coe MCIEEM*

A solid introduction to site assessment and the process of Preliminary Ecological Appraisal (PEA) with sessions covering effective desk studies, survey preparation as well as the hierarchy of mitigation, compensation and enhancement. Training sessions include a field trip within the beautiful South Downs National Park to practice Phase 1 habitat survey and protected species risk assessment of farmland and park adjacent to the venue.

*Level: Beginner.*

## Surveying for Bats in Woodlands

**3-4 August, Wotton-under-Edge, Gloucestershire**

*Trainer: Jim Mullholland MCIEEM*

Over two days of classroom and field-based training, delegates will explore survey design, survey methods and analysis of results. Field sessions will develop practical skills, including setting up of catching equipment and up to two evening catching sessions.

*Level: Intermediate – Advanced.*

## Introduction to Professional Bat Work

**6 September, Chipping, Lancashire**

*Trainer: Pat Waring CEnv MCIEEM*

Ideal for those new to professional bat work, this course explores the key skills, experience and knowledge necessary for undertaking professional bat work in the UK. The day combines field and classroom-based sessions to introduce bat biology and ecology, legislation and mitigation. Survey techniques are considered in more detail in the complementary training *Introduction to Professional Bat Surveys*.

*Level: Beginner.*

## Introduction to Professional Bat Surveys

**12 September, Chipping, Lancashire**

*Trainer: Pat Waring CEnv MCIEEM*

Complementing our *Introduction to Professional Bat Work*, this one-day training event introduces the range of surveys, tools and equipment used to assess sites for bats and start undertaking professional bat work in the UK. Sessions will cover: describing and surveying buildings, assessing the potential for bats in buildings, recognising and identifying signs of bats, bat emergence surveys and bat activity surveys.

*Level: Beginner.*

## An evidenced-based approach to camera-trapping

**16 September, Edinburgh**

*Trainers: Mel Findlay MCIEEM and Patrick White MCIEEM*

### NEW

The course will detail what should be considered when using camera-trapping to assist with assessment of resting sites and activity surveys of mammals. The training will focus on critical aspects of survey design and methodology, with reference to recent research studies and input from Royal Zoological Society of Scotland staff. The course is pitched at intermediate – advanced level, and combines classroom sessions with supporting practical work.

*Level: Intermediate – Advanced.*

## Peatland Restoration

**26-27 September, Buxton**

*Trainer: Penny Anderson CEcol FCIEEM (rtd)*

### NEW

Penny Anderson leads this two-day, intermediate – advanced level training event focused on the restoration of blanket bog and wet heath. Classroom sessions and an extended field trip will explore the importance of peatlands for biodiversity and ecosystem services, the key factors affecting peatland ecosystems, the range of restoration objectives and some of the challenges and techniques for achieving them.

*Level: Intermediate – Advanced.*



## Meet the Author – Fionnuala O'Neill

### *What do you do?*

I am a principal ecologist with BEC Consultants in Dublin. My work can involve everything from tender-writing to the final project report, via botanical and habitat surveys, aerial photo interpretation, field and digital habitat mapping and data analysis. Much of my current work is associated with the monitoring and assessment of EU Annex I habitats.

### *What or who first inspired you to make a career in ecology or environmental management?*

I was always interested in plants. I was lucky enough to grow up in rural Ireland with botanically rich fields and hedgerows all around me. I made a small herbarium one summer and my parents helped me to identify the plants. They were interested in nature as well, so I suppose it started at home and grew from there.

### *How did you get to where you are today?*

It wasn't a straightforward career path! I graduated with a BSc in Plant Science, completed a one-year diploma in computers (it was the early 1990s – IT was booming, ecology wasn't!) and worked as a programmer for five years. An overseas stint changed my perspective and I returned to university to get back to botany. A PhD followed and a chance encounter led to two summer seasons with BEC, who later took me on full-time.

### *What have been the most important steps along the way?*

Everything played its part. The degree was an obvious first step. The years in

IT, although they moved me away from ecology, gave me transferable skills that I still use today. My PhD was in woodland ecology and I finished it just as a national woodland survey was getting under way, helping me get a job with a company that has a wide portfolio of projects and a great team of people with complementary areas of expertise.

### *Are there any 'must-have' qualifications and/or experience?*

Any qualification that provides you with essential skills, such as report-writing and data analysis, is important and helps you get your foot in the door, but experience gets you invited in for a cup of tea – it shows you have the necessary interest and ability. I wouldn't have got my first survey job if I hadn't had the right qualification, but the experience I gained from those two field seasons formed the basis for my current career.

### *Do you have any advice for someone setting out on a career in ecology and environmental management?*

Attend as many workshops and courses as you can. Go to outings organised by your local wildlife group, bird-watching club, BSBI, etc. – many of these are free and you meet loads of interesting people who, in my experience, are incredibly generous to beginners with their time and expertise. You'll build up a network of ecological colleagues and friends and you never know when one of them will deliver you your big break.

### *What's the best thing about your job?*

Getting to visit some truly stunning locations, often well off the beaten track. I live in a beautiful, ecologically rich and diverse country and because my job spans a wide range of habitats, I get to see a lot of it.

### *What's the downside?*

Brambles, blackthorn and lashing rain. And a garden that looks like a jungle because it's sadly neglected between April and September (that's my excuse anyway).

### *What's next for you?*

This summer I'll be out surveying juniper scrub and saltmarshes, and I will get to some grasslands and woodlands too. I'll contribute to the survey reports and also to some of the national conservation assessments for the Annex I habitats I've been surveying. A busy year in store!

### *What is your top tip for success?*

Persevere. Get involved. Take (and make) every opportunity to get to know other ecological professionals and gain experience. Even if you initially only get unpaid experience, it will stand you in good stead. Working with professionals in the field will teach you more than you'll ever learn in a lecture hall.

### For further information

Contact Fionnuala at:  
foneill@botanicalenvironmental.com

# CIEEM Skills Gap Project

Debbie Bartlett FCIEEM and Eulalia Gomez-Martin GradCIEEM  
University of Greenwich

CIEEM has recently conducted a second Skills Gap Project. The first resulted in the launch of a degree accreditation scheme and the development of the Competency Framework in 2013, which was revised in January 2016.

A combination of recent changes affecting the profession, such as Chartered status, emerging large infrastructure projects, austerity cuts affecting statutory agencies and local authorities, and uncertainty surrounding Brexit, suggested it was time for a new Skills Gap enquiry. The results of a members' skills survey, carried out in summer 2016, were reported to the November 2016 conference, at which workshops enabled issues to be explored. A follow-up survey, targeting employers, was conducted early in 2017. This article summarises the results and considers the implications for CIEEM and the higher education institutions (HEI) sector.

The Members' Survey asked about skills acquired in the recent past, those envisioned as needed in future and motivation for developing new skills. Up to three answers could be given to each question and analysis revealed that management and communication were the most frequent responses, as shown in Figure 1.

All members were sent the questionnaire and 319 responded. However only 246 completed the last section and, as this contained personal information, full analysis has not been possible. The available data, compared with overall membership statistics revealed that 20% of Fellows, 6.4% of Full, 3.5% of Associate and just 1.2% of Graduate members completed the questionnaire. The low proportion of early career grades is particularly disappointing as it is likely these would have greater training needs,

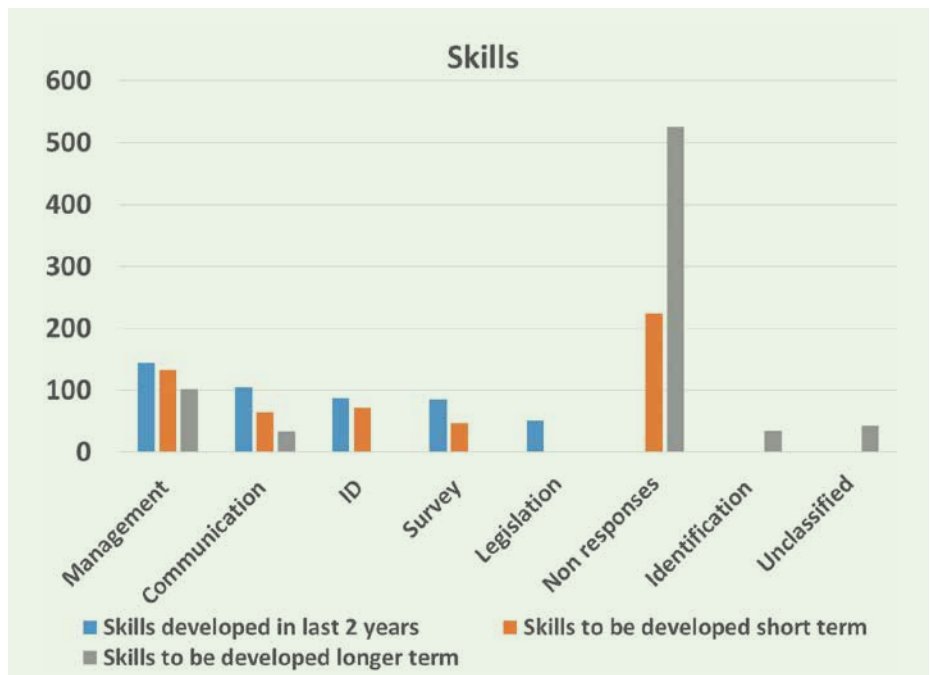


Figure 1. Most frequent skills identified by respondents

and these would be different to those of established professionals.

The workshops took place during the Autumn Conference, held in Nottingham on 1-2 November 2016<sup>1</sup>. A brief presentation introduced the Project and summarised the questionnaire results as a context for delegates to consider why management and communication skills are a key issue; whether this was education failing to provide a good foundation, lack of adequate support for building on basic skills in career progression, or changes in work place requirements.

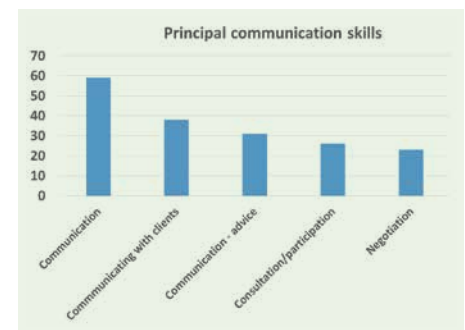
Most initially felt that they had not been taught project management. Discussion revealed that completing assignments to deadlines, undertaking research projects and group work are core programme components and fundamental to developing project management skills. There was a clear message that proficiency in communication should develop with career progression, with differences in written and verbal skills identified and consensus that uniformity is not realistic. Dealing with awkward clients and breaking bad news were highlighted as specific areas requiring training.

Workshop participants were asked about future skill requirements. The results were consistent with those from the member survey, with identification skills, survey methods, legislation/policy, and data management identified as priorities. The drivers for these included changing technology, personal aspiration, changing legislation/policy/Brexit, career progression and employer/client needs.

Further analysis revealed the top five topics under Management and Communications, listed in Table 1 and the graphs below.

**Table 1: Management and communication skills**

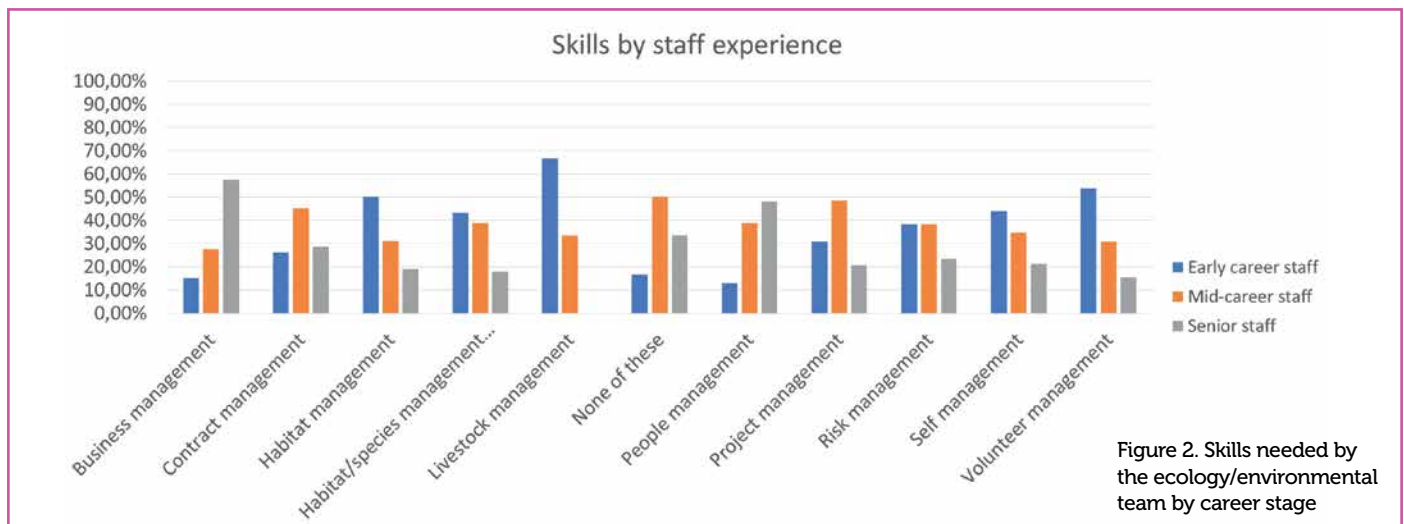
Management		Communication	
Project management	102	Communication	59
Business management	87	Client communication	38
Leadership	78	Giving advice	31
People management	41	Communication/participation	26
Habitat management	31	Negotiation	23



The employer survey, carried out in early 2017, was informed by the previous results and began by establishing company size and sector. Of 44 responses, 18 had more than 500 employees, nine had less than 10. The majority (28) were private sector/consultancies, six were local authorities, six were NGO/voluntary sector and one from a statutory nature conservation body. A list of options enabled training needs to be identified for early, mid-career or senior staff. The management priority for early career staff related to habitats and volunteer

management; while for early/mid-career it was risk and habitat and species management. Training in project, contract and people management was needed for mid-career staff, with senior staff also requiring people management. Business management was exclusively identified for senior staff, with self-management training relevant for all grades.

Presentations were the communication priority for early career staff, with media and client training at early/mid-career levels. Negotiating/influencing, advising,



**Figure 2. Skills needed by the ecology/environmental team by career stage**

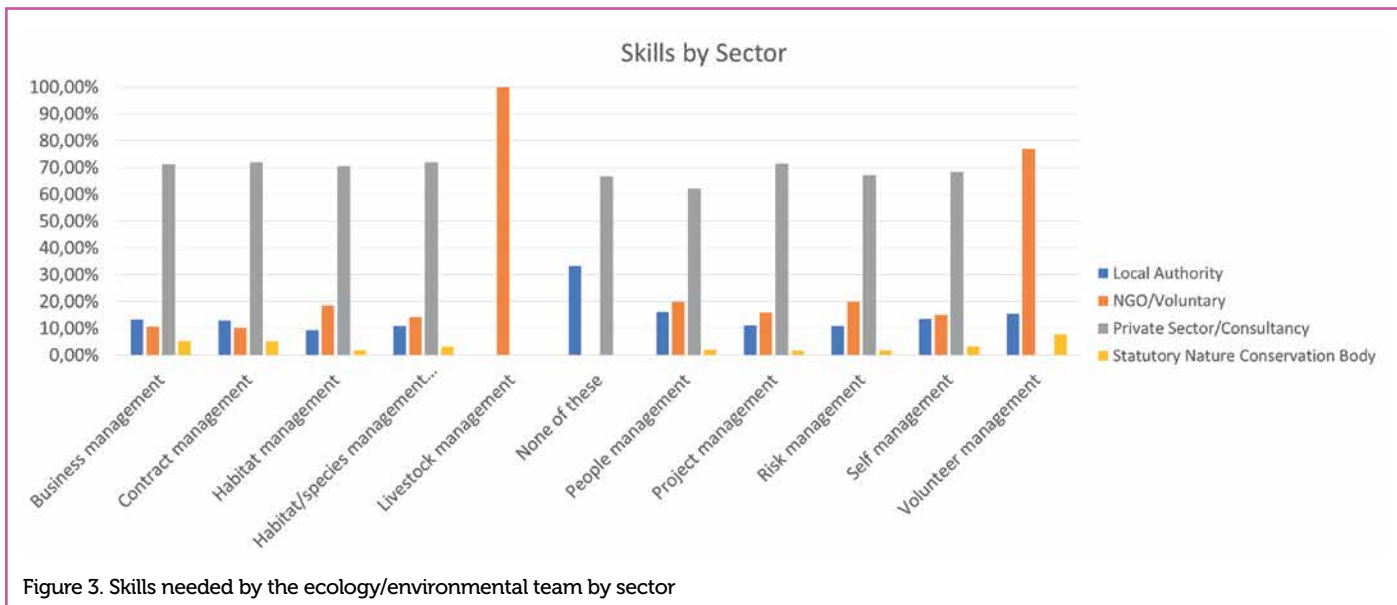


Figure 3. Skills needed by the ecology/environmental team by sector

and stakeholder consultation/participation training was identified at mid-career and senior level, with the latter also requiring campaigning skills. The response to specific training needed for the ecology/environmental team is shown in Figures 2 and 3.

These figures demonstrate the importance of sector and career stage data in providing useful information

Employers were asked about their graduate recruitment process. While 16 reported no issues, top of the consultant's deficit list was poor plant ID, followed by field survey and Phase 1 habitat survey skills, and report writing. Lack of a relevant degree was a surprise as there are 16 CIEEM accredited BSc programmes and a further 5 MSc programmes. Specialist skills included bats, birds, grass ID and marine ecology, perhaps best addressed by targeting recruitment to specific universities. Local authority respondents identified critical thinking, legislation/planning and species survey licences, while NGOs needed better practical habitat/species/project management, and people engagement skills.

### What does this mean for CIEEM?

While these results do not represent a full cross section of the membership they are indicative, and information about future requirements can inform CIEEM's training programme. However, this does not include transferable skills, the most frequently mentioned group. The workshop discussions suggested

that universities could be more explicit in providing basic skills in assignments and research projects, to be developed during career progression.

Clearly employers want junior staff who can 'hit the ground running', equally universities aim to produce graduates equipped for the work place. While much can be done by, for example, bringing in external speakers from industry, setting up advisor groups to inform curriculum development, and making assignments as realistic as possible, universities are constrained by regulations. The CIEEM accreditation scheme should incentivise change towards a more work-orientated ethic but lecturer-student and employer-employee relationships are very different (just think about the cash flow!).

The introduction of the Apprenticeship Levy, requiring larger companies to contribute to a fund that can part-fund apprentices will make significant changes combining on the job training with study on day or block release basis<sup>2</sup>. CIEEM, working with employers and the University of Greenwich, has recently gained approval to develop Apprenticeship Standards<sup>3</sup> for the occupations of Ecologist and Environmental Manager. Once these are completed any registered training provider can work with companies requiring apprenticeships – not only those subject to the levy. This integration between the education and employment sectors is a real opportunity for the profession and should go a long way towards closing the skills gap.

### Notes

1. 2016 Autumn Conference: Skills for the Future: Understanding the impacts of new tools, techniques and approaches. Presentations available at <http://www.cieem.net/2016-autumn-conference->
2. See <https://www.gov.uk/government/publications/apprenticeship-levy-how-it-will-work/apprenticeship-levy-how-it-will-work>
3. See <https://www.gov.uk/government/collections/apprenticeship-standards>

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# What's the Point of Conservation Science?

## A Workshop Exploring the Rough Edges of an 'Evidence-Based' Approach

Greg Carson CEcol CEnv MCIEEM  
Ecology Network

### Background

As members of CIEEM, we have a commitment to the overall objectives of the Institute, which include advancing the understanding and the standards of our craft as well as furthering the conservation, management and enhancement of biodiversity.

In order to deliver the above, we agree to (amongst other things) apply objectivity, relevance, accuracy, proportionality and impartiality as well as have regard to the relevant published technical guidance and standards<sup>1</sup>.

As practitioners, we make decisions based upon previous training, our individual experiences and accepted guidance. So whether we are sitting at our desk developing conservation policy, hacking scrub from a heathland or waiting for sunrise when undertaking a bat survey, our activity at any particular moment is (or at least should be!) based upon accepted methods, albeit potentially tempered by professional judgement which is required to take into consideration the particular circumstances of whatever matter we may be addressing.

### The Workshop

There has been much discussion about the void that sits between scientific research, and practical delivery. In an attempt to develop solutions to bridge this gap, Mark O'Connell (ERT Conservation) and Rachel White (University of Brighton), hosted a two-day workshop at the beginning of February, specifically with a view to establish what conservation science practitioners needed, in order to understand/deliver their activities effectively. From the website<sup>2</sup>, one could clearly sense the frustration in

seeing the issue of 'barriers' to the flow of evidence having been discussed *ad nauseam*, but also the sense of resolve to create a model by which we can enable effective conduits of information between scientists and researchers, and the practitioners who are charged with day to day delivery of everything from policy, to hands on land management.

Cheekily entitled *What's the Point of Conservation Science?*, the meeting drew together 40 practitioners from diverse backgrounds (albeit all connected with the environmental sector) and levels of experience. This 'diversity' was intentional, with the attendees forming a 'sample' whose job it was to work through a process identifying the tasks they undertake as individuals and assigning to those tasks areas where evidence was required.

The scene was set with a number of introductory presentations.

Lucy Rogers (Avon Wildlife Trust) outlined the information that was key to an NGO whose focus was on conservation – being able to measure environmental change, know what actions to take and most importantly, know if the actions being taken are resulting in the desired outcomes. She acknowledged that resources were always an issue and as such, delivery tended to be prioritised over evidence.

Gary Kass (Natural England) gave a perspective from Natural England, and focussed upon the 'Big Six' questions for which they require evidence:

1. Where and how do we restore landscape connectivity?
2. In the natural environment, what do we want to measure, why and how?

3. What is the best way to use new technologies?
4. What does a healthy ecosystem look like?
5. Are there better ways of managing our ecosystems?
6. What is the impact of changes in the natural environment and ecosystem services upon people's health and wellbeing?

Carlos Abrahams (Baker Consultants, representing CIEEM) provided a personal viewpoint from a consultant's perspective, questioning a few commonly used survey approaches and pointing out that much of the guidance we use is not based upon robust science. He stressed the increased weight upon evidence-informed approaches, especially in light of the revised Environmental Impact Assessment (EIA) regulations, which include provision for monitoring.

Eleanor Sterling (American Museum of Natural History) gave a most enlightening presentation (via Skype) where she referred to the importance of bridging the gap between 'users' and 'producers' of information, especially in relation to getting the conservation message across to decision-makers. Referring in particular to people and project design, she highlighted avoiding 'engagement fatigue' and choosing certain variables solely because they can be numerically measured. She briefly explored the difference between making 'evidence-based' and 'evidence-informed' decisions, and the limitations to 'expert opinion'.

Mark and Rachel provided an overview of the project and outlined the format of the two days. They also provided a summary of a questionnaire completed by the participants (100% response rate!) prior



to the meeting. It emerged that one of the key concerns was the degree to which available evidence was of direct relevance to one's job. In preparation for the task that lay ahead for the participants, Mark explored such issues as what constitutes a research question, especially in relation to scale, and the importance of contrasting information requirements at different scales (for example, within one organisation, a strategist may require national level metrics, while a field worker requires local evidence to guide and evaluate his/her practical management). The context for the workshop was illustrated by Figure 1.

The meeting was also informed by two 'optional' lunchtime talks, one by Peter Long (Oxford University) which featured his work on the Local Ecological Footprinting Tool (LEFT) – an online resource that has the potential to provide detailed global environmental information at an astounding range of scales. On the second day, Rebecca Smith (Conservation Evidence), provided an outline of the Conservation Evidence initiative, and in particular demonstrated how it was a two-way process, encouraging submission of material by, as well as provision to, practitioners in a variety of formats.

The participants were split into five breakout groups, for which a chairperson for each had been nominated previously. An environmental science student from Brighton was assigned to each group, to add their perspective.

In order to provide a starting point, Mark used a competency framework adapted from CIEEM and other similar approaches, which divides broad areas of work according to component tasks, which in turn are subdivided into the tangible activities that are required to deliver each task. Each group was provided with an (electronic) table of the framework, with

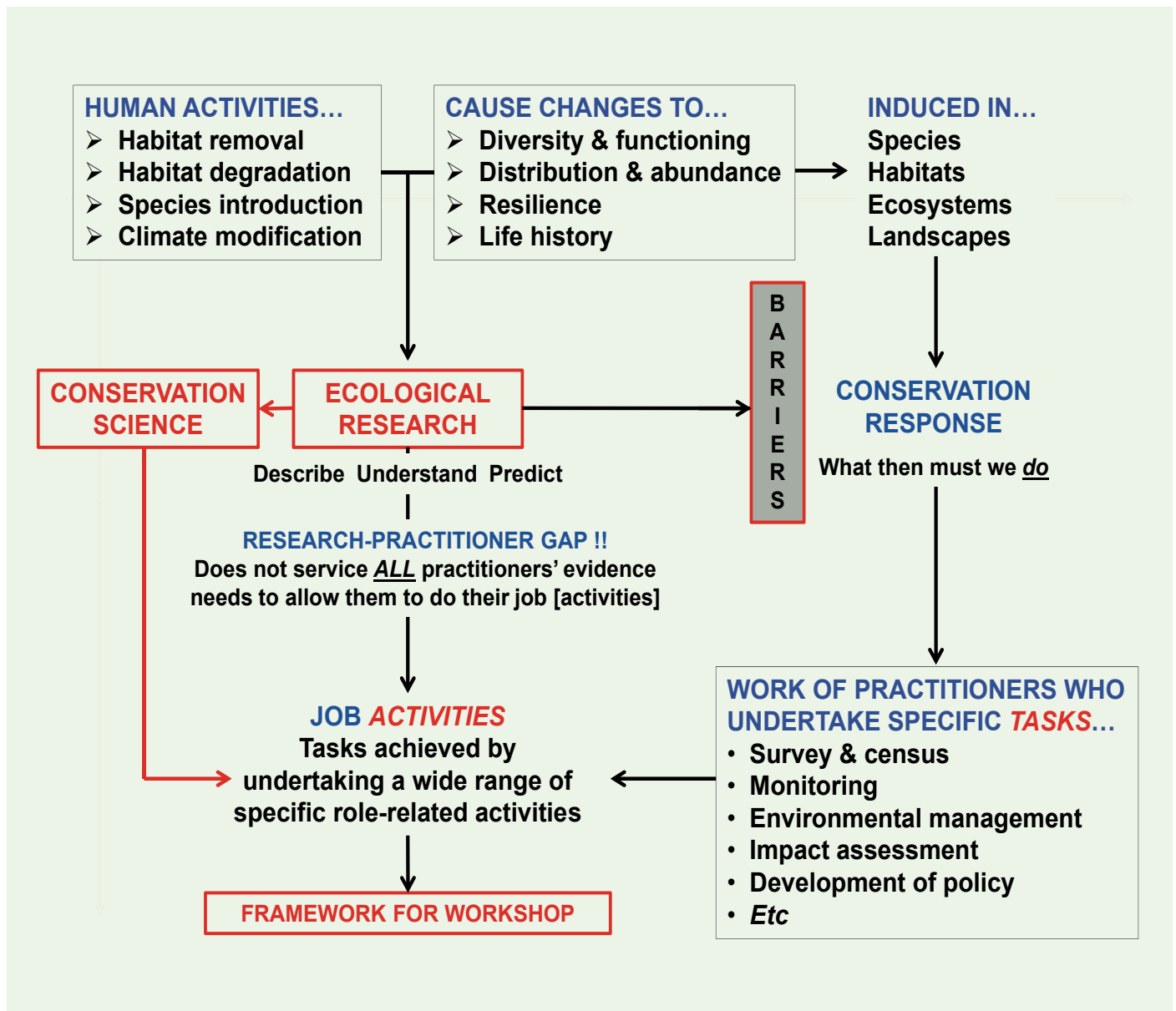


Figure 1: Diagram demonstrating the context of the workshop in relation to issues surrounding conservation science (used with the kind permission of Mark O'Connell)

an added blank column against each task, headed 'specific evidence required'.

The initial task for each group was to work through the framework, and check that the range of questions being asked was valid and complete. In other words, checking that the headings for the broad areas of work, the tasks and activities for each task, were appropriate for the exercise. For example, one of the task activities states: "Provide evidence on nature conservation and wider environmental management to successfully influence Government...". So in drilling down into this particular task, we asked ourselves "Do we need evidence on the methods/effectiveness of providing evidence?", and concluded that this was not a particularly high priority.

The five groups collectively worked through the table, and by no means managed to address and evaluate every task activity. However, there was sufficient 'coverage' to enable us to agree on the majority of headings. Once the framework had been set, we then turned our attention to the actual evidence required. This is where the diversity of the participants proved most effective, as it provided a range of evidence to set against each (agreed) task activity. Finally, we were asked to classify the required evidence we identified according to how important it was at five different geographic scales.

As one would expect, there was considerable diversity amongst the participants in terms of what each considered to be a priority for conservation evidence to enable them to deliver their role more effectively. Of particular interest, there was a broad acknowledgement of a paucity of evidence related to the 'social/people-centric' aspects of our work, and a broad feeling amongst participants that subsequent stages to the process needed to draw on practitioners from disciplines other than ecology and environmental management.

At the time of writing Mark and Rachel had yet to produce a summary of the collated outcome of the meeting, but from the feedback provided by the different groups during the meeting, I expect that we will see the development of a practical based framework of conduits for information flow that will create a real

enhancement to the robustness of our work as ecologists and environmentalists<sup>3</sup>.

### Application

When undertaking our work, it may be that the application of our understanding of current guidance and standards occasionally throws up results that are unexpected. Or that we may tweak accepted methods to accommodate particular circumstances which then prove to provide us with greater insight/understanding of the matter with which we are dealing. Mechanisms exist to enable such 'advances' in understanding to be communicated to a wider audience. For example, *In Practice* plays an important role in such dissemination, along with other 'grey' literature. Our own CIEEM Best Practice Awards were set up precisely for that purpose.

Whilst such 'causal' evidence is of use, there exists a swathe of empirical evidence, largely stemming from academic studies/literature. Of course, when as practitioners we follow accepted guidance, that guidance should be making reference to, if not be ultimately based upon, empirical evidence which may be available. But like a game of 'Chinese whispers', can we be sure that the guidance itself has taken account of all the available evidence? And even if this is so, can we be sure that there have not been more recent studies which have the potential to alter, perhaps radically, the way the guidance is set out? As ecological/environmental practitioners, to what extent are we able to locate and absorb the empirical evidence directly?

It is tempting to simply accept that we are undertaking our craft to the best of our ability and, as such, are compliant with our *Code of Professional Conduct*. And this may be the case. But ecology and environmental management are inexact sciences, and although we may never achieve 100% 'true' understanding, we should always strive to get as close as we can. This ERT Conservation project<sup>2</sup> has the capacity to assist us in ensuring that our analyses and outcomes relating to conservation action, are more rigorously constructed.

The workshop's focus is also most timely given the current political climate. As we progress in departing from the European Union, there will be enormous

pressure on our governing administration to keep the economy buoyant. One facet to this will be the re-evaluation of regulations that may hinder (or perhaps more accurately, be perceived to hinder) economic growth. The EU Birds and Habitats Directives are likely to be casualties. Nonetheless, Government will wish to explore alternatives to regulation to deliver environmental safeguard, and the emphasis on robust professional standards is likely to be a feature. So as professionals, it will become increasingly important that our work is based upon objective and up-to-date understanding of our trade. This work is likely to make an important contribution to this goal.

### Acknowledgement

Thanks go to Carols Abrahams, whose suggestions greatly improved the quality of this article.

### Notes

1. Taken from the CIEEM Code of Professional Conduct, June 2016
2. [http://www.ert-conservation.co.uk/wpcs\\_intro.php](http://www.ert-conservation.co.uk/wpcs_intro.php)
3. Following a further workshop with a broader range of participants, Mark's envisaged output is 'A Practical Guide to Conservation Science'

### About the Author

Dr Greg Carson runs Ecology Network Ltd, an environmental consultancy based in London. He has previously worked as an Associate within a large multi-disciplinary engineering consultancy, as a county ecologist, and for The Wildlife Trusts. Greg sits on CIEEM's Advisory Forum and represents the Institute on the UK Great Crested Newt Working Group.

**Contact Greg at:**  
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## Call for Papers

CIEEM Autumn Conference 2017

# Mitigation, Monitoring and Effectiveness

21-22 November 2017, Manchester

This two-day conference will focus on recent research into the effectiveness of habitat and species mitigation, innovative approaches to monitoring and data capture/use, and the role of the profession in contributing to the evidence base for the effectiveness of mitigation techniques.

Further details and a pro-forma for submitting proposals for papers/workshops are available by emailing: [enquiries@cieem.net](mailto:enquiries@cieem.net)

The deadline for offers of papers is 28 July 2017.

# Employers' Investment in Continuing Professional Development (CPD)

**Karen Hood-Cree**

Professional Development Coordinator, CIEEM

For employers, supporting continuing professional development (CPD) should be a high priority. It benefits not only the employee but also enhances the organisation's resilience, collective competence and capacity for growth. Investing in ongoing knowledge acquisition and personal development demonstrates that employees are valued and valuable.

Planning CPD should be a core element of any annual performance review process. The plan should be relevant to the role (and potential role), development needs and organisational demands. Whether resulting from a conversation between a staff member and a line manager, or as a result of self-reflection, the CPD plan provides a framework for maintaining knowledge and skills as well as exploring new areas of interest or business need.

There are many different forms of CPD. CIEEM's membership CPD obligation is

based on a combination of structured and unstructured development linked to the Competency Framework. Whilst training courses, conferences and webinars are some of the obvious ones, others may be less obvious. Mentoring (as mentor or mentee), new project work, committee work, subject-specific reading, research and work shadowing are other examples but there are many more.<sup>1</sup>

Members are expected to keep a record of their CPD and we provide an online tool to enable you to do this (available via the Members' Area of the website<sup>2</sup>). The tool also includes a CPD planner. Each year the Training, Education and Careers Development Committee (TECDC) randomly audits a selection of members' CPD records to ensure that membership obligations are being met.

If you require any further information about CPD please contact [cpd@cieem.net](mailto:cpd@cieem.net).



## Notes

1. Competency Framework Themes and other information can be found at: <http://www.cieem.net/eligibility-information>
2. <http://cieem.activclient.com/login.aspx?Type=AREA>

# Developing Ecological Clerk of Works Accreditation

Following extensive consultation, work has now begun on a project to develop an Accredited Ecological Clerk of Works (ECoW) scheme. Supported by a wide range of project partners – including the Construction Industries Training Board (CITB), the Civil Engineering Contractors Association (CECA), HS2, Scottish Environment Protection Agency (SEPA) and the Association of Ecological and Environmental Clerk of Works (AEECoW) – the first phase of the project is underway.

Ecological Clerks of Works are a vital part of the development construction process. Undertaken effectively, the role can provide practical, site-specific and proportionate assistance to contractors to ensure that they comply with relevant environmental regulations, planning conditions and client requirements whilst protecting valuable biodiversity features on site and overseeing ecological mitigation activities. Undertaken badly, the role can lead to avoidable costs, project timetable delays and/or adverse publicity for both clients and contractors as well as poor outcomes for biodiversity.

## Accrediting ECoWs

There is a growing demand for ECoWs in the UK, and potentially in Ireland, as infrastructure projects get underway. Contractors are concerned about the availability of sufficient, competent ECoWs now and in the years ahead, identifying this as one of the principal risks to successful infrastructure delivery to planned timescales. There is also



recognition amongst ECoW service providers that there is a need to raise the profile of the role, to increase contractors' and clients' understanding of the role, and to improve the competence of ECoWs on site. An accredited ECoW scheme will seek to address these issues

## Current Work

CIEEM is currently working with CECA on a CITB-funded research project to seek empirical evidence of the scale of skills gaps and skills shortages in the ECoW role. This research project will be concluded next month. Some CIEEM members have been taking part in the research and your contribution is much appreciated.

Alongside this research we have been working with Greenbridge Ltd and a multi-disciplinary UK and Ireland Advisory Group to develop competency profiles, linked to CIEEM's Competency Framework, for three ECoW roles, identifying key knowledge, skills and behaviours. The three roles differ in the extent to which they are operational, advisory or auditing work on site.

## Next Steps

The next steps will involve agreeing the standards for each role and the preparation of a detailed structure and outline course content for the associated training programme, along with assessment processes. This will be done in liaison with the Irish National Accreditation Board as well as CITB in the UK. In addition to a comprehensive training and assessment programme for those new to the role, there will also be a 'fast-track' assessment route for those who are already experienced and can demonstrate that they meet the agreed competence standards.

A further update will be provided in the September issue of *In Practice*.



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## Could you be the right person to lead the Institute on the next stage of its journey?

We are now inviting self-nominations for the position of **CIEEM President 2018-2021**. Elected by the membership, the CIEEM President leads the organisation in delivering its vision and strategy. At our AGM in November 2017 we will be electing a new President to take office in November 2018 (having first served for one year as President-Elect) and serving until November 2021. Candidates must be a Full member or Fellow, will need to be able to allocate time to the role, must be willing to be a public face for the Institute and have experience of working at a strategic level. Could this be you?

We are also seeking new **Governing Board** and **Advisory Forum** members including an **Hon. Secretary-Elect** (to take up the post in November 2018). These are all critically important roles in supporting the Institute's work and decision-making on behalf of the members. The successful candidates will have the opportunity to use their skills and experience to help their professional body grow and develop further. These are exciting and challenging times and we hope to make the experience of serving on the Governing Board or Advisory Forum as fulfilling as possible.

Self-nominations are invited by 31 August 2017. Further details on the roles and how to apply are available at [www.cieem.net/governance](http://www.cieem.net/governance) or by contacting [enquiries@cieem.net](mailto:enquiries@cieem.net).

**Get involved and make a difference.**

# Criminal Prosecution – Are You Covered?

Working in the environmental field creates a number of risks over and above the standard 'breach of duty' claims that can often arise against other professionals.

The main difference, and perhaps the most nerve-wracking, is the fact that you can be open to a criminal prosecution arising out of an alleged breach of the various pieces of environmental legislation that governs certain aspects of biodiversity protection.

In the normal course of events, a criminal prosecution would fall outside the scope of a Professional Indemnity policy, given that they generally provide cover for any civil liability arising out of the conduct of your professional business. However, given that, at CIEEM Insurance Services (operated by McParland Finn Ltd), we have been dealing with the requirements of CIEEM members for more than 20 years, we are well aware that your requirements go over and above a straightforward 'Civil Liability' policy. As a result, as a standard benefit for CIEEM members, the policy we arrange on your behalf specifically includes cover for the costs incurred in dealing with a criminal prosecution.

This additional cover provides that your insurers will cover you for:

*"... the costs and expenses incurred with the prior consent of the [Insurer] in the defence of any criminal proceedings against the Insured (or any appeal against a conviction arising from such proceedings) in respect of a breach of any statute or statutory regulations ..."*

As a result, if you are contacted by the Police or the Environment Agency regarding any actual or alleged criminal offence in connection with any environmental work undertaken on a project, provided you contact us as soon as practicable, then cover is in place to help safeguard your position and assist in dealing with the investigation.



Please note that not all insurers will include this cover as standard so you should check your policy carefully and make sure the additional cover is included. Not to do so can be an expensive mistake.

Should you be in the unfortunate position of needing to seek legal advice under this clause then you do need to be aware that most insurers will have their own legal firms to whom any work associated with claims under this clause will be referred. In most cases, to be covered by the insurance policy, any legal work associated with a claim will be undertaken by one of these firms (i.e. you do not normally get to choose which legal firm you can use).

With this in mind, our insurers utilise the services of one of the UK and Ireland's leading insurance and risk law specialists. Not only is the firm an established presence within the insurance sector, they also have a dedicated and experienced team of solicitors on hand to assist with these issues. The services that they provide can range from assisting in the preparation of witness statements to attending interviews under caution and defending you at trial. As these services fall within the scope of the policy we arrange on your behalf, any costs incurred in dealing with the investigation and the prosecution will fall to your insurers provided that you abide by the terms and conditions of the policy.

We appreciate that the first thought that you may have when contacted by the Police or the Environment Agency regarding a possible prosecution may be to obtain legal advice before contacting your insurance brokers. However, while this is understandable, this could result in a conflict with the terms of the policy as the cover will then not generally apply to any costs incurred without the insurers' consent.

It is possible that insurers may be prepared to contribute towards any costs incurred without their consent, although it should be noted that this is entirely at their discretion and they are not obliged to do so. As such, you may still be faced with paying these legal costs, either in part or in full, which would otherwise have fallen to the insurers.

CIEEM Insurance Services are here to protect you and your company in the event that a claim, be it a criminal prosecution or a civil liability claim, and in order to receive the full benefit of the cover under the policy we would recommend that you contact us as soon as you become aware of a potential problem. We can then ensure that you benefit in full from the cover provided under the policy.

If you would like to discuss the issues raised in this article please phone 01612 377 729 or email [joea@cieem-insurance.co.uk](mailto:joea@cieem-insurance.co.uk). Alternatively please visit [www.cieem-insurance.co.uk](http://www.cieem-insurance.co.uk) for more information.



# Chartered Membership

Fellows and Full Members of CIEEM can develop their skills and gain professional recognition from employers, colleagues and clients by achieving Chartered status. CIEEM offers two Chartership awards:

- Chartered Ecologist (CEcol):**  
 The Register of Chartered Ecologists recognises the effective application of knowledge and understanding of the science of ecology by professionals committed to the highest standards of practice.
- Chartered Environmentalist (CEnv):**  
 CIEEM is one of 23 professional bodies licensed by the Society for the Environment (SocEnv) to award Chartered Environmentalist status. CEnv is an increasingly recognised standard of good environmental practice.

The following profile highlights the work of Chartered professionals and provides an insight into the kind of roles that these senior ecologists and environmental managers are required for.

## New Chartered Members

CIEEM is pleased to announce the following new Chartered members:

Chartered Ecologist
Dr Robert Iredale CEcol MCIEEM
Miss Mandy Apps CEcol MCIEEM
Dr Jo Parmenter CEcol CEnv MCIEEM
Dr Peter Foss CEcol MCIEEM
Dr Patrick Crushell CEcol MCIEEM
Dr Liat Wicks CEcol MCIEEM
Mr Michael Stopa CEcol CEnv MCIEEM
Mr Gordon Haycock CEcol CEnv MCIEEM
Mr Mark Lang CEcol CEnv MCIEEM
Ms Paola Reason CEcol CEnv MCIEEM
Miss Rachel Brady CEcol MCIEEM

Chartered Environmentalists
Mr Gavin Ward CEnv MCIEEM
Mr Matthew Oakley CEnv MCIEEM
Mr Barry Clarkson CEnv MCIEEM
Dr Kate Vincent CEnv MCIEEM
Miss Tamara Percy CEnv MCIEEM
Mr Marc Jackson CEnv MCIEEM
Mrs Nicola Tyrell CEnv MCIEEM
Mrs Julie Bhatti CEnv MCIEEM

## Chartered Ecologist application deadlines

CEcol Application due date	CEcol Interviews
23 June 2017	w/c 11 Sept 2017
15 Sept 2017	w/c 11 Dec 2017

## Chartered Environmentalist application deadlines

CEnv application due date	CEnv report submission	CEnv Interviews
1 September 2017	24 November 2017	8 January 2018

Please note, these dates are subject to the availability of assessors and may change.



## Dr Sarah Cox (née Jackson) CEcol CEnv MCIEEM

Associate Director, The Ecology Consultancy

### Why did you join CIEEM?

I joined CIEEM to demonstrate my commitment to quality and standards and to be part of a wider community of ecologists.

### Why did you apply for Chartered status?

I applied as a means of providing my clients with the security of knowing the level of service they would get from me and also as a means of assessing my own performance as an ecologist. I believed Chartered Status was extremely important for my own development as an ecologist and to provide a benchmark for improving my own skills.

### How did you find the Chartership process?

The process was not easy but through the process of reviewing the competencies, it allows you to critically appraise yourself and think about all aspects of your own

development. Not only to highlight strengths, but also weaknesses or areas where improvements are needed.

### How has achieving Chartered Status impacted on the types of work you undertake?

I believe I now have a stronger case to bid for more complex, high profile work than previously. Chartered Status provides a benchmark for clients to assess my skills and level of competence. This is especially important when representing clients at Inquiry for instance as it clearly demonstrates my level of expertise and adds weight to any opinions stated.

### What is your education background?

I have a BSc (joint hon) Biology and Geography, MRes Ecology and Environmental Management (Distinction), PhD Conservation Biology/Urban Ecology.

If you are interested in submitting your own profile please contact the Registration Officer, Michael Hornby, at [RegistrationOfficer@cieem.net](mailto:RegistrationOfficer@cieem.net).

### What training experience do you have?

I have completed numerous training courses and attended workshops and conferences over the years. The Ecology Consultancy also runs various courses through the year for CIEEM and others.

### What is the best thing about your job?

I relish the challenges of my role within the company. It is hectic and extremely demanding, but the huge variation in my role means that I have to operate at the highest level at all times. Our teams rely on the quality of my outputs/advice and that of other senior managers in the company and this means that I continually strive to make sure that, wherever possible, I can provide them with the advice and support they require to do their jobs and advance their own careers.



# British Ecological Society

Richard English

Communications Manager, British Ecological Society

## Journal of Applied Ecology



Spring is a time of change and new starts, and we have plenty of new initiatives and collaborations for 2017.

We're continuing to work hard with our *Journal of Applied Ecology* on developing an online resource to help bridge the gap between academics and practitioners.

We've run a number of focus groups and presented our updated findings to CIEEM; the initiative will be a web resource containing a variety of information types relevant to applied ecology, including summaries, reports and journal articles.

Our *Journal of Applied Ecology* also has two timely research papers on the EU Common Agricultural Policy (CAP): 'Sensitivity of the farmland bird community to crop diversification in Sweden: does the CAP fit?' by Josefsson *et al.* and 'The importance of trees for woody pasture bird diversity and effects of the European Union's tree density policy' by Jakobsson and Lindborg (see pages 65-67).

We were very pleased to collaborate with CIEEM and take part in their webinar series on Friday 7 April 2017. Prue Addison presented 'Decision triggers for evidence-based conservation management', based on her *Practitioner's Perspective* article. These articles are designed for people involved in hands-on management to provide thought-provoking discussion and are free to read at:

<http://www.journalofappliedecology.org/view/0/PractitionersPerspective.html>

### Invasive Species Week

It is vital to understand the ecology of invasive species and their potential impacts, as well as helping to predict which will arrive next, and how to prevent spread. Scientific research and ecological evidence play a vital role in detecting when

a species is in the wild causing negative impacts and in helping to know how to eradicate them. We produced a Virtual Issue for Invasive Species Week as part of our effort to share evidence and inform good practice:

[www.britishecologicalsociety.org/invasivespecies2017](http://www.britishecologicalsociety.org/invasivespecies2017)

Our *Practitioners Perspectives* provides a platform for individuals involved in hands-on management of ecological resources – and provides an opportunity for environmental NGOs and practitioners engage with, challenge and advance the evidence of invasive non-native species (INNS).

<http://www.journalofappliedecology.org/view/0/PractitionersPerspective.html>

[www.journalofappliedecology.org](http://www.journalofappliedecology.org)

### Making Research More Applied

The Convention on Biological Diversity (CBD) remains an important international treaty for the UK. We are signed up to Aichi Biodiversity Target 9 that "by 2020, *invasive alien species and pathways are identified and prioritized, priority species are controlled or eradicated, and measures are in place to manage pathways to prevent their introduction and establishment.*" Improving the evidence underpinning methods of early detection and ensuring appropriate rapid response techniques once an INNS has been detected is vital; as is rehabilitation and long term management of sites or species. The GB Non-Native Species Strategy, and its implementation plan, set out the CBD principles and is a useful document to use to align research within an applied framework in Britain.

The first research action within the GB Non-Native Species Strategy

implementation plan is to "establish a working group with responsibility for improving coordination, developing a strategic plan, communicating with the research community, and influencing funders of research". While this is has yet to be set up, it will provide an extremely important link between the research community and policy-makers.

### Brexit

As the UK Government proceeds with the Brexit negotiations, it is vital that our community makes itself heard by engaging proactively with the debate. Since the referendum, we have held two high profile events on the consequences of Brexit for science and the environment, met with the Brexit Minister to discuss our concerns, and successfully informed a number of Parliamentary inquiries.

As the Brexit process unfolds, we will strengthen this engagement through the work of our new Brexit Policy Working Group. This work will require the expertise and active participation of our community – join our Brexit Mailing List now or tell us your priorities: [ben@britishecologicalsociety.org](mailto:ben@britishecologicalsociety.org).

Cross-border collaboration is essential for excellent science and effective environmental protection; it is essential that this is recognised in the UK's approach to the Brexit negotiations.

We have been, and will continue to work in partnership with a wide range of partners in order to communicate our messages. Our European collaboration continues with our joint Annual Meeting 'Ecology across Borders' in Ghent on 11–14 December with the GfÖ, NecoV and in association with EEF: [www.ecology2017.info](http://www.ecology2017.info) #EAB2017

# Building Bridges between Farming and Nature: Grazing is Amazing

## Codi Pontydd rhwng Ffermio a Natur: Pori yn Rhagori

Welsh Section  
Conference 2017

Cynhadledd Adran  
Cymru 2017

**Diana Clark MCIEEM**  
Welsh Section Support Officer

After months of planning and numerous telephone conversations, in early February several folk from the Welsh Section Committee, together with various CIEEM staff members, arrived in a sunny Llandudno for a joint conference with PONT and Natur.



The conference was opened by Mike Alexander MCIEEM, current Chair of PONT and Executive Director of Natur. He outlined the importance and value of our cultural landscape, formed over thousands of years as a (mainly unintentional) by-product of people toiling to provide a living for their families, and the need to celebrate these special and precious places. Mike also handed over the baton from Natur to CIEEM – to whom a significant amount of encouragement and support has been given, and for which we are

incredibly grateful. Mike's introductory talk was followed by CIEEM's CEO, Sally Hayns CEcol MCIEEM, providing a summary of her own background and how this has been intertwined with North Wales over the years. For the benefit of members and non-members alike, she also introduced CIEEM as a professional body, describing the very diverse work that the organisation carries out.

Matthew Quinn (Environment and Sustainable Development, Welsh Government) spoke next, emphasising natural resources as our biggest asset and the great need for local collaborative action to meet challenges/opportunities presented by the new legal framework in Wales. We also heard from Kevin Austin (Agriculture Strategy and Policy, Welsh Government), who spoke on the Common Agricultural Policy (CAP) framework, what we have learnt so far, how this may change post-Brexit and whether we can adapt novel approaches from abroad to suit us. This was followed by a fascinating presentation on grazer selectivity and the effect of this on both environmental outputs and animal food-products (Bill Grayson, Morecambe Bay Conservation Grazing Company). Next up we heard Wolfgang Suske's (SUSKE Consulting) entertaining perspective on how one agri-environment



scheme in Austria is run using results-based payments, followed by a short presentation from Mike Alexander on grazing within woodlands. The final conference presentation of the day was from Geraint Jones (Pembrokeshire Coast National Park Authority) who spoke to us in Welsh about the Pembrokeshire Grazing Network and some of the key issues that have emerged over the last 15 years.

The conference day was interspersed with short 'soap-box style' pitches from PONT, summarising recent work that the organisation has been driving in each area of Wales, together with Q&A sessions with all speakers, which generated some lively debate.

CIEEM's Welsh Section Committee then held their short Annual Members' Meeting, presenting a summary of recent events



in Wales and outlining some of our plans for things to come. During the conference dinner we enjoyed hearing Iolo Williams speaking passionately about his personal experiences with the natural world and the farming community in Wales – a real story-teller and entertainer. The rest of the evening was spent catching up with friends, colleagues and acquaintances (old and new) in the cosy hotel bar.

Day 2 saw several more soap-box sessions, plus a beautifully-presented talk on meadow restoration projects (Trevor Dines, Plantlife) and an eloquent discussion on the need for longer time-frames, bigger spatial scales, an understanding of place, freedom from unrealistic targets and a welcome for the unquantifiable, when it comes to managing our relationship with the environment (John Rodwell, Independent Ecologist).

The highlight of Day 2 was a choice of an indoor workshop or one of four field trips to the bracing Great Orme, looking at how conservation grazing has been applied in practice to a beautiful and highly popular local site. This included (amongst other things) a walk around the National Trust-owned Parc Farm, which has seen so much media interest of late. Dan Jones pays just £1 per year for his tenancy, in exchange for shepherding the land in a sympathetic manner that benefits both people and wildlife. Dan's group explored the highs and lows of such an approach, plus enjoyed watching a shepherd doing what he does best – herding sheep with the aid of his faithful dog.

The Welsh Section Committee would like to extend a huge *diolch yn fawr* to PONT for all of the hard work that went into organising the conference, as well as the encouragement and financial support from Natur that has assisted my appointment here in Wales. It was a pleasure also to welcome such a wide-range of speakers to our event, many of whom gave up their time for free. Plus of course the conference could not have run without the support of the 140+ delegates who attended. We look forward to further developing close ties with a multitude of organisations in the future, and hope to see you at a Welsh Section event sometime soon.

PONT works with individuals and organisations to deliver appropriate grazing regimes for the benefit of wildlife, both on individual sites and at a local and regional level. You can find out more about PONT by visiting [www.pontcymru.org](http://www.pontcymru.org).

Check out the CIEEM Welsh Section Committee at [www.cieem.net/welsh-committee-profiles](http://www.cieem.net/welsh-committee-profiles). We currently have several vacancies so do get in touch if you are interested in contributing.

### About the Author

Diana Clark works as the CIEEM Welsh Section Support Officer for two days a week, supporting the Section Committee and staff at the Secretariat to run informal events, training, student engagement opportunities and policy responses in Wales.

**Contact Diana at:**  
[dianaclark@cieem.net](mailto:dianaclark@cieem.net)





# Member Network News

CIEEM has two types of Member Networks: Geographic Sections and Special Interest Groups. Each is run by a committee of members for the benefit of other members, providing opportunities to network, share knowledge and learn more about the science and practice of our profession.

For further information about Member Networks and how you can get involved, please visit [www.cieem.net/get-involved](http://www.cieem.net/get-involved).

## WALES

### Bryophyte identification day, Pensychnant Nature Reserve

18 March 2017

A small group of CIEEM members braved the wind and rain at Pensychnant Nature Reserve in Conway, North Wales, to hunt out and identify various species from the vast array of bryophytes hosted at the reserve.

The morning was spent identifying and sampling out in the field followed by an afternoon drying off after the inclement weather and identifying samples using microscopes, hand lenses and identification keys.

The day was led by the very experienced and enthusiastic Lucia Ruffino of the North Wales Non-flowering Plant Group, who helped delegates understand the complexities of bryophyte structure in order to identify the species sampled. A great day was had by all, despite the weather!

Find out more about the Welsh Section and upcoming events at [www.cieem.net/geographic-sections/8/02.-wales](http://www.cieem.net/geographic-sections/8/02.-wales)

You can read more about the recent joint Welsh conference on page 58.



## IRELAND

### Irish Section Conference 2017: Advancing EclIA in Ireland

6 April 2017, Dublin

Delegates gathered at the Dublin Chamber of Commerce for a day looking at EclIA with talks from a great line-up of speakers, including a keynote from Bill Sutherland of Conservation Evidence.

The morning session kicked off with a presentation on Hydrology and Ecological Impact Assessment, which highlighted the multidisciplinary approach required to examine interactions between water and ecosystems (Ray Flynn, Queens University Belfast). This was followed by a discussion on the newly revised EPA Guidelines on Environmental Impact Assessment Reports, which reflect changes in directives, legislation and case law since the previous guidelines were published in 2002 (Paul Fingleton, CAAS); and a talk on the approach taken for ecological data collection for the N6 Galway City Ring Road project (Aebhin Cawley, Scott Cawley).

After the morning break, there were presentations on air pollution in Northern Ireland (Gary Dodds and Keith Finnegan, NIEA); the latest advances in bat assessment and mitigation (Paul Scott, Bat Conservation Ireland); EclIA for Wind Farms (Chris Perry, NIEA); and the value of biological records and how organisations such as CEDaR can engage

## WALES

### An Evening with Natterjack Toads

19 April 2017, Talacre

14 delegates, led by Kim Norman (Excal Ltd), Land Management Advisor for ENI UK Ltd at Talacre, Flintshire, spent an engaging April evening hearing about the history of natterjack toads at this site, before heading out to find them. The tropical-sounding croaks of the males as they try to attract females in from their daytime burrows in the surrounding dunes drew a different sort of attention as participants intervened to weigh and measure them.

Strings of natterjack eggs were also marked with numbered and dated flags to enable Kim to plan for the date of emergence. We would like to thank Kim for a superb evening and allowing us to act under her licence for this European Protected Species.

You can read more about this event at [www.cieem.net/wales](http://www.cieem.net/wales)

Measuring a  
natterjack toad



A natterjack toad  
sits patiently on the  
weighing scales



**Other great Member Network events over the last quarter have included:**

- Biodiversity Data with the Scottish Section
- The European eel with the East of England Section
- Ecological report writing workshop with the South West Section
- Perspectives on EclA with the West Midlands Section
- Conservation Dogs with the East Midlands Section
- 3<sup>rd</sup> edition bat guidelines with the Welsh Section

These events are all organised by our volunteer committees and we hope many of you have been able to go along and enjoy their efforts. During the last year, your Member Networks organised no less than 83 local events, representing over 2000 opportunities to network and share expertise! This activity is increasing steadily each year, not only providing access to great low-cost CPD events, but also valuable opportunities to network, with many events organised jointly with other bodies.

If you would like to see more happening in your area, please do get in touch with your committee – especially if you are able to offer a bit of time to help make it happen. Find out more at [www.cieem.net/get-involved](http://www.cieem.net/get-involved).

more comprehensively with data providers to assist the collation of data sets (Damian McFerran, CeDAR).

The afternoon session provided a thought-provoking workshop on the need for evidence-based Mitigation (Bill Sutherland, Conservation Evidence). An interactive session with the audience of consultants and practitioners revealed what specific types of conservation interventions the group would most like to see tested to implement effective mitigation measures. The final session of the day brought together perspectives and insights on the EclA process from a client, consultant and local authority perspective, and the day closed with the Irish Section Annual Member's Meeting.

You can find full details of all the speakers, along with their presentations at [www.cieem.net/previous-conferences](http://www.cieem.net/previous-conferences).



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

For information on vacancies in your Member Network committees visit [www.cieem.net/cieem-committee-vacancies](http://www.cieem.net/cieem-committee-vacancies).

# New Members

The decision on admission is usually taken by the Membership Admissions Committee under delegated authority from the Governing Board but may be taken by the Governing Board itself. CIEEM is pleased to welcome the following individuals as new members:

## ADMISSIONS

### Full Members

David Brown, Nicholas Carter,  
Dr Jennifer Dodd, Duncan Ludlow,  
Andrew Pearson, Paul Roberts,  
Nora Washbourne

### Upgrades to Full Membership

Rachel Barber, Victoria Brooks,  
Caroline Ford, Isla Hoffmann Heap,  
Anna Maxwell, Andrew Perry, Emma Reid,  
Kieran Shaw, Christopher Turner,  
Dr Nick Underhill-Day, Kim Wallis,  
David Watts

### Associate Members

Lydia Bach, Dr Carly Benefer,  
Dr Pamela Boyle, Lyn Cooch,  
Carol Donaldson, Andrew Hill,  
Martin Kennedy, Ben Walsh

### Upgrades to Associate Membership

Grace Burdge, Ishbel Campbell,  
Sean Clarke-Davey, Claire Dovey,  
Kelly Downward, Joseph Dyson,  
Gemma French, Jon Garner, Kate Holland,  
Natalie Kay, Ben Lansbury,  
Joanne Martindale, Richard Millington,  
Owen O'Keefe, Harry Smith, Amy Sneap,  
Victoria Telford, Peter Timms,  
Stephanie Walker, Olivia Winter

### Graduate Members

Sophie Barrell, Joshua Birchall,  
Katherine Bird, Gillian Birtles,  
Ayesha Carew, Gary Chan,  
Aidan Crowl, Dr Naomi Dalton,  
Patrick Ellison, Thomas Fawley, Lee Glasby,  
Christopher Greenland, Henry Gunning,  
Alex Hellyar, Rachel Hill, Kathryn Jones,  
Sorrel Kiamil, Kim Kirkbride, Laura Kor,  
Olga Krylova, Diane Megias,  
Dr Catherine Norris, Alex Perry,  
Catherine Porter, Hannah Rowding,  
Manu Santa-Cruz, Phoebe Shaw Stewart,  
Joseph Shepherdson, Emily Shipley,  
Amy Slater, Carolyn Smith, Nicholas Trull,  
Diana Webber, Adam West,  
Matthew Wingrove, Sharon Yardy,  
Jessica Yorke

### Upgrades to Graduate Membership

Stuart Abernethy, Misho Baxendale,  
Krisztina Fekete, Oliver Glenister,  
Adam Hicks, Natalie Morrison,  
Michael Perkins, Shaun Pryor,  
Vanessa Reeves, Thomas Rickman,  
Amie-Beth Sabin, Emily Simpson,  
Hayley Tomlin, Jodie Twose, Mate Vakarcs,  
Laura Vint, Bede West, Viola Zanetta

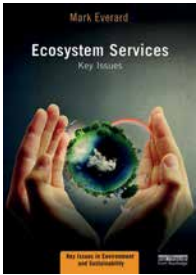
### Qualifying Members

Craig Baker, George Clutterbuck,  
Joseph Whitehead, Kelly Farrelly,  
Leane Holyoak, Matthew Hodgson,  
Max Hemmings, Steven Gregory

### Student Members

David Arnott, Claire Butt, Seán Byrne,  
Hannah Claydon, Adam Collett,  
Michael Connor, Joanna Coxon,  
Jack Dorkings, Darren Ellis, Neil Fraser,  
Mairi Gillis, Alexander Hargreaves,  
Eleanor Harrison, Alexia Hemming,  
James Hodgson, Daniel Hooper,  
Nicola Howie, Katie James, Bill Jeffreys,  
Abigail Johnson, Henry Koehler,  
Gary Lindsay, Pak Yi Lou, Rebecca Marsh,  
Alice Martin-Walker, Margaret McCallum,  
Susan Medcalf, Mark Morgan,  
Elaine Morrice, Michelle Newman,  
Jean Oudney, Nicolle Paisley,  
Amelia Reddish, Talek Renals,  
Jamie Renwick, Alison Rogers,  
James Rowland, Rachel Rowlands,  
James Sanderson, Andrew Saxon,  
Samantha Stockley, Rosalyn Thompson,  
Rachael Thurston, Richard Twining,  
Caroline Vaughan, Lyndsay Walsh,  
George Wilkinson, Rachel Wuest,  
Natalie Yoh

## Recent Publications



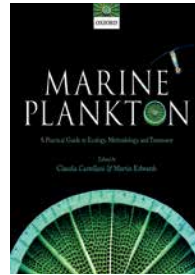
### Ecosystem Services: Key Issues

Author: Mark Everard  
ISBN: 9781138692725

Available from: [www.routledge.com](http://www.routledge.com)  
Price: £20.79

Given their rapid evolution, is the timing right for an authoritative guide on ecosystem services? Mark Everard has been active in innovation and application since the 1980s. His new book charts this journey both conceptually and using many practical case studies from across the world. Covering the underpinning science, areas of consensus and divergence, and important considerations of ethics and economics, this excellent book is for anyone interested in learning more and keeping up with developments. Ecosystem services offer a powerful lever for bringing nature into the political mainstream; this new volume presents the 'state of the art' of this transformation.

**Ann Skinner FCIEEM**

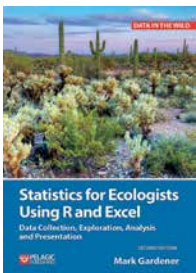


### Marine Plankton: A Practical Guide to Ecology, Methodology, and Taxonomy

Editors: Claudia Castellani  
and Martin Edwards  
ISBN: 9780199233267

Available from: [www.nhbs.com](http://www.nhbs.com)  
Price: £150.00

This publication provides a practical guide to plankton biology with a large geographic coverage spanning the North Sea to the north-eastern Atlantic coast of the USA and Canada. Marine Plankton is divided into three sections: an overview of plankton ecology, an assessment of methodology in plankton research covering sampling, preservation, and counting of samples, and a taxonomic guide richly illustrated with detailed line drawings to aid identification. This is an essential reference text suitable for senior undergraduate and graduate students taking courses in marine ecology (particularly useful for fieldwork) as well as for professional marine biologists.



### Statistics for Ecologists Using R and Excel (2<sup>nd</sup> Edition)

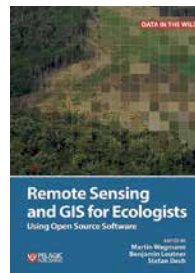
Author: Mark Gardener  
ISBN: 9781784271398

Available from: <https://pelagicpublishing.com>  
Price: £34.99

This is a book about the scientific process and how you apply it to data in ecology. It shows how to plan for data collection,

how to assemble data, how to analyse data and finally how to present the results. The book uses Microsoft Excel and the powerful OpenSource R program to carry out data handling as well as producing graphs.

Statistical approaches covered include: data exploration; tests for difference – t-test and U-test; correlation – Spearman's rank test and Pearson product-moment; association including Chi-squared tests and goodness of fit; multivariate testing using analysis of variance (ANOVA) and Kruskal-Wallis test; and multiple regression.



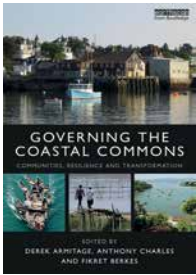
### Remote Sensing and GIS for Ecologists

Editors: Martin Wegmann, Benjamin  
Leutner and Stefan Dech  
ISBN: 9781784270223

Available from: <https://pelagicpublishing.com>  
Price: £34.99

This publication shows how ecologists can integrate remote sensing and GIS into their daily work. It will allow ecologists to get started with the application of remote sensing and to understand its potential and limitations. Using practical examples, the book covers all necessary steps from planning field campaigns to deriving ecologically relevant information through remote sensing and modelling of species distributions. All practical examples in this book rely on OpenSource software and freely available data sets. Quantum GIS (QGIS) is introduced for basic GIS data handling, and in-depth spatial analytics and statistics are conducted with the software packages R and GRASS.

## Recent Publications



### Governing the Coastal Commons: Communities, Resilience and Transformation

Editors: Derek Armitage, Anthony Charles and Fikret Berkes

ISBN: 9781138918436

Available from: [www.routledge.com](http://www.routledge.com)

Price: £26.39

Coastal communities depend on the marine environment for their livelihoods, but the common property nature of marine resources poses major challenges for the governance of such resources. Through detailed cases and consideration of broader global trends, this volume examines how coastal communities are adapting to environmental change, and the attributes of governance that foster deliberate transformations and help to build resilience of social and ecological systems. Governance here reflects how communities, societies and organisations (e.g. fisher cooperatives, government agencies) choose to organise themselves to make decisions about important issues, such as the use and protection of coastal commons (e.g. fishery resources). The book shows how a governance approach generates insights into the specific forms and arrangements that enable coastal communities to steer away from unsustainable pathways. It also provides an analytical lens to consider important questions of power, knowledge and legitimacy in linked social-ecological systems.



### Wildlife and Wind Farms – Conflicts and Solutions

#### Volume 1 – Onshore: Potential Effects

#### Volume 2 – Onshore: Monitoring and Mitigation

Editor: Martin Perrow

Available from: <https://pelagicpublishing.com>

Price: £34.99 each

This multi-volume work provides a comprehensive overview of the interactions between wind farms and wildlife.

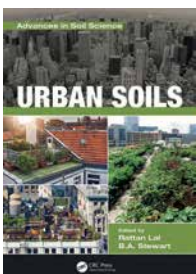
**Volume 1** documents the current knowledge of the potential impacts upon wildlife during both construction and operation. An introductory chapter on the nature of wind farms and the impact assessment process is followed by a series



of in-depth chapters documenting effects on climatic conditions, vegetation, terrestrial invertebrates, aquatic invertebrates and fish, reptiles and amphibians, birds, bats and terrestrial mammals. A synopsis of the known and potential effects of wind farms upon wildlife in perspective concludes the volume.

**Volume 2** provides a state-of-the-science guide to monitoring and mitigation to minimise or even eliminate impacts on wildlife from wind farms. The survey and monitoring section includes detailed chapters on birds and bats followed by chapters on modelling of collision risk and populations and the statistical principles of fatality monitoring. The following mitigation section comprises chapters on spatial planning and effective mitigation strategies for bats, birds and raptors including through repowering. A synopsis of international best planning and practice concludes the volume.

Volumes 3 (Offshore: Potential Effects) and 4 (Offshore: Monitoring and Mitigation) are yet to be published.



### Urban Soils

Editors: R. Lal and B.A. Stewart

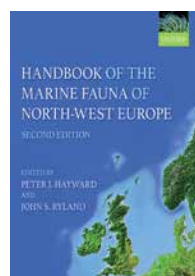
ISBN: 9781498770095

Available from: [www.routledge.com](http://www.routledge.com)

Price: £91.20

Urban soil comprises geological material drastically disturbed by anthropogenic activities. Urban soils play a role in the production of food, aesthetics of residential areas, and pollutant dynamics.

Properties of urban soils are normally not favourable to plant growth, are contaminated by heavy metals, and are compacted and sealed. This book explains properties of urban soils; effects of urbanisation on the cycling of C, N, and water assesses; impacts of management of urban soils; soil restoration; urban agriculture and food security; assesses ecosystem services provisioned by urban soils, and describes synthetic and artificial soils.



### Handbook of the Marine Fauna of North-West Europe (2<sup>nd</sup> Edition)

Editors: Peter Joseph Hayward and John S. Ryland

ISBN: 9780199549450

Available from: [www.nhbs.com](http://www.nhbs.com)

Price: £49.99

This authoritative guide enables accurate identification of the common components of the inshore benthic invertebrates of the British Isles and adjacent European coasts, as well as a substantial proportion of fish species. This new edition builds upon the strengths of the earlier work and is thoroughly revised throughout to incorporate advances in both the taxonomy and ecology of the organisms concerned.



### Practitioner's Perspective: Lack of sound science in assessing wind farm impacts on seabirds

Green, R.E. *et al.*

**Journal of Applied Ecology** 2016, **53**: 1635–1641.  
doi:10.1111/1365-2664.12731

Wind energy is expected to provide 9–14% of global electricity generation by 2050. This may eventually reduce climatic change and its negative impacts on biodiversity, but there are also several poorly quantified negative effects on wild species. For example, birds and bats are killed by colliding with turbine blades or towers and there may be effects of wind farms on mortality and reproductive rates of a wide range of species from avoidance and displacement. Birds may incur additional costs or forego benefits because of reduced transit or foraging within or near to wind farms. Positive effects of renewable energy infrastructure on populations of wild species have also been proposed and, in a few cases, quantified. These include possible enhancement of food resources of seabirds by protection from fishing from the presence of offshore installations and the provision of artificial substrates as habitat for fish and invertebrates.

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Open access: <http://onlinelibrary.wiley.com/doi/10.1111/1365-2664.12731/full>

### Avoidance of wind farms by harbour seals is limited to pile driving activities

Russell, D.J.F. *et al.*

**Journal of Applied Ecology** 2016, **53**: 1642–1652.  
doi:10.1111/1365-2664.12678

The authors studied whether harbour seals *Phoca vitulina* avoided wind farms being constructed using impact pile driving in The Wash, south-east England. There was no significant displacement during construction as a whole. However, during piling, seal usage (abundance) was significantly reduced up to 25km from the piling activity. Within 25km of the centre of the wind farm, there was a 19–83% decrease in usage compared to during breaks in piling, equating to a mean estimated displacement of 440 individuals. Displacement was limited to piling activity; within 2h of cessation of pile driving, seals were distributed as per the non-piling scenario.

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Open access: <http://onlinelibrary.wiley.com/doi/10.1111/1365-2664.12678/full>

### Spatial targeting of habitat creation has the potential to improve agri-environment scheme outcomes for macro-moths

Alison, J. *et al.*

**Journal of Applied Ecology** 2016, **53**: 1814–1822.  
doi:10.1111/1365-2664.12750

This study provides evidence that for conservation of species associated with a specific type of semi-natural habitat, AES interventions are most effectively positioned close to that habitat.

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Open access: <http://onlinelibrary.wiley.com/doi/10.1111/1365-2664.12750/full>

### Seeking convergence on the key concepts in 'no net loss' policy

Bull, J.W. *et al.*

**Journal of Applied Ecology** 2016, **53**: 1686–1693.  
doi:10.1111/1365-2664.12726

The authors identify inconsistencies that emerge in the usage of eight key terms and phrases associated with no net loss (NNL) policies: biodiversity, frames of reference (i.e. baselines, counterfactuals), no net loss, mitigation hierarchy, biodiversity offset, in-kind/out-of-kind, direct/indirect, and multipliers. For each term, the authors make recommendations to support conceptual convergence, reduce ambiguity and improve clarity in communication and policy documentation. However, they also warn of the challenges in achieving convergence, especially given the linguistic inconsistencies in several of these key concepts among countries in which NNL policies are employed.

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### Solving environmental problems in the Anthropocene: the need to bring novel theoretical advances into the applied ecology fold

Cadotte, M.W. *et al.*

**Journal of Applied Ecology** 2017, **54**: 1–6. doi:10.1111/1365-2664.12855

Despite multiple advances, there is differential success in the transition of some ecological tools and concepts into applied practice. The authors examine how and why some theories, concepts and methods successfully transition to the applied realm and to ask if some other areas of research have more to offer applied ecology than has yet been realised.

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Open access: <http://onlinelibrary.wiley.com/doi/10.1111/1365-2664.12855/full>

### Providing foraging resources for solitary bees on farmland: current schemes for pollinators benefit a limited suite of species

Wood, T. J., Holland, J.M. and Goulson, D.

**Journal of Applied Ecology** 2017, **54**: 323–333.  
doi:10.1111/1365-2664.12718

The authors' results show that the majority of solitary bee species present on farmland in south-east England collect most of their pollen from plants that persist unaided in the wider environment, and not from those included in agri-environment schemes focused on pollinators. If diverse bee communities are to be maintained on farmland, existing schemes should contain an increased number of flowering plant species and additional schemes that increase the diversity of flowering plants in complementary habitats should be studied and trialled.

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Open access: <http://onlinelibrary.wiley.com/doi/10.1111/1365-2664.12718/full>

### Transition from conventional to light-emitting diode street lighting changes activity of urban bats

Lewanzik, D. and Voigt, C.C.

*Journal of Applied Ecology* 2017, 54: 264–271.

doi:10.1111/1365-2664.12758

Light pollution is rapidly increasing and can have deleterious effects on biodiversity, yet light types differ in their effect on wildlife. Among the light types used for street lamps, light-emitting diodes (LEDs) are expected to become globally predominant within the next few years.

At light-emitting diodes (LEDs), the competitive advantage is reduced for light-tolerant bats. Thus, the global spread of LED street lamps might lead to a more natural level of competition between light-tolerant and light-averse bats. This effect could be reinforced if the potential advantages of LEDs over conventional illuminants are applied in practice: choice of spectra with relatively little energy in the short wavelength range; reduced spillover by precisely directing light; dimming during low human activity times; and control by motion sensors. Yet, the potential benefits of LEDs could be negated if low costs foster an overall increase in artificial lighting.

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Open access: <http://onlinelibrary.wiley.com/doi/10.1111/1365-2664.12758/full>

### Commentary: Bridging ecology and conservation: from ecological networks to ecosystem function

Harvey, E. *et al.*

*Journal of Applied Ecology* 2017, 54: 371–379.

doi:10.1111/1365-2664.12769

Current approaches to conservation may be inadequate to maintain ecosystem integrity because they are mostly based on rarity status of organisms rather than functional significance. Alternatively, approaches focusing on the protection of ecological networks lead to more appropriate conservation targets to maintain ecosystem integrity. The authors propose that a shift in focus from species to interaction networks is necessary to achieve pressing conservation management and restoration ecology goals of conserving biodiversity, ecosystem processes and ultimately landscape-scale delivery of ecosystem services. The authors discuss historical and conceptual advances, current challenges and ways to move forward, and also propose a road map to ecological network conservation, providing a novel ready to use approach to identify clear conservation targets with flexible data requirements.

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Open access: <http://onlinelibrary.wiley.com/doi/10.1111/1365-2664.12769/full>

### Invasive species management will benefit from social impact assessment

Crowley, S.L., Hinchliffe, S. and McDonald, R.A.

*Journal of Applied Ecology* 2017, 54: 351–357.

doi:10.1111/1365-2664.12817

Established approaches for addressing the social implications of invasive species management can be limited in effectiveness and democratic legitimacy. More deliberative, participatory approaches are emerging that allow integration of a broader range of socio-political considerations. Nevertheless, there is a need to ensure that these are rigorous applications of social science. Social impact assessment offers a structured process of identifying, evaluating and addressing social costs and benefits. The authors highlight its potential value for enabling meaningful public participation in planning and as a key component of integrated assessments of management options.

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Open access: <http://onlinelibrary.wiley.com/doi/10.1111/1365-2664.12817/full>

### Review: Human activities and biodiversity opportunities in pre-industrial cultural landscapes: relevance to conservation

Fuller, R.J. *et al.*

*Journal of Applied Ecology* 2017, 54: 459–469.

doi:10.1111/1365-2664.12762

In adopting perceived 'traditional' management practices, modern conservation rarely achieves the range and complexity of conditions that were present in the past. A better understanding of past practices allows more favourable management of those surviving semi-natural habitats where historic assemblages persist. When creating or restoring habitats, after interruption of management sufficiently long for dependent assemblages to be lost, better appreciation of historic management encourages novel forms of intervention to enhance biodiversity, with emphasis on complex structural and spatial heterogeneity at nested scales, biomass removal and nutrient reduction. These strongly management-based approaches are complementary to the use of large herbivores to create and maintain dynamic ecotonal mosaics in the manner advocated by some proponents of 'rewilding'.

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Open access: <http://onlinelibrary.wiley.com/doi/10.1111/1365-2664.12762/full>

## Sensitivity of the farmland bird community to crop diversification in Sweden: does the CAP fit?

Josefsson, J. *et al.*

**Journal of Applied Ecology** 2017, **54**: 518–526.  
doi:10.1111/1365-2664.12779

This study illustrates the importance of a consideration of structural - rather than species - diversity of crops for biodiversity, in this case farmland birds. The authors also underline the absence of such a distinction in current EU Common Agricultural Policy Greening, while simultaneously setting levels on crop diversification too low resulting in little to no change in landscape-scale crop diversity on Swedish farmland. The authors recommend that future efforts to manage farmland biodiversity should include ways of increasing the structural diversity of crops at the scale of farms and landscapes.

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## Do agri-environment schemes result in improved water quality?

Jones, J.I. *et al.*

**Journal of Applied Ecology** 2017, **54**: 537–546.  
doi:10.1111/1365-2664.12780

The results of this study indicate that agri-environment schemes can deliver improvements in water quality, through a reduction in diffuse pollution from agricultural sources. However, it is not easy to demonstrate scheme effectiveness; the combination of field survey and modelling used here provides a framework for addressing these difficulties. A spatially targeted approach for agri-environment scheme options to protect water resources from diffuse pollution is likely to be most effective at delivering water quality improvements.

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## A toolkit for optimizing fish passage barrier mitigation actions

King, S. *et al.*

**Journal of Applied Ecology** 2017, **54**: 599–611.  
doi:10.1111/1365-2664.12706

This study shows the benefits of combining a coarse resolution barrier assessment methodology with state-of-the-art optimisation modelling to cost-effectively plan fish passage barrier mitigation actions. The modelling approach can help inform on-the-ground river restoration decision-making by providing a recommended course of action that best allocates limited resources in order to restore longitudinal connectivity and maximise ecological gains.

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## Commentary: Is citizen science an open science in the case of biodiversity observations?

Groom, Q., Weatherdon, L. and Geijzenborffer, I.R.

**Journal of Applied Ecology** 2017, **54**: 612–617.  
doi:10.1111/1365-2664.12767

The assumption that voluntary data collection leads to data sharing does not recognise the wishes and motivations of those who collect data, nor does it respect the crucial contributions of these data to long-term monitoring of biodiversity trends. To improve data openness, citizen scientists should be recognised in ways that correspond with their motivations. Furthermore, organisations that manage these data should make their data sharing policies open and explicit.

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Open access: <http://onlinelibrary.wiley.com/doi/10.1111/1365-2664.12767/full>

## Assessing patterns in introduction pathways of alien species by linking major invasion data bases

Saul, W.-C. *et al.*

**Journal of Applied Ecology** 2017, **54**: 657–669. doi:10.1111/1365-2664.12819

Linking data bases on invasive alien species by harmonising and consolidating their pathway information is essential to turn dispersed data into useful knowledge. The standard pathway categorisation scheme recently adopted by the Convention on Biological Diversity may be crucial to facilitate this process. This study demonstrates the value of integrating major invasion data bases to help managers and policy-makers reach robust conclusions about patterns in introduction pathways and thus aid effective prevention and prioritisation in invasion management.

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Open access: <http://onlinelibrary.wiley.com/doi/10.1111/1365-2664.12819/full>

## The importance of trees for woody pasture bird diversity and effects of the European Union's tree density policy

Jakobsson, S. and Lindborg, R.

**Journal of Applied Ecology** 2017. doi:10.1111/1365-2664.12871

The results of this study show that tree density is not the limiting factor, but rather a driver of bird diversity and species composition in woody pastures and that tree density limits may fail to capture the whole range of biological values. To improve policy recommendations, the authors stress the importance of considering additional social-ecological drivers associated to management quality (e.g. taking into account moral and cultural motivations among farmers) to preserve biodiversity in woody pastures.

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# Forthcoming Events 2017

For information on these events please see [www.cieem.net](http://www.cieem.net).

## Conferences

Date	Title	Location
4 July 2017	Summer Conference 2017 – Integrated Management of the Marine Environment	Southampton
21-22 November 2017	Autumn Conference 2017 – Mitigation, Monitoring and Effectiveness	Manchester

## Training Courses

8 June 2017	Beginners' Guide to the National Vegetation Classification	Carlisle
13 June 2017	Otter Ecology and Surveys	Cannock
14 June 2017	Otter Mitigation	Cannock
14 June 2017	Preliminary Ecological Appraisal: An Applied Approach	Lewes
26 June 2017	Using Indicator Species for Habitat Assessment (Phase I and NVC) – Grasslands	Salisbury
27 June 2017	Water Vole Ecology and Surveys	Ilkeston
27-28 June 2017	QGIS for Ecologists and Conservation Practitioners	Gloucester
28 June 2017	Water Vole Mitigation	Ilkeston
5-7 July 2017	Working with Crayfish: Survey Methods, Ecology, Mitigation, Licensing and Invasive Species	Settle
19 July 2017	Hazel Dormouse Handling	Herne Bay
27 July 2017	Beginners' Guide to the National Vegetation Classification	Skipton
3-4 August 2017	Surveying for Bats in Woodlands	Gloucester
26 August 2017	Bat Handling and Identification	Herne Bay
1 September 2017	Hazel Dormouse Handling	Herne Bay
6 September 2017	Introduction to Professional Bat Work	Chipping
11-12 September 2017	Introduction to Phase 1 Habitat Mapping and Plant Identification	Newark
12 September 2017	Introduction to Professional Bat Surveys	Chipping
13 September 2017	Preliminary Ecological Appraisal: An Applied Approach	Lewes
14 September 2017	Using Indicator Species for Habitat Assessment (Phase I and NVC) – Heathlands and Acid Grassland	New Forest
16 September 2017	An Evidenced-Based Approach to Camera-Trapping	Edinburgh
19 September 2017	Water Vole Ecology and Surveys	Cirencester
19 September 2017	Introduction to Bats and Bat Surveys	London
20 September 2017	Water Vole Mitigation	Cirencester
20 September 2017	Introduction to Bats and Bat Surveys	Dunblane
21 September 2017	Bat Impacts and Mitigation	Dunblane
25 September 2017	Eurasian Beaver Ecology and Surveys	Dunkeld
26 September 2017	Eurasian Beaver Management and Mitigation	Dunkeld
26-27 September 2017	Peatland Restoration	Buxton
28 September 2017	Survey and Monitoring of Road and Rail and Associated Mitigation Schemes for Bats	Leeds
5 October 2017	Making the most of BREEAM and Home Quality Mark	London
13 October 2017	Understanding Wildlife Law	Nottingham
11 October 2017	Badger Ecology and Surveys	Llandeilo
12 October 2017	Badger Mitigation	Llandeilo
17 October 2017	Badger Survey, Impacts and Mitigation	Dunblane
26-27 October 2017	Intermediate QGIS	London



**Undertaking training  
has helped me  
share my  
expertise**

**David Goddard is a Senior Ecologist at WYG, who has benefitted from career development opportunities and has been able to share his expertise through mentoring. David tells us more:**

I returned to university as a mature student and graduated with a BSc in Environmental Conservation. Whilst I enjoyed studying, I chose to work as an ecological consultant during my final year. It was around this time that I co-authored a report for English Nature (now Natural England) specifying how to carry out the surveying and monitoring of Odonata on all SSSIs within England.

At WYG, I am responsible for delivering a wide variety of ecological projects and have developed a specific interest in ornithology, aquatic and terrestrial invertebrate surveys. I have been able to share my expertise with colleagues by delivering internal training on invertebrate surveys and providing project specific advice and support.

Sharing my expertise has improved the team's capabilities including how to assess sites for invertebrate potential and identify where further surveys and mitigation are required. I have subsequently led training courses for external organisations including Derbyshire and Nottinghamshire Wildlife Trusts, BTCV and National Trust.

I'm grateful for WYG's support, allowing me to broaden my abilities by attending and delivering courses that cover a wide range of invertebrate species groups such as aculeate hymenoptera (bees, ants and wasps), ground beetles, centipedes, millipedes and woodlice and site assessment using invertebrates.



**If you're interested in ecology and have got what it takes to join WYG's ecology team, search and apply for roles at [www.wygcareers.com](http://www.wygcareers.com) or email your CV to [ecology@wyg.com](mailto:ecology@wyg.com).**



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# Water Vole Conservation Services

The Ecology Consultancy's specialist in-house team offer a comprehensive range of services for water vole conservation, covering all licensable and non-licensable activities:

- Water vole survey, including habitat assessment and population estimates;
- Advice on impacts, mitigation recommendations and enhancements;
- Licence applications and liaison with Natural England;
- A cost effective approach to translocation, methods including:
  - Live cage trapping and translocation;
  - Displacement;
- Overwintering facilities and health screening provided where required;
- Receptor site creation and habitat design advice;
- Population monitoring, passive monitoring, radio tracking and pit tagging.

Our team will provide a fast and reliable service to ensure projects run smoothly and without delay; our specialists can work alongside your own team of ecologists.

For further information on how we can help you with your upcoming water vole projects, please contact us on the details below.



Ecology Consultancy

T: 01273 813739

E: [sussex@ecologyconsultancy.co.uk](mailto:sussex@ecologyconsultancy.co.uk)

W: [www.ecologyconsultancy.co.uk](http://www.ecologyconsultancy.co.uk)



## Autumn Conference 2017 Sponsorship & Exhibition Opportunities

Engage directly with ecologists and environmental managers at our Autumn Conference 2017. We have 10 exhibition places available and one sponsorship package. If you are interested in any of these opportunities please contact [EmmaDowney@cieem.net](mailto:EmmaDowney@cieem.net).

Our Autumn Conference will take place on 21-22 November 2017 in Manchester.

For information on other advertising and sponsorship opportunities please contact [EmmaDowney@cieem.net](mailto:EmmaDowney@cieem.net).



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## Water Vole Mitigation Specialists.

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- Water vole surveys, monitoring and population assessment.
- Impact assessments and mitigation plans.
- Licence applications and liaison with the statutory authorities.
- Translocation options from live trapping to supervised displacement.
- Overwintering, breeding, health screening and reintroduction facilities.
- Receptor site design, planting and fence construction.
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- A partnership based approach.

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