Evidence published in 2014/2015

Natural England undertakes and commissions a range of studies to provide evidence and advice to assist us in delivering our duties. This note summarises the science and evidence published during 2014/15, including reports and notes written by our own staff, with partners or on our behalf by contractors. It also lists articles and reports written by our specialists and published by others, as well as other evidence published through our Access to Evidence Catalogue.

Message from Chief Scientist Tim Hill

"Making more of our evidence accessible to inform decision making is fundamental to the way we operate. This report illustrates the breadth of evidence we make available on our Access to Evidence catalogue and also highlights the contributions our staff have made to many other publications. This sharing of knowledge and collaboration with stakeholders and partners enables our combined environmental expertise to deliver more for the natural environment. "

Types of evidence

For this note evidence has been categorised into:

- Understanding the impacts of our advice and interventions and evaluating their effectiveness
- Improving our approaches to monitoring and evaluation
- Understanding the state and trends of our natural and cultural environments and the pressures upon them
- Evidence published in external journals, reports and books
- Other evidence

Evidence reports and notes

In the financial year 2014/2015 we published 67 reports and information notes on a wide range of subjects.

Long-term Monitoring on the Lizard NNR photo Neil Pike

These include:

- economics;
- engagement with the natural environment;
- landscape;
- geology;
- climate change; and
- many aspects of terrestrial and marine biodiversity.

Understanding the impacts of our advice and interventions and evaluating their effectiveness

We evaluate our evidence to help us assess the impact and the effectiveness of our interventions on the natural environment. By monitoring our interventions to address environmental impacts and by assessing the effects our actions have we can understand where and how we need to improve.

Access to Evidence EIN014

First edition 10 December 2015

NATURAL ENGLAND

Examples of some of these evidence reports we published 2014/2015 include:

NECR156 - Assessment of the effect of Environmental Stewardship on improving the ecological status of grassland, moorland and heath

This study is one of three, which assessed the degree of success in delivery of the Environmental Stewardship (ES) objectives. The aim of these studies was to evaluate how well Government funded agri-environment interventions have delivered against specific stated objectives for environmental outcomes and to provide recommendations for the future.

It examined whether the management options selected within Higher Level Stewardship (HLS) agreements were having the expected impact on the ecological status of three key habitats (grassland, moorland and heath). The results showed that HLS consistently improves all features and habitats where the options were applied. It also showed that HLS has generally been well targeted with management options chosen that are suitable for the condition and location of the habitat.

The findings of this report, and **NECR157** and **NECR158 below** have contributed to a wider analysis of similar linkages between management options and ES objectives and they were used to help formulate and implement the new Countryside Stewardship scheme.

NECR157 - Assessing the importance of spatial location of agri environment options within the landscape to butterflies

This is the second of the three studies assessing the degree of success in delivery of the Environmental Stewardship (ES) objectives. It looked at the impact of agri-environmental schemes on the populations of butterfly species and concluded that there was evidence that components of the agri-environment schemes are supporting butterfly populations within agricultural landscapes.

NECR158 - Assessment of the effects of Environmental Stewardship on landscape character

This is the third study to assess the degree of success in delivery of the Environmental Stewardship (ES) objectives. This study reviewed the extent and condition of key landscape features managed under ES by comparing the agri-environment scheme data with data collected for the Countryside Survey 2007 and investigated the influence of features managed under ES on the cultural values of landscapes using previously collected data on perceptions of landscape.

NECR169 - Review of literature - how transport's soft estate has enhanced green infrastructure, ecosystem services, and transport resilience in the EU

Transport infrastructure can have a significant environmental impact and this study was commissioned to look at how land within or adjacent to the transport corridors has been used or enhanced for to help deliver biodiversity gain, ecological connectivity and ecosystem services. The project outputs are being used to inform a three year programme of work within Nature Improvement Area's.

NECR176 - Review of Favourable Conservation Status and Birds Directive Article 2 interpretation within the European Union

This report was commissioned to provide an understanding of how the Birds and Habitats Directive is being implemented across European Union Member State. The study provides examples of good practice that could benefit our approach in England and help Natural England improve its own approaches and advice on the Birds and Habitats Directive. For example Belgium (Flanders) has established a co-ordinated approach of regional conservation objectives to ensure Special Areas of Conservation and Special Protection Areas are contributing to national objectives.

NECR179 - A review of the effectiveness of different on-site wastewater treatment systems and their management to reduce phosphorus pollution

Diffuse water pollution is a major reason why SSSI waterbodies do not meet favourable condition and/or the water quality targets in the EC Water Framework and Habitats Directives. This report presents results of a literature review to enable Natural England to develop a more evidence based approach to reducing

phosphorous pollution and refine the advice we give about the risks of different types of small domestic discharges.

Improving our approaches to monitoring and evaluation

This can involve developing more efficient and effective techniques, considering new and novel technologies and developing our work with partners to encourage greater join up and sharing of effort and data. Some examples of the reports we have published on this include:

NECR147 - Development of a generic framework for informing Cumulative Impact Assessments (CIA) related to Marine Protected Areas (MPA) through evaluation of best practice

This study has produced a comprehensive yet standardised framework that is practical, logical and usable by Natural England case officers who advise on CIA of human activities affecting MPA features.

NERR056 - Assessing the potential for mapping ecosystem services in England based on existing habitats

Ecosystem services are the benefits derived by people from the natural environment. This report describes a new approach to mapping ecosystem services at the England scale to help Natural England deliver its responsibilities under the Natural Environment White Paper and Biodiversity 2020 Programme. It provides a detailed overview of the methodology for mapping ecosystem services and sets out some of the significant challenges with the task. It also outlines a number of recommendations for further work on simple ecosystem map provision based on lessons learned from the project.

NECR154 - The development of a lowland heathland structured species surveillance partnership and sites network

The aim of this project was to explore the feasibility of establishing and operating a national network of lowland heathlands across England to provide a focus for recording activity by volunteer biological recorders. Through the pilots feedback was collected and a number of recommendations were provided, which should inform future development of organised and integrated surveillance networks to support a variety of both national and local reporting requirements.

NECR159 - Ecosystem Services Transfer Toolkit

This literature review studied the effect of land management actions on the provision of ecosystem services. The output was an Excel spreadsheet that can be searched and queried by Natural England staff and anyone else involved in making land management decisions. It identifies evidence of the effects of specific land management actions on ecosystem services. It follows on from a pilot that looked at the feasibility of developing an evidence toolkit for managing ecosystem services in the uplands.

Understanding the state and trends of our natural and cultural environments and the pressures upon them

Developing our evidence base is key to understanding the state and trends of our terrestrial and marine environments and the pressures upon them. Each year under our single Evidence Programme, we undertake and support a series of projects at both a national and local scale, that seek to gather evidence about the natural environment. These projects consider what evidence is already there, it's value, how it is changing and identifies and fill in the gaps so we have a robust and accurate evidence base, which informs our decisions and advice. Examples of the reports we published in 2014/15 include:

NECR145 - Earthworms in England: distribution, abundance and habitats

This report represents the findings of this study and is the first attempt at a structured national survey of earthworm diversity and abundance. It combines data from a commissioned survey with existing validated records to identify our commonest, less abundant and rarest earthworm species, as well as linking them to soil conditions and habitats. The report is now being published as part of our work to make our evidence more accessible. It will be of interest to conservationists, biological recorders and anyone interested in earthworms. It will also enable people generating more data on earthworm populations to apply the same methods used in the report.

Natural England have used the findings to support a follow-up project to conduct further targeted surveys of our rarest earthworm species, and to collate additional distribution records from wider academic sources. We will use this data, alongside additional information, to identify and clarify the conservation status of our earthworm fauna, and to support any conservation action required to safeguard it.

NERR057 - Microeconomic Evidence for the Benefits of Investment in the Environment 2 (MEBIE2)

This report is the second report on the Microeconomic Evidence for the Benefits of Investment in the Environment (MEBIE). MEBIE is a guide to relevant evidence on the benefits of investment in the natural environment, with a particular focus on England. The first report was published in 2012 and has been widely used both within and outside Natural England to assist in understanding the benefits of the natural environment. This version of MEBIE incorporates over 100 pieces of new evidence, and a simplified format, and contains some new chapters on Consumer spending, Pollination and Pest control.

NECR162 - Climate change refugia for the flora and fauna of England

An important question for conservation is whether refugia might exist under current and future anthropogenic climate change. This report was commissioned to identify the characteristics of potential refugia; to investigate evidence for the existence of contemporary refugia by analysing patterns of local persistence and disappearance of over 1000 species across a range of taxa; and to identify sites in England with the potential to function as refugia for different taxonomic groups at a range of spatial scales. The results of the report will be used by Natural England and others to advise on and help design conservation areas and ecological networks that will be resilient to climate change.

JP007 - An assessment of the effects of the 2013-14 flooding on the wildlife and habitats of the Somerset Levels and Moors

The winter 2013-14 flooding of the Somerset Levels and Moors had major impacts on communities, property, transport infrastructure, tourism and agriculture. Such a significant event will inevitably also affect the natural environment. This report provides an assessment of the effects the flooding had on the natural environment and paints a picture of how the nature of the Somerset Levels and Moors appear to have responded to the major flood event.

Non-breeding season populations of seabirds in UK waters: Population sizes for Biologically Defined Minimum Population Scales (BDMPS) (NECR164)

The aim of this evidence project was to address the limitations in population scales and population estimates relevant to the non-breeding season by reviewing and defining species-specific non-breading season seabird populations at biologically defined minimum population scales (BDMPS). The findings will enable the apportioning of potential impacts of marine renewal developments during the non-breeding season and can be used by those engaged in marine spatial planning and impact assessments.

Natural England summaries of evidence (EIN003 - EIN011)

What do we know about the variety of life on earth, the effects of climate change, land management, marine life, ecosystems, the geology of England and the economic benefits of the natural environment? These are just some of the topics covered by Natural England's summaries of evidence to provide information to the public on the wealth of knowledge we hold about the natural environment. Covering the full range of Natural England's work, each document provides a statement of the current evidence base, setting out what we do know, what we don't know and areas that are subject to active research and debate.

Articles and reports written by Natural England Specialists

Natural England specialists cover a wide range of disciplines across the environmental sciences, as well as social science, sustainable development, geographic information and statistics. Sharing knowledge with colleagues, stakeholders and partners, including working in collaboration with haring knowledge and

collaborating with colleagues, stakeholders and partners is one of their key roles.

In 2014-15 many of these collaborations successfully resulted in the publication of new evidence and/ or analysis. A flavour of the types of articles published in journals, books and reports is included here, sub-divided into 5 categories: climate change, ecosystem services & futures techniques, species, habitats and landscape for ease of searching. Natural England contributors are in bold. For the full list of collaborations in journals, books and reports please see Appendix 2.

Climate change

Article citation:

WRIGHT, J. & **MORECROFT, M.** (2014), Adaptation to a changing climate in practice, *In Practice*, 85, pp 11-13, CIEEM. **http://www.cieem.net/in-practice**

Summary

The evidence is clear that the climate is changing, and we are beginning to observe the impacts of this on the UK's wildlife. Evidence shows a clear northward and upward shift in many temperature-sensitive species, including some new arrivals from continental Europe. Warmer springs are causing budbreak, flowering, laying of eggs and other biological events to occur earlier in the year, and the composition of plant and animal communities is changing in a way that is consistent with warming temperatures. This raises the question of how we can adapt conservation and environmental management to minimise the adverse effects of climate change and take advantage of any opportunities?

Article citation

MORECROFT, M. (2014), Climate Change Adaptation Manual, *In Practice*, 85, page 14, CIEEM **http://www.cieem.net/in-practice**.

Summary

'Climate Change Adaptation Manual: Evidence to support nature conservation in a changing climate' is the title of a new resource for conservation managers and advisors. (It was published by Natural England and the RSPB, in partnership with the Environment Agency's Climate Ready Support Service and the Forestry Commission).

Article citation

SPEAKMAN, L. (2014), The Climate Change Report Cards – tools for understanding the impacts of climate change on the environment, *In Practice*, 85, pp 15-16, CIEEM. **http://www.cieem.net/in-practice**.

Summary

The Climate Change Report Cards provide an overview of the impact of climate in the UK. They provide an accessible summary of the latest scientific evidence to help inform policymakers, decision makers and those involved in environmental management.

Ecosystem Services & future techniques

Report Citation

SCOTT, A., CARTER, C., HÖLZINGER, O., EVERARD, M., RAFAELLI, D., HARDMAN, M., BAKER, J., GLASS, J., LEACH, K., WAKEFORD, R., REED, M., **GRACE, M., SUNDERLAND, T., WATERS, R**., CORSTANJE, R., GLASS, R., GRAYSON, N., HARRIS, J., & TAFT, A. (2014) UK National Ecosystem Assessment Follow-on. Work Package Report 10: Tools – Applications, Benefits and Linkages for Ecosystem Science. (TABLES). UNEP-WCMC, LWEC, UK **http://uknea.unep-wcmc.org/Resources/tabid/82/Default.aspx**

Summary

The UK NEAFO Work Package 10 translates the 12 principles of the Ecosystem Approach1 into pragmatic advice to enable policy and decision-makers to embed the value of nature within policies and decisions and produce better outcomes for ecosystems and their services.

Species

Article citation

STROH, P.A., LEACH, S.J., AUGUST, T.A., WALKER, K.J., PEARMAN, D.A., RUMSEY, F.J., HARROWER, C.A., FAY, M.F., **MARTIN, J.P.**, PANKHURST, T., PRESTON, C.D. & **TAYLOR, I.** 2014. *A Vascular Plant Red List for England*. Botanical Society of Britain and

Ireland, Bristol.
http://www.bsbi.org.uk/england.html

Summary

The results detailed in this vascular plant Red List present for the first time the current state of England's flora measured against standardised IUCN criteria. Almost one in five species has been assessed as threatened, with many more species assessed as 'Near Threatened'.

Article Citation

JEREMY BIGGS, NAOMI EWALD, ALICE VALENTINI, COLINE GABORIAUD, TONY DEJEAN, RICHARD A. GRIFFITHS, JIM FOSTER, JOHN W. WILKINSON, ANDY ARNELL, **PETER BROTHERTON**, PENNY WILLIAMS, FRANCESCA DUNN Using eDNA to develop a national citizen science-based monitoring programme for the great crested newt (*Triturus cristatus*) *Biological Conservation* 183 (2015) 19–28
http://dx.doi.org/10.1016/j.biocon.2014.11.029

Summary

The use of environmental DNA (eDNA) is rapidly emerging as a potentially valuable survey technique for rare or hard to survey freshwater organisms. For the great crested newt (Triturus cristatus) in the UK, the substantial cost and manpower requirements of traditional survey methods have hampered attempts to assess the status of the species. We evaluated the use of eDNA methods for monitoring great crested newts in the UK. We found that eDNA was more effective than standard methods in detecting newt presence or absence. In addition, we found that volunteers were able to collect eDNA samples successfully with only limited training suggesting that a national volunteer eDNA monitoring programme is feasible for great crested newts, and potentially other species.

Habitats

Article citation

SUE REES, JON CURSON & DAVE EVANS. Conservation of coastal soft cliffs in England 2002–2013 *Journal of Coastal Conservation* **Online: 18 December 2014, pp 1 – 9**

Summary

This paper highlights the biological and geological importance of England's coastal soft cliff resource, and the coastal processes that sustain their conservation value. Since publication of the Maritime Cliff and Slope Habitat Action Plan in 1999 and designation of Special Areas of Conservation for the Annex I habitat 'Vegetated sea cliffs of the Atlantic and Baltic coasts' there has been a legal and policy obligation to conserve and enhance the quality of cliff environments, their habitats and species and their dependence on geomorphology at different scales. Rather than always using hard engineering approaches to stabilise soft cliffs, there is an increasing appreciation of the need to make use of adaptation for built assets through the planning system and working towards better understanding of the role of eroded sediment in provision of ecosystem services.

Book chapter citation:

GOLDBERG, EMMA (2015) The UK's Ancient Woodland Inventory and its Use, in Kirby, K.J. and Watkins, C. (Eds) *Europe's Changing Woods and Forests: From Wildwood to Cultural Landscapes*
http://www.cabi.org/bookshop/book/9781780643373

Summary

The chapter concerns the development and use of the ancient woodland inventory, as a tool for woodland conservation in the UK, discussing some of its challenges and the benefits, as well as its future development.

Book chapter citation:

JEFFERSON, R.G., SMITH, S.L.N & MacKINTOSH, E. J. 2014 *Guidelines for the Selection of Biological SSSIs*. Part 2: Detailed Guidelines for Habitats and Species Groups. Chapter 3 Lowland Grasslands. Joint Nature Conservation Committee, Peterborough.
http://jncc.defra.gov.uk/pdf/SSSI_Chptr03_revision_2014(v1.0).pdf

Summary

This chapter updates and replaces the previous Lowland Grassland SSSI Selection Guidelines chapter (Nature Conservancy Council 1989). It provides detailed guidance for use in selecting

lowland grassland sites throughout Great Britain to recommend for notification as SSSIs. It should be used in conjunction with Part 1 of the SSSI Selection Guidelines, as published in 2013 (Bainbridge et al 2013), which detail the overarching rationale, operational approach and criteria for selection of SSSIs.

Landscape

Article citation

MACGREGOR N, WATTS K, PARK K, FUENTES-MONTEMAYOR F, **DUFFIELD S** (2014) *Studying past landscape change to inform future conservation*. ECOS 35 (3/4), 53-59

Summary

The Woodland Creation and Ecological Networks (WrEN) project, led by the University of Stirling, Forest Research and Natural England, is taking advantage of the opportunities offered by Britain's landscapes to study the ecological networks concept. Woodland sites in central England and central Scotland are being surveyed to investigate how the presence and abundance of a wide range of woodland species (including plants, invertebrates, mammals and birds) relate to a wide range of site- and landscape-level ecological network attributes.

Sharing other evidence

Our **Access to Evidence catalogue** includes details about the studies we run or commission others to undertake on our behalf, as well as site specific information such as management and restoration plans to enhance local areas.

In 2014 over 800 records were published on the catalogue, as well as the reports mentioned above and listed in appendix 1 below other evidence-based work we shared through the catalogue and included:

Site Improvement Plans (SIPs)

Over 270 Site Improvement plans for our Special Areas of Conservation and Special Protected Areas were published in 2014. The plans provide a high level overview of the issues (both current and predicted) affecting the condition of features on the sites and outlines the priority measures required to improve their condition.

SIPs are based on Natural England's current evidence and knowledge and consist of three parts: a Summary table, which sets out the priority Issues and Measures; a detailed Actions table, which sets out who needs to do what, when and how much it will cost; and a set of tables containing contextual information and links.

They are not legal documents, but they are live documents that will be updated to reflect changes in our evidence/knowledge and as actions get underway.

Some examples of other evidence also published on the catalogue include:

Catchment Sensitive Farming Natura 2000 targeting plans

Local Access Forum National Conference presentations 2014

Conservation Objectives for European Sites

Paths for Communities case studies

Further information

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Annex 1 – Natural England reports published 1 April 2014 – 31 March 2015

The following is a list of our reports and information notes published during the 2014/15 financial year.

Natural England Commissioned Reports (NECR)

These are reports that we have commissioned others to write on our behalf.

NECR123 - Monitor of Engagement with the Natural Environment: The national survey on people and the natural environment: Technical Report from the 2012 - 2013 survey - (second edition)

NECR132 - Literature review and analysis of the effectiveness of mitigation measures to address environmental impacts of linear transport infrastructure on protected species and habitats (third edition)

NECR134 - A review of the beetles of Great Britain: The Soldier Beetles and their allies – second edition

NECR136 - Results of the 2012/13 visitor survey on the Thames Basin Heaths Special Protection Area (SPA) - (second edition)

NECR138 - Long term effectiveness of Environmental Stewardship in conserving upland hay meadows in the Pennine Dales

NECR144 - The Dormouse Reintroduction Programme: A review - (second edition)

NECR145 - Earthworms in England: distribution, abundance and habitats

NECR146 - Increasing landscape connectivity: evaluating the risks that this will encourage invasive non-native species

NECR147 - Development of a generic framework for informing Cumulative Impact Assessments (CIA) related to Marine Protected Areas through evaluation of best practice

NECR148 - A review of the beetles of Great Britain: The Darkling Beetles and their allies – second edition

NECR150 - Monitor of Engagement with the Natural Environment survey (2009 - 2012): Visit taking in the South Pennines

NECR151 - Assessing and addressing the impacts of ash dieback on UK woodlands and trees of conservation importance (Phase 2) - (second edition)

NECR152 - Assessing the genetic connectivity of two octocoral species in the Northeast Atlantic

NECR153 - Survey and analysis of vegetation and hydrological change in English dune slack habitats

NECR154 - The development of a lowland heathland structured species surveillance partnership and sites network

NECR155 - Care farming: Defining the 'offer' in England

NECR156 - Assessment of the effect of Environmental Stewardship on improving the ecological status of grassland, moorland and heath

NECR157 - Assessing the importance of spatial location of agri environment options within the landscape to butterflies

NECR158 - Assessment of the effects of Environmental Stewardship on landscape character

NECR159 - Ecosystem Services Transfer Toolkit

NECR160 - Isles of Scilly Complex SAC: Reef Feature Condition Assessment - Kelp forest communities and vertical rock: 2013 baseline dive survey

NECR161 - A review of the scarce and threatened beetles of Great Britain: The leaf beetles and their allies

NECR162 - Climate change refugia for the flora and fauna of England

NECR163 - Palaeoecological evidence to inform identification of potential climatic change refugia and areas for ecological restoration

NECR164 - Non-breeding season populations of seabirds in UK waters: Population sizes for Biologically Defined Minimum Population Scales (BDMPS)

NECR165 - Condition assessment of Thanet Coast Special Area of Conservation

NECR166 - Monitor of Engagement with the Natural Environment: a pilot for an indicator of visits to the natural environment by children - interim findings from Year 1 (March 2013 to February 2014)

NECR167 - Visits to the natural environment in East London: Analysis of data from the Monitor of Engagement with the Natural Environment survey (2009-2013)

NECR168 - NEWP32 Transport green corridors: literature review, options appraisal and opportunity mapping

NECR169 - Review of literature - how transport's soft estate has enhanced green infrastructure, ecosystem services, and transport resilience in the EU

NECR170 - The impact of phosphorus inputs from small discharges on designated freshwater sites

NECR171 - Development of a risk assessment tool to assess the significance of septic tanks around freshwater SSSIs: Phase 1 – Understanding better the retention of phosphorus in the drainage field

NECR172 - Waterbird population trend analysis of the Mersey Estuary SPA, Mersey Narrows & North Wirral Foreshore pSPA and Ribble & Alt Estuaries SPA

NECR173 - Review and analysis of changes in waterbird use of the Mersey Estuary SPA, Mersey Narrows & North Wirral Foreshore pSPA and Ribble & Alt Estuaries SPA

NECR174 - A review of the stoneflies (Plecoptera) of Great Britain

NECR176 - Review of Favourable Conservation Status and Birds Directive Article 2 interpretation within the European Union

NECR177 - Monitor of Engagement with the Natural Environment: Analysis of expenditure during visits

NECR178 - Isles of Scilly eelgrass bed voluntary monitoring programme: 2014 Annual Survey

NECR179 - A review of the effectiveness of different on-site wastewater treatment systems and their management to reduce phosphorus pollution

Natural England Research Reports

These are evidence reports written by our own staff.

NERR056 - Assessing the potential for mapping ecosystem services in England based on existing habitats

NERR057 - Microeconomic Evidence for the Benefits of Investment in the Environment 2 (MEBIE2)

NERR058 - A review of the Monitor of Engagement with the Natural Environment (MENE) survey

NERR059 - Isles of Scilly SAC: Intertidal Under-Boulder Communities Survey 2011

NERR060 - Recent losses of permanent grassland – an assessment of the evidence

Technical Information Notes

These are notes on scientific and technical issues, including practical advice to help our staff, partners and others implement work.

TIN120 - Establishing marine Special Protection Areas - (third edition)

TIN165 - A possible new marine Special Protection Area for birds in Northumberland

TIN166 - A possible new marine Special Protection Area for birds within the Solent and along the Dorset Coast

TIN168 - A review of Poole Harbour Special Protection Area

TIN170 - Proposals for a Special Protection Area on Morecambe Bay and the Duddon Estuary and adjacent coast

Access to Evidence Information Notes

These notes improve access to the evidence that we generate and use.

EIN001 Natural England's evidence published in 2013/2014

EIN002 Re-introducing natural grazing: Natural England evidence

EIN003 - Summary of evidence: Access and engagement

EIN004 - Summary of evidence: Biodiversity

EIN005 - Summary of evidence: Climate change

EIN006 - Summary of evidence: The ecosystem approach and a secure future environment

EIN007 - Summary of evidence: Geodiversity

EIN008 - Summary of evidence: Land management

EIN009 - Summary of evidence: Land use

EIN010 - Summary of evidence: Marine

EIN011 - Summary of evidence: Wood-pasture and parkland

Natural England Joint Reports

These are collaborative documents published by us or partner organisations jointly, or in association.

JP006 - Priority river habitat in England – mapping and targeting measures

JP007 - An assessment of the effects of the 2013-14 flooding on the wildlife and habitats of the Somerset Levels and Moors

JP008 - Priority lake habitat in England – mapping and targeting measures

JP009 - Monitor Engagement with the Natural Environment: Annual report from the 2013-2014 survey

JP010 - Monitor Engagement with the Natural Environment: Technical report from the 2013-2014 survey

The data files for this page have also been updated to include the latest findings **Monitor of Engagement with the Natural Environment 2009-14: Datasets and guidance on use (DATA001)**

MCZ050 - Natural England's advice to Defra on recommended Marine Conservation Zones to be considered for consultation in 2015

Appendix 2 List of collaborations in journals, books and reports

Natural England contributors are in bold.

Climate Change

Title/ Citation/ Journal / Book	Summary
Article citation: Gillingham, P.K., Bradbury, R.B., Roy, D.B., Anderson, B.J., Baxter, J.M., Bourn, N.A.D., Crick, H.Q.P., Findon, R.A., Fox, R., Franco, A., Hill, J.K., Hodgson, J.A., Holt, A.R., **Morecroft, M.D**., O'Hanlon, N.J., Oliver, T.H., Pearce-Higgins, J.W., Procter, D.A., Thomas, J.A., Walker, K.J., Walmsley, C.A., Wilson, R.J. & Thomas, C.D. (2015) *The effectiveness of protected areas in the conservation of species with changing geographical ranges*. Biol. J. Linn. Soc. DOI: 10.1111/bij.12506	The value of Protected Areas (PAs) for conserving biodiversity in the long term has been questioned, given that species are changing their distributions in response to climatic change. In this study, we analysed fine-scale distribution data from detailed resurveys of seven butterfly and 11 bird species in Great Britain aiming to examine any effect of PA designation in preventing extinctions and promoting colonisations. Conclusions reached suggest that PAs will remain an important strategy for conservation under climatic change.
Article citation: Newson S., Oliver, T., Gillings, S., **Crick, H., Morecroft M., Duffield, S., Macgregor, N**., Pearce Higgins, J. (2014) Can site and landscape scale attributes buffer bird populations against weather events? *Ecography* 37: 872-882. DOI: 10.1111/ecog.00575	This paper explores the relative importance of site features (woodland coverage and how compact the site is) and landscape features (woodland coverage in surrounding 5km radius and distance to nearest site) for the resilience of woodland bird populations to cold winter weather. The results provide support for efforts to develop a landscape-scale approach to conservation work.
Article citation: Julie A. Ewald, Christopher J. Wheatley, Nicholas J. Aebischer, **Simon J. Duffield, Humphrey Q.P. Crick and Michael D. Morecroft**. Influences of extreme weather, climate, and pesticide use on invertebrates in cereal fields over 42 years. *Global Change Biology* 07/2015; DOI:10.1111/gcb.13026	Cereal fields are central to balancing food production and environmental health in the face of climate change. Within them, invertebrates provide key ecosystem services. Using 42 years of monitoring data collected in Southern England, we investigated the sensitivity and resilience of invertebrates in cereal fields to extreme weather events and examined the effect of long-term changes in temperature, rainfall and pesticide use on invertebrate abundance. Some long-term trends in invertebrate abundance correlated with temperature and rainfall, indicating that climate change may affect them. However, pesticide use was more important in explaining the trends, suggesting that reduced pesticide use would mitigate the effects of climate change.
Article citation: Rannow, S., Macgregor, N.A., Albrecht J., **Crick, H.Q.P**., Forster, M., Heiland, S., Januar, G., **Morecroft, M.D**., Neubert, M., Sarbu, A., Sienkiewicz, J. (2014) Managing protected areas under climate change: challenges and priorities. *Environmental Management* 54:732-743. DOI 10.1007/s00267-014-0271-5	In 2012, there was an International Conference on Managing Protected Areas under Climate Change and this paper summarises the main conclusions of the 120 assembled conservationists. The paper identifies the most pressing priorities and challenges for putting in place effective adaptation in protected areas, and to highlight some of the actions required to overcome institutional, political, and information barriers and

	support successful implementation.
Article citation: **Morecroft, M. D. Crick, H. Q. P., Duffield, S. J., Macgregor, N. A., Taylor S**. (2014) Enhancing the impact of climate science. *Nature Climate Change* 4,842–843 doi:10.1038/nclimate2371 **http://www.nature.com/nclimate/journal/v4/n10/nclimate2371/metrics/index.htm l**	This was a short paper to counter a pessimistic one on the value of evidence for helping policy development. It was concluded that the evidence needed to be presented as succinctly and clearly as possible, that the weight of evidence in the climate debate had been extremely influential, but there was still a challenge for society in turning policy into practice, and that evidence has a key role in this.
Article citation: Fenn, K., Malhi, Y, **Morecroft, M**, Lloyd, C. and Thomas M. (2015) The carbon cycle of a maritime ancient temperate broadleaved woodland at seasonal and annual scales. *Ecosystems* 18: 1-15. DOI: 10.1007/s10021-014-9793-1	
Article citation: Butt, N., Bebber, D.P. T., Riutta, Crockatt, M., **Morecroft, M.D.,** Malhi, Y. (2014) Relationships between tree growth and weather extremes: Spatial and interspecific comparisons in a temperate broadleaf forest. *Forest Ecology and Management* 334 (2014) 209–216. DOI: 10.1016/j.foreco.2014.09.006	
Article citation: Anderson-Teixeira …. **Morecroft, M** et al. (2014) CTFS-ForestGEO: a worldwide network monitoring forests in an era of global change. *Global Change Biology*. DOI: 10.1111/gcb.12712	
Article citation: Riutta, T, Slade EM, **Morecroft, MD**, Bebber DP, Malhi, Y. (2014) Living on the Edge: quantifying the structure of a fragmented forest landscape in England. *Landscape Ecology* 29: 949-961. DOI: 10.1007/s10980-014-0025-z	
Article citation: Wright, J. & **Morecroft, M.** (2014), Adaptation to a changing climate in practice, *In Practice*, 85, pp 11-13, CIEEM. **http://www.cieem.net/in-practice .**	The evidence is clear that the climate is changing, and we are beginning to observe the impacts of this on the UK's wildlife. Evidence shows a clear northward and upward shift in many temperature-sensitive species, including some new arrivals from continental Europe. Warmer springs are causing budbreak, flowering, laying of eggs and other biological events to occur earlier in the year, and the composition of plant and animal communities is changing in a way that is consistent with warming temperatures. This raises the question of how we can adapt conservation and environmental management to minimise the adverse effects of climate

	change and take advantage of any opportunities?
Article citation: **Morecroft, M.** (2014), Climate Change Adaptation Manual*, In Practice*, 85, page 14, CIEEM. **http://www.cieem.net/in-practice.**	'Climate Change Adaptation Manual: Evidence to support nature conservation in a changing climate' is the title of a new resource for conservation managers and advisors. (It was published by Natural England and the RSPB, in partnership with the Environment Agency's Climate Ready Support Service and the Forestry Commission).
Article citation: **Speakman, L. (**2014), The Climate Change Report Cards – tools for understanding the impacts of climate change on the environment, *In Practice*, 85, pg 15-16, CIEEM. **http://www.cieem.net/in-practice.**	The Climate Change Report Cards provide an overview of the impact of climate in the UK. They provide an accessible summary of the latest scientific evidence to help inform policymakers, decision makers and those involved in environmental management.
Article citation: **Taylor, S.,** (2014), National Biodiversity Climate Change Vulnerability Model*, In Practice*, 85, pg 17-19, CIEEM.	The National Biodiversity Climate Change Vulnerability Model allows users to assess the vulnerability of priority habitats to climate change with a view to building resilience. It uses a GIS based spatial assessment approach designed and trialled by Natural England.
Article citation: **Speakman, L**. & Broadmeadow, M., (2014), Climate Change Mitigation in Rural Landscapes, In Practice, 85, pg 28-30, CIEEM. **http://www.cieem.net/in-practice.**	New approaches and tools are being developed to improve our understanding of how the management and conservation of the natural environment can reduce greenhouse gas emissions, and protect and enhance natural carbon stores found in our soils and vegetation. Many of these initiatives are not only incentivising climate change mitigation activities, but are also delivering on adaptation, supporting improved financial viability of land management businesses and helping to achieve conservation targets for priority habitats.

Ecosystem Approach & Future Techniques

Title/ Citation/ Journal / Book	Summary
Report citation*:* Scott, A., Carter, C., Hölzinger, O., Everard, M., Rafaelli, D., Hardman, M., Baker, J., Glass, J., Leach, K., Wakeford, R., Reed, M., **Grace, M., Sunderland, T., Waters, R**., Corstanje, R., Glass, R., Grayson, N., Harris, J., & Taft, A. (2014) UK National Ecosystem Assessment Follow-on. Work Package Report 10: Tools – Applications, Benefits and Linkages for Ecosystem Science. (TABLES). UNEP-WCMC, LWEC, UK. **http://uknea.unep-wcmc.org/Resources/tabid/82/Default.aspx**	The UK NEAFO Work Package 10 translates the 12 principles of the Ecosystem Approach1 into pragmatic advice to enable policy and decision-makers to embed the value of nature within policies and decisions and produce better outcomes for ecosystems and their services.
Article citation: including Gary Kass Parker M, Acland A, Armstrong HJ, Bellingham JR, Bland J, Bodmer HC, et al. (2014) Identifying the Science and Technology Dimensions of Emerging Public Policy Issues through Horizon Scanning. *PLoS ONE* 9(5): e96480. doi:10.1371/journal.pone.0096480 http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0096480	Public policy requires public support, which in turn implies a need to enable the public not just to understand policy but also to be engaged in its development. In our horizon scanning exercise, we used a modified Delphi technique. A wide group of people with interests in the science and policy interface elicited a long list of emergent policy issues in which science and technology would feature strongly. Thirty issues were identified within broad areas of business and technology; energy and environment; government, politics and education; health, healthcare, population and aging; information, communication, infrastructure and transport; and public safety and national security.
Report citation: including Gary Kass Scott, A., et al (2014). Guidance to incorporating ecosystems services into Futures / Scenario Tools. In: *National Ecosystem Approach Toolkit*, Editor: Alister Scott. **http://neat.ecosystemsknowledge.net/pdfs/futures-tools-toolkit.pdf**	The purpose of this guidance is to provide practitioners, consultants, researchers and decision-makers who are carrying out Futures work or who are involved in a Visioning or Scenarios process with practical advice on how to apply the tool effectively. This guidance was produced as part of Work Packages 9 and 10 of the UK National Ecosystem Assessment Follow-On (UKNEA-FO) Programme. It should be read in combination with the General Guidance which sets the wider context of the Ecosystem Approach and the range of 'ecosystem-services proofed' tools.
Report citation: Brown, I., Harrison, P., Ashley, J., Berry, P., Everard, M.,	This study analysed the suite of response

Firbank, L., Hull, S.,Lundy, L., Quine, C., Rowan, J., Wade, R., Walmsley, S., Watts, K., & **Kass, G**. (2014) UK National Ecosystem Assessment Follow-on. Work Package Report 8: Robust response options: What response options might be used to improve policy and practice for the sustainable delivery of ecosystem services? UNEP-WCMC, LWEC, UK.LWEC.

http://uknea.unep-wcmc.org/LinkClick.aspx?fileticket=F3RVcJwAll0%3D&tabid=82

options available to decision makers in terms of their robustness to present and future change. To achieve this, this study developed a stress-testing approach to assess the consequences for natural capital and resultant ecosystem services when response options are evaluated against major drivers of change. The UK NEA scenarios were used to contextualise future drivers of socioeconomic change, with additional compound effects due to climate change. After testing the current suite of response options, implications were considered for future policy design.

Report citation:

Haines-Young, R., Tratalos, J., Birkinshaw, S., Butler, S., Gosling, S., Hull, S., **Kass, G**., Lewis, E., Lum, R., Norris, K., Potschin, M., & Walmsley, S. (2014) UK National Ecosystem Assessment Follow-on. Work Package Report 7: *Operationalising scenarios in the UK National Ecosystem Assessment Follow-on*, UNEP-WCMC, LWEC, UK.

http://www.nottingham.ac.uk/cem/pdf/RHY_et_el_2014_NEAFO_Scenarios.pdf

An aim of the UK NEA Follow-on (UK NEAFO) was to develop and communicate the evidence base of the UK NEA and make it relevant to decision and policy making. It also provided an important opportunity for those working on scenario methods and concepts to scrutinise the role of futures thinking in the management of ecosystem services and so develop their effectiveness as decision-support tools. This study therefore asked: how can the UK NEA scenarios help us to understand, manage and communicate the consequences of changes in ecosystem services across all scales?

Handbook citation:

Porter, J., Jagota, L., Brookes, J., Mahony,P., Howard, B., **Waters, R**., Hunt, D. (2014). *Ecosystem Approach Handbook.* Countryscape, Manchester.
http://ecosystemsknowledge.net/node/2227

Report citation:

Coaters, P., Brady, E., Church, A., Cowell, B., Daniels, S., DeSilvey, C., Fish, R., Holyoak, V., Horrell, D., Mackey, S., Pite, R., Stibbe A. and **Waters, R. (**2014). Arts and Humanities *Perspectives on Cultural Ecosystem Services*. UNEP-WCMC, LWEC, UK**. http://uknea.unep-wcmc.org/Resources/tabid/82/Default.aspx**

Report citation:

UK National Ecosystem Assessment (2014) The UK National Ecosystem Assessment: Synthesis of the Key Findings. UNEP-WCMC, LWEC, UK. Authors (Part III Knowledge Exchange):General Public: Everard, M., Gosling, L., Martin, K.,

Monk, K., **Waters, R.** & Albon, S.
http://uknea.unep-wcmc.org/Resources/tabid/82/Default.aspx

Article citation:	
Stewart J. Clarke, Julian Harlow, Alexandra Scott , **Mark Phillips** Valuing the ecosystem service changes from catchment restoration: A practical example from upland England *Ecosystem Services 15* (2015) 93 – 102	The application of ecosystem services to management requires simple approaches that can be applied with minimal data. This paper presents a practical example of a low input approach for a small upland catchment.

Species

Title/ Citation/ Journal / Book	Summary
Article citation: Malcolm Ausden, Richard Bradbury, **Andy Brown**, Mark Eaton, Leigh Lock and James Pearce-Higgins (2015). Climate Change and Britain's Birdlife: What Might We Expect? *British Wildlife* 26: 161-174	The authors discuss how Britain's birdlife might change in the next few decades, concentrating on which birds we might gain, or risk losing, as regular breeding species. They then use this, together with other information on the predicted impacts of climate change on birds and their habitats, to explore the implications of changes in climate for our approach to bird conservation in Britain.
Article citation: Ashbrook, K., Taylor, A., Jane, L., **Carter, I.** & Szekely, T. (2015). Impacts of survival and reproductive success on the long term population viability of reintroduced great bustards *Otis tarda* in the UK. *Oryx*, doi:10.1017/S0030605315000368. **https://www.researchgate.net/publication/279448275**	Re-introductions aim to re-establish species within their historic ranges through the release of wild or captive bred individuals following extirpation (or extinction) in the wild. There is no general agreement on what constitutes a successful re-introduction but the probability of the population achieving long term persistence should be re-addressed. This paper reviews a 10 year trial re-introduction of great bustard (*Otis tarda*), a globally threatened bird species, to the UK and assesses the long term population viability.
Article citation*:* Smart, J., Wotton, S.R., Dillon, I.A., **Cooke, A.I., Diack, I., Drewitt, A.L., Grice, P.V**. & Gregory, R.D. 2014. Synergies between site protection and agri-environment schemes for the conservation of waders on lowland wet grasslands*. Ibis* 156: 576–590 doi: 10.1111/ibi.12153	
Article citation: Bright, J.A., Field, R.H., Morris, A.J., **Cooke, A.I.,** Fern, J., **Grice, P.V.** & Peach, W. 2014. Influence of crop type and Agri-Environment management on the use of over-winter stubbles by farmland birds in England. *Bird Study* doi: 10.1080/00063657.2014.939940	
Article citation: Burgess, M.D., Bright, J.A., Morris, A.J., Field, R.H., **Grice, P.V., Cooke, A.I.** & Peach, W. 2014. Influence of agri-environment scheme options on territory settlement by Yellowhammer (*Emberiza citronella*) and Corn Bunting (*Emberiza calandra*). *Journal of Ornithology* 156:153–163.	

DOI: 10.1007/s10336-014-1113-1

Article citation:

Stroh, P.A., Leach, S.J., August, T.A., Walker, K.J., Pearman, D.A., Rumsey, F.J., Harrower, C.A., Fay, M.F., **Martin, J.P.,** Pankhurst, T., Preston, C.D. & Taylor, I. 2014. *A Vascular Plant Red List for England*. Botanical Society of Britain and Ireland, Bristol.

http://www.bsbi.org.uk/england.html

The results detailed in this vascular plant Red List present for the first time the current state of England's flora measured against standardised IUCN criteria. Almost one in five species has been assessed as threatened, with many more species assessed as 'Near Threatened'.

Article citation:

Stockdale, J.E., Dunn, J.C., Goodman, S.J. Morris, A.J., Sheehan, D.K., **Grice, P.V**. & Hamer, K.C. 2014.The protozoan parasite *Trichomonas gallinae* causes adult and nestling mortality in a declining population of European Turtle Doves, *Streptopelia turtur. Parasitology* 1-9.
doi:10.1017/S0031182014001474

Article citation:

Bright, J.A., Field, R.H., Morris, A.J., **Cooke, A.I.,** Fern, J., **Grice, P.V**. & Peach, W. 2014. *Effect of plot type, age and date on seed depletion and bird use of Wild Bird Seed Mixtures in England*.
doi:10.1080/00063657.2014.957641

Article citation:

Burgess, M.D., Bellamy, P.E., Gillings, S., Noble, D.G., **Grice P.V**. & Conway, G.J. 2015. The impact of changing habitat availability on population trends of woodland birds associated with early successional plantation woodland. *Bird Study* 62: 39-55.
DOI: 10.1080/00063657.2014.998622

Article citation:

Bright, J.A., Morris, A.J., Field, R.H., **Cooke, A.I., Grice, P.V**., Walker, L.K., Fern, J., & Peach, W.J. 2015. Higher-tier agri-environment scheme enhances breeding densities of some priority farmland birds in England. *Agriculture, Ecosystems and Environment* 203: 69–79**.**

Article citation:

Dunn, J.C., Morris, A.J. & **Grice, P.V**. 2015. Testing bespoke management of foraging habitat for European Turtle Doves *Streptopelia turtur*. *Journal of Nature Conservation* 25: 23-34.

Report citation*:*

Hayhow DB, Conway G, Eaton MA, **Grice PV**, Hall C, Holt CA, Kuepfer A, Noble DG, Oppel S, Risely K, Stringer C, Stroud DA, Wilkinson N and Wotton S, 2014. *The state of the UK's birds 2014*. RSPB, BTO, WWT, JNCC, NE, NIEA, NRW and SNH, Sandy, Bedfordshire.

https://www.rspb.org.uk/Images/state-of-the-uks-birds_tcm9-383971.pdf

The state of the UK's birds 2014 (*SUKB*), is the fifteenth edition of this report. It provides a one-stop shop for all the latest results from annual, periodic and one-off surveys and monitoring studies. The report provides an in-depth, up-to-date overview of the status of bird populations in the UK and its OTs, and gives an update on trends for as many of the UK's regularly occurring species as possible.

Article citation:

JEFFERSON, R.G. & PORTER, K. 2014 Insects and meadow flowers. *Antenna,* 38, 149-157.
A pdf scan of this article/paper can be found at:
http://www.floodplainmeadows.org.uk/content/invertebrates

This article aims to describe the potential composition of the insect 'guild' associated with the flowers and seeds of herbaceous vascular plants in meadows. There have been suggestions that for those grasslands managed as hay meadows, changing their management to maximise or enhance their entomological interest (including supporting pollinator populations) could be beneficial.

Article citation:

Jon Webb & Nick Mott. Riparian beetles from a coastal stream catchment in North Devon. *The Coleopterist* 23(2): 59-64, September, 2014

The East Lyn and its tributaries support a unique mixture of riparian species associated with exposed riverine sediments and the splash zones of waterfalls.

Article citation

Suggitt, A., Wilson, R., August, T., Fox, R., Isaac, N. B., **Macgregor, N., Morecroft, M**. & Maclean, I. D. (2015). Microclimate affects landscape level persistence in the British Lepidoptera. *Journal of Insect Conservation*, 19: 237-253. DOI 10.1007/s10841-014-9749-y

Microclimate has been known to drive variation in the distribution and abundance of insects for some time. Until recently however, quantification of microclimatic effects has been limited by computing constraints and the availability of fine-scale biological data. Here, we tested fine-scale patterns of persistence/extinction in butterflies and moths against two computed indices of microclimate derived from Digital Elevation Models: a summer solar index, representing fine-scale variation in temperature, and a topographic wetness index, representing fine-scale variation in moisture availability

Article citation:

Jon Webb & Suzanne Perry. *Saproxylic Coleoptera* of Grimsthorpe Park, South Lincolnshire. *The Coleopterist* 23(3): 116-127, December 2014

Grimsthorpe Park is of national importance for its saproxylic assemblage of invertebrates. Vane trapping on this site produced eight

	new vice-county records and 17 more species of saproxylic beetles (a useful method to employ for investigating the dead wood fauna of veteran trees).
Article Citation*:* Jeremy Biggs, Naomi Ewald, Alice Valentini, Coline Gaboriaud, Tony Dejean, Richard A. Griffiths, Jim Foster, John W. Wilkinson, Andy Arnell, **Peter Brotherton**, Penny Williams, Francesca Dunn Using eDNA to develop a national citizen science-based monitoring programme for the great crested newt (*Triturus cristatus*) *Biological Conservation* 183 (2015) 19–28 **http://dx.doi.org/10.1016/j.biocon.2014.11.029**	The use of environmental DNA (eDNA) is rapidly emerging as a potentially valuable survey technique for rare or hard to survey freshwater organisms. For the great crested newt (*Triturus cristatus*) in the UK, the substantial cost and manpower requirements of traditional survey methods have hampered attempts to assess the status of the species. We evaluated the use of eDNA methods for monitoring great crested newts in the UK. We found that eDNA was more effective than standard methods in detecting newt presence or absence. In addition, we found that volunteers were able to collect eDNA samples successfully with only limited training suggesting that a national volunteer eDNA monitoring programme is feasible for great crested newts, and potentially other species.
Article citations*:* Fay, M.F. & **Taylor, I.** (2015) 801: *Cypripedium calceolus*. *Curtis's Botanical Magazine* 32, 24-32 Fay, M.F.; Sayers, B. & **Taylor, I**. (2015) 802: *Dactylorhiza viridis. Curtis's Botanical Magazine* 32, 33-41 Fay, M.F. & **Taylor, I.** (2015) 803: *Ophrys fuciflora. Curtis's Botanical Magazine* 32, 42-50 Fay, M.F**.; Taylor, I.** & Sayers, B. (2015) 804: *Ophrys insectifera*. *Curtis's Botanical Magazine* 32, 51-62 Fay, M.F. & **Taylor, I.** (2015) 805: *Orchis anthropophora*. *Curtis's Botanical Magazine* 32, 63-71 Fay, M.F. & **Taylor, I.** (2015) 806: *Orchis purpurea*. *Curtis's Botanical Magazine* 32, 72-81 Fay, M.F. & **Taylor, I.** (2015) 807: *Cephalanthera rubra*. *Curtis's Botanical Magazine* 32, 82-90 **http://onlinelibrary.wiley.com/doi/10.1111/curt.2015.32.issue-1/issuetoc**	A series of seven papers in a Special Issue of Curtis's Botanical Magazine on British wild orchids and the possible impacts of climate change.

Habitats

Title/ Citation/ Journal / Book	Summary
Conference proceedings*:* Meeting the Biodiversity 2020 targets for heathlands: Where are we now and what is the gap? **Isabel Alonso** *11th National Heathland Conference*, March 2015 (Proceedings being edited, to be published in our Access to Evidence soon)	
Article Citation: **Alonso, Isabel** & Haerdtle, Werner (2015). Resolving potential conflicts between different heathland ecosystem services through adaptive management *Ecological Questions* 21/2015: 101 – 103 **(DOI: 10.12775/EQ.2015.017)**	Climate change and consistently high nitrogen atmospheric deposition are causing changes in the ecology and physiognomy of heathland habitats which affect the ecosystem services that they provide. In this paper we quantified how traditional management practices affect these services, but also how they could be adapted to the current conditions in order to maintain the features that visitors and wildlife value on heathlands.
Book chapter citation: **Goldberg, Emma** (2015) The UK's Ancient Woodland Inventory and its Use, in Kirby, K.J. and Watkins, C. (Eds) *Europe's Changing Woods and Forests: From Wildwood to Cultural Landscapes* **http://www.cabi.org/bookshop/book/9781780643373**	The chapter concerns the development and use of the ancient woodland inventory, as a tool for woodland conservation in the UK, discussing some of its challenges and the benefits, as well as its future development.
Book chapter citation: **JEFFERSON, R.G.,** SMITH, S.L.N & MacKINTOSH, E. J. 2014 *Guidelines for the Selection of Biological SSSIs. Part 2: Detailed Guidelines for Habitats and Species Groups. Chapter 3 Lowland Grasslands.* Joint Nature Conservation Committee, Peterborough. **http://jncc.defra.gov.uk/pdf/SSSI_Chptr03_revision_2014(v1.0).pdf**	This chapter updates and replaces the previous Lowland Grassland SSSI Selection Guidelines chapter (Nature Conservancy Council 1989). It provides detailed guidance for use in selecting lowland grassland sites throughout Great Britain to recommend for notification as SSSIs. It should be used in conjunction with Part 1 of the SSSI Selection Guidelines, as published in 2013 (Bainbridge *et al* 2013), which detail the overarching rationale, operational approach and criteria for selection of SSSIs.
Article citation: **Peel, S.,** Grassland biodiversity: how we might meet international commitments. *Grassland Science in Europe, vol 19 – EGF at 50: the Future of European Grasslands. pp 379-381.* European Grassland Federation: Aberystwyth.	England has very challenging targets to meet the UN Convention on Biological Diversity, whilst aspiring to produce more food. And with a low proportion of publicly-owned land this has to be achieved largely from commercial farmland. Most grassland receives less than 50 kg ha-1 of N fertiliser and has high

	potential for increasing biodiversity as well as greater production.
Article citation: **Sue Rees, Jon Curson** & Dave Evans. Conservation of coastal soft cliffs in England 2002–2013 **Journal of Coastal Conservation** First online: 18 December 2014, pp 1 - 9	This paper highlights the biological and geological importance of England's coastal soft cliff resource, and the coastal processes that sustain their conservation value. Since publication of the Maritime Cliff and Slope Habitat Action Plan in 1999 and designation of Special Areas of Conservation for the Annex I habitat 'Vegetated sea cliffs of the Atlantic and Baltic coasts' there has been a legal and policy obligation to conserve and enhance the quality of cliff environments, their habitats and species and their dependence on geomorphology at different scales. Rather than always using hard engineering approaches to stabilise soft cliffs, there is an increasing appreciation of the need to make use of adaptation for built assets through the planning system and working towards better understanding of the role of eroded sediment in provision of ecosystem services.
Article Citation: Humphrey J, Watts K, Fuentes-Montemayor E, **Macgregor NA**, Peace A, Park K (2015) What can studies of woodland fragmentation and creation tell us about ecological networks? A literature synthesis. *Landscape Ecology* 30, 21-50	The development of ecological networks could help reverse the effects of habitat fragmentation on woodland biodiversity in temperate agricultural landscapes. However, efforts to create networks need to be underpinned by clear evidence of the relative efficacy of local (e.g. improving or expanding existing habitat patches) versus landscape-scale actions (e.g. creating new habitat or corridors in the landscape matrix). Using cluster analyses this paper synthesised the findings of 104 studies, published between 1990 and 2013 focusing on the responses of woodland vascular plant, vertebrate, cryptogam and invertebrate species to local and landscape variables.

Landscape

Title/ Citation/ Journal / Book	Summary
Book chapter citation*:* **Brown, E.J.** (2014) Geo-conservation in the Lower Thames. In Bridgland, D.R., Allen, P. and White, R.S. (eds) *The Quaternary of the Lower Thames and Eastern Essex.* Field Guide: Quaternary Research Association, London. p55 – 65.	
Article Citation: **Macgregor N,** Watts K, Park K, Fuentes-Montemayor F, **Duffield S** (2014*) Studying past landscape change to inform future conservation.* ECOS 35 (3/4), 53-59	The Woodland Creation and Ecological Networks (WrEN) project, led by the University of Stirling, Forest Research and Natural England, is taking advantage of the opportunities offered by Britain's landscapes to study the ecological networks concept. Woodland sites in central England and central Scotland are being surveyed to investigate how the presence and abundance of a wide range of woodland species (including plants, invertebrates, mammals and birds) relate to a wide range of site- and landscape-level ecological network attributes.
Article Citation: Suggitt AJ, Jones RT, Caseldine CJ, Huntley B, Stewart JR, Brooks SJ, Brown E, Fletcher D, Gillingham PK, Larwood J, **Macgregor NA**, Silva B, Thomas Z, Wilson RJ, Maclean IMD (2015) A meta-database of Holocene sediment cores for England. *Vegetation History and Archaeobotany* doi: 10.1007/s00334-015-0515-1	Extracting sediment cores for palaeoecological and archaeological investigations has occurred extensively across England since the early 20th century. Here, using a combination of systematic meta-searching and knowledge of the unpublished ('grey') literature, we have assembled a meta-database of some 763 sediment cores for palaeoecological records, documented across 273 scientific studies. The majority of these (90 %) were sediment cores upon which pollen analyses had been performed, but other types of evidence, such as plant macrofossil and faunal records were also identified. We are making this meta-database publicly available, in the hope that it will assist further investigations into Holocene vegetation history, palaeoecology, geoarchaeology and environmental change.
Article citation: Jordan, H & **Prosser, C.** 2014. Indicators of the Anthropocene: is there a case for conservation? *Geology Today*, 30, (2), 61-66.	The Earth's atmosphere, biosphere and lithosphere are increasingly being modified by human activity. Given this anthropogenic

	influence on the natural environment, the case for recognizing an Anthropocene Epoch has recently been made and there is ongoing debate as to whether, and how, to formally characterise and define such an epoch. This article explores whether or not the landscapes, deposits, landforms and key marker horizons that may be used to characterise and define an Anthropocene Epoch could, and should, be identified and conserved in the same manner as other parts of the geological succession.