

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

1 General introduction

This summary sets out Natural England's assessment of the evidence relating to the ecosystem approach and a secure future environment. It provides a statement of the current evidence base, presenting:

- what we know (with supporting data and key references);
- areas that are subject to active research and debate; and
- what we do not yet know from the evidence base.

It also provides information on Natural England research and key external research programmes to show how we are seeking to fill gaps.

This summary forms part of a suite of summaries covering all of Natural England's remit. The summaries are not systematic reviews, but enable us to identify areas where the evidence is absent, or complex, conflicting and/or contested. These summaries are for both internal and external use and will be regularly updated as new evidence emerges and more detailed reviews are completed.

2 Introduction to the ecosystem approach and a secure future environment

This is a brief summary of the evidence that is relevant to implementation of an ecosystem approach to the management of the natural environment, including evidence relating to a future where benefits of the natural environment are secure.

The ecosystem approach puts people and the benefits they gain from the natural environment at the heart of decision making about land use and management practices. It underpins Government's policy, as set out in the 2011 Natural Environment White Paper *The Natural Choice: securing the value of nature* (Stationery Office 2011). The ecosystem approach also places an emphasis upon understanding the value to society of benefits from ecosystem services the natural environment provides so that informed choices can be made. It also recognises the need to manage the environment as a dynamic ecological system, providing multiple benefits at any one locality.

Natural England requires evidence supporting the adoption of the ecosystem approach so that it can fulfil its role as advisor to government and others about the natural environment, and also in its delivery activities.

Natural England Access to Evidence Information Note EIN006

Summary of evidence: The ecosystem approach

Natural England has a statutory duty to contribute towards sustainable development and to secure the benefits of the natural environment for both current and future generations. We therefore also require evidence about possible future states of the natural environment, so that we might plan our activities to optimise our outcomes.

The evidence relating to the ecosystem approach and a secure future environment is presented below in two sections:

- Delivering an ecosystem approach.
- Future security of the natural environment and its benefits.

3 Delivering an ecosystem approach

We know that:

3.1 For the most part our ecosystems are well described and we know their status in the recent past. We have developed and used robust classifications of ecosystems for site designation, monitoring and reporting (eg Rodwell 1991-2000; Jackson 2000; Connor *et al.* 2004). In our State of the Natural Environment Report (Natural England 2008) we set out our understanding of the current status of ecosystems. We know for several habitats the rate of change in the second half of the 20th century. These findings have been supported and extended by the results of the UK National Ecosystem Assessment (UK NEA 2011). For example we know that semi-natural grasslands declined by c. 97% between the 1930s and 1980s (Fuller 1987) and total woodland cover increased between 1947- 2002 (Hopkins & Kirby 2007). We understand the way in which the ecological characteristics of some habitat types are changing, for example woodlands are developing more closed canopies due to lack of management (eg Kirby *et al.* 2005; Carey *et al.* 2008; NERC/CEH 2009).

3.2 There are multiple drivers of ecosystem change. Habitat change is driven by multiple factors which operate in concert. For example in woodlands change is occurring due to: lack of management, decreased deposition of acid rain, invasive non-native and native species, the browsing damage of deer and climate change (Hopkins & Kirby 2007). Factors in other ecosystems include over-fishing, over-grazing, over-burning, nutrient enrichment and drainage (Natural England 2008; UK NEA 2011).

3.3 Ecosystems deliver complex bundles of ecosystem services that tend to be skewed towards those that can be traded in markets. A given ecosystem can deliver provisioning, regulating and cultural services and these are underpinned by a suite of supporting services (MEA 2005; UK NEA 2011). However, many ecosystems have been significantly modified to deliver more provisioning services, particularly food production, at the expense of regulating and cultural services which are difficult to trade in markets. Possibly the best researched example of service provision optimisation anywhere in the world is that of managed realignment on the English coast, whereby coastal defences have been breached to allow tidal flooding by the sea. There are 23 such schemes (Dixon *et al.* 2009) and services delivered include sediment retention, carbon sequestration, recreation, biodiversity conservation, food production from grazing animals and acting as fish nurseries for commercial fish stocks (Andrews *et al.* 2008; Everard 2009).

3.4 Healthy ecosystems and the services they provide have economic value. The valuation of ecosystem services has been the main focus of interest amongst environmental economists for c.15 - 20 years and there is a rapidly growing literature. Defra (2007) has produced a manual setting out the methodologies for economic valuation of ecosystem services and guidelines on value transfer methods

Natural England Access to Evidence Information Note EIN006

Summary of evidence: The ecosystem approach

(Defra 2010). The UK National Ecosystem Assessment (UK NEA 2011 & 2014) has further developed this conceptual framework, developed a range of methods for economic valuation and provided examples of how they can be applied. This topic is important as the Treasury Green Book (HM Treasury 2003) makes such valuation a requirement of public bodies.

3.5 The general public find it difficult to understand the terminology used to describe the ecosystem approach. Defra and Natural England-funded research (Define Research 2007; Fleming & Inwood 2013), as well as the findings of the UK NEA (2011) have shown that the general public find it difficult to understand terms such as “ecosystem” and “ecosystem services”, whilst the terms “nature”, “place” and “landscape” are more meaningful. These studies also show that people do understand the many benefits we derive from nature when appropriately explained. However the specific characteristics of some services (eg flood regulation) are not easily understood by the general public and this limits our ability to assess their value and peoples’ preferences (Christie *et al.* 2011).

3.6 Ecosystem services in England are delivered through a variety of mechanisms. A range of provisioning services (principally food and timber) are traded in markets which distorts the supply of other services (Braat *et al.* 2008; Harlow *et al.* 2010). A range of regulatory and cultural services are paid for under agri-environment schemes (eg biodiversity conservation, landscape character, genetic conservation, flood protection) which can therefore be described as payment for ecosystem services (PES) schemes. Complex regulation exists and indirectly supports ecosystem services, such as biodiversity conservation and water purification, most often by limiting adverse impacts, such as pollution. Land purchase or lease is the normal route for delivery of provisioning services, but has been carried out to deliver regulatory and cultural services such as flood regulation and biodiversity conservation.

Areas that are subject to active research and debate:

3.7 Interpretation of the term “cultural service”. Cultural services are described in the Millennium Assessment classification as “non consumptive uses of the environment” (MEA 2005), but this does not reflect the meaning of the term to social scientists. Whilst some cultural services such as recreation and tourism are relatively easy to characterise and quantify, others such as inspiration and spiritual value are not (Natural England 2010).

3.8 The role of economic valuation. The ecosystem services perspective is that nature has ‘value’ to the extent that it satisfies people’s wants and needs. However, practical constraints limit our ability to value non-traded commodities and it is particularly difficult to value inter-generational costs and benefits (Dasgupta 2007). There are also arguments for environmental protection founded on a purely ethical basis (McCauley 2006).

What we don’t know:

3.9 We do not understand the bio-physical basis of many important ecosystem services. For example carbon storage and water regulation emerge prominently in most analyses of ecosystem services. The largest carbon stores in England are in arable and grassland soils (Bradley *et al.* 2005) but evidence concerning whether these soils are losing carbon is conflicting (Bellamy *et al.* 2005; Emmett *et al.* 2010; Smith *et al.* 2007). Large areas of uncertainty surround the role of ecosystem management in flood risk (O’Connell *et al.* 2004).

Natural England Access to Evidence Information Note EIN006

Summary of evidence: The ecosystem approach

3.10 The role of biodiversity in ecosystem services is incompletely understood. The living component of ecosystems is involved in delivery of most ecosystem services, but the species involved vary (eg pollination is delivered by insects; often unknown micro-organisms deliver purification services (EASAC 2009). Some services are most easily understood at the level of ecosystem structure and process (eg greenhouse gas regulation, flood regulation).

3.11 How geography and management influence services. Most ecosystem service analysis has been on a habitat basis (eg UK NEA 2011). However, a habitat type may deliver different services from place to place. For example herb-rich meadows in the lowlands may deliver crop pollination but upland meadows do not, as field and orchard crops do not occur. Variations in habitat management also impact upon services. For example the relative intensity of moorland grazing, drainage and burning will influence carbon storage, water quality and biodiversity conservation.

3.12 Where trade-offs and synergies of ecosystem service provision occur. Individual ecosystems deliver a bundle of services. However there are cases when trade-offs occur eg management of floodplains for flood water storage in summer can damage biodiversity and agricultural production. Conversely we do not have a systematic understanding of which bundles of services can be delivered at specific localities by ecosystems, which will vary with geographical location and the way the system is managed.

3.13 The role of social capital in ecosystem service delivery. A range of individuals and organisations are potentially able to facilitate or frustrate the ecosystem approach. How to develop sufficient understanding, co-operation and commitment amongst relevant actors, in their formal roles (eg position within organisations; land ownership) and informal roles (eg as innovators or facilitators) are poorly understood.

3.14 The economic value of ecosystems and ecosystem services across the full range of circumstances in which they occur. Currently a large proportion of economic analysis of ecosystem services is based upon extrapolation from the results of a limited number of primary studies (ie value transfer). This is because the gathering of new primary valuation data is expensive and has long lead times. Amongst other things, such results are required to test the results of econometric models.

3.15 The effectiveness of delivery mechanisms and how to develop new ones. We have limited understanding of how comparatively effective and efficient specific delivery mechanisms are (eg payment for ecosystem services, regulation, tax incentives, markets, land purchase), and how these mechanisms operate in concert.

3.16 Does an ecosystems approach work in practice? We have relatively little concrete evidence about how successful an ecosystems approach is in practice, particularly over the long term.

4 Future security of the natural environment and its benefits

We know that:

4.1 Based upon projection of recent trends we know that there is almost certainly going to be further human demand placed upon land use in England. The demand for more water, food, timber, building land and better conservation and flood regulation have been identified as particularly significant sectoral requirements which will need to be reconciled. These land use pressures are likely to be most severe in South East England (Foresight Land Use Project 2010).

Natural England Access to Evidence Information Note EIN006

Summary of evidence: The ecosystem approach

4.2 The future state of the natural environment will be influenced by a wide range of inter-related drivers. Drawing on horizon scanning undertaken in partnership with Defra and the Environment Agency, we have carried out an analysis of the 14 critical global drivers of change that could affect the natural environment to 2060 (Natural England 2009a). The global drivers are: climate change; converging new technologies; demographics; energy; food security; world economic power shifts; governance; health and well-being; infectious diseases; mobility; money; wealth; economy; resources; values and people. Building on these global drivers, we have developed four scenarios that present a range of plausible pictures of how the natural environment, and people's engagement with it, could be affected over the period to 2060 (Natural England 2009b). We have also used the global drivers to develop a set of 2030 scenarios so we can explore how drivers may impact at different timescales (unpublished). For example, in 2030 the transition to a low carbon economy is likely to have huge policy implications but by 2060 the transition may have been made and societal concerns moved on.

4.3 In all scenarios, the future state of the natural environment is determined largely by the choices that people make, shaped by their values and the broader context in which they live. The scenarios describe the effects of different ways that choices can be made. The nature of the choices and the systems in place to make those choices vary across the scenarios, but essentially they are shaped by:

- the availability of resources - for example, energy supplies, food or water;
- scientific and technological capabilities - for example, innovation for low-carbon energy, industrial food production and information technology;
- societal preferences around trade-offs - for example, balancing renewable energy generation or flood risk management against nature conservation; and
- the scale and nature of decision-making - for example, spatially (from global to local), over time (from short to long term) and through relationships (directed to voluntary).

What we don't know:

4.4 Which drivers acting independently and in conjunction with others will most strongly influence the future state of the natural environment. While all aspects of the future are inherently uncertain, for some factors such as sea level rise, and the ageing structure of our population the trends are more certain. For others, such as climate change there are projections that allow us to anticipate a broad envelope of change. Many other drivers are much less predictable, notably those relating to developments in technology, economics, social values and politics. It is here that a 'perfect storm' of converging trends could have devastating effects on the natural environment. It is only through continual horizon scanning that we can spot emerging or combinations of trends that could significantly affect our delivery.

4.5 The detailed cause and effect relationships in each of the scenarios. The analysis contained in the scenarios report is a first-pass assessment of the potential influences that life in each future might have on the natural environment in terms of people's engagement with it, biodiversity and landscapes.

4.6 Although we have developed a set of 2030 scenarios to see how the global drivers could play out in the near to medium term, we need further analysis on how our outcomes, projects and delivery objectives would play out under each of these scenarios. In particular, we would benefit from knowing any issues that are common across all scenarios on which we need to 'act now'.

Natural England Access to Evidence Information Note EIN006

Summary of evidence: The ecosystem approach

5 Current Natural England evidence projects

5.1 We are developing a method to make information about our current evidence projects available to everyone. In the meantime a list of Natural England's evidence projects that were current in 2014 relating to ecosystem services can be seen on the National Archives at:

<http://webarchive.nationalarchives.gov.uk/20140711133551/http://www.naturalengland.org.uk/ourwork/evidence/ecosystemapproach.aspx>.

5.2 RP1415: Economic valuation of Bassenthwaite Ecosystem Services Pilot Project. This project builds on the Bassenthwaite Ecosystem Services Pilot Project, completing the evidence picture for our Lake District based upland pilot. The project will value ecosystem services provided under different land use and land management interventions and compare these with costs. The research also builds upon recent Defra funded modelling work on Environmental Stewardship and ecosystem services delivery in this catchment. This research will contribute to the Natural England evidence base on natural capital and wider work described by NEWP and the Natural Capital Committee.

5.3 RP0753: Assessing the potential for mapping ecosystem services in England based on existing habitats. This project develops a series of England level Ecosystem Service maps which can be used to support England Biodiversity Strategy targets and Natural England's Ecosystems Approach embedding project. The project will research whether it is possible to produce simple ecosystem service maps that can be used at all spatial scales and which can be made readily accessible to practitioners without the need for significant investment of their resources. A separate part of the project will draw together current service mapping initiatives and make them available to all via an online tool.

5.4 RP0917: Ecosystem Service Transfer Tool. This project is building on a successful feasibility study undertaken in 2010 to review the links between management interventions and changes in ecosystem service provision. A main objective of this research is to explore the possibility of developing a methodology for ecosystem services transfer (EST) so that place-specific research findings about ecosystem services and how they are impacted by management can be applied systematically more widely.

5.5 RP2033: Managing ecosystem service evidence review. This project builds on the Ecosystem Service Tool (RP0917) developed with the Natural Environment Research Council (NERC) Biodiversity and Ecosystem Service Sustainability (BESS) programme which was a systematic evidence review to understand what the literature tells us about the link between management and ecosystem service delivery. This project seeks to summarise the literature review into accessible management advice (linked to the level of certainty) which is meaningful to practitioners and academics and summaries of evidence.

5.6 RP1971: Applying the Ecosystem Approach at the landscape scale: Exploring new perspectives on land use planning and management advice for city regions. This interdisciplinary PhD represents a partnership approach with Birmingham City University and will build on research of recent interdisciplinary applied projects (Rural Economy and Land Use (RELU-RUF); UK National Ecosystem Approach Follow On (NEAFO) Work Packages 9 & 10). It will carry out new work to further develop concepts and extend insights into current professional practice in relation to applying ecosystem-based thinking to policy and decision-making for the built and natural environments.

Natural England Access to Evidence Information Note EIN006

Summary of evidence: The ecosystem approach

6 Key external research programmes

6.1 Living with Environmental Change (LWEC). A 10 year programme which combines the environmental R&D resources of Government departments, devolved administrations and agencies. One of its five objectives is “To manage ecosystem services for human well-being and to protect the natural environment in a changing world”. Natural England is represented on the LWEC Ecosystem Task Force which focuses on knowledge exchange.

6.2 The Economics of Ecosystems and Biodiversity (TEEB). A global programme to analyse the economic benefits of biodiversity and ecosystems, the costs of their degradation, and future options for their management. A major part of the work was published in October 2010, with additional studies published by 2012 and current country-focussed studies underway.

6.3 Biodiversity & Ecosystem Service Sustainability (BESS). A six year (2011 - 2017) NERC funded research programme, which aims to contribute to our understanding of the functional role of biodiversity in key ecosystem processes and improve understanding of the role of biodiversity in ecosystem service provision at landscape scale.

6.4 Valuing Nature research programme. The Valuing Nature research programme aims to better understand and represent the complexities of the natural environment in valuation analyses and to consider the wider societal and cultural value of ecosystems services, even where these may have no perceived market value. It is a major 5 year research programme funded by the research councils and Defra. This builds on an initial two years which developed a shared understanding between economists, social scientists and natural scientists in the valuation of biodiversity, ecosystem services and natural resources

6.5 The Natural Capital Committee. The Natural Capital Committee is an independent advisory body, set up in 2012. It provides advice to the government on the state of England’s natural capital - that is, our natural assets includes forests, rivers, land, minerals and oceans.

6.6 BD5005 Managing Grassland Diversity For Multiple Ecosystem Services. Defra funded research to assess the potential for UK grasslands to deliver multifunctional objectives of carbon sequestration, nutrient retention, pollination and biodiversity conservation, while maintaining economically viable levels of production.

6.7 Ecosystems Knowledge Network. The network facilitates knowledge exchange between practitioners, researchers, local interest groups, decision makers and land and water managers involved in practical application of the ecosystem approach. The Network was launched in January 2012 and draws together experience from the UK and elsewhere.

6.8 National Ecosystem Assessment Follow On. The second phase of the NEAFO has focused on further work on economics, cultural services, shared values and tools for policy and decision makers. This was completed in June 2014 but knowledge exchange continues through the LWEC ecosystems task force.

6.9 Horizon scanning and futures function for the Defra project partnership. The purpose of the project is to deliver an horizon scanning and futures function for the Defra Network (including Natural England, Environment Agency and the Forestry Commission) and other partners, at the Centre for Environmental Risks and Futures (CERF), Cranfield University. The function is underpinned by four work

Natural England Access to Evidence Information Note EIN006

Summary of evidence: The ecosystem approach

streams: 1) regular horizon scanning; 2) risk analysis of emerging issues; 3) foresight studies; and 4) skills capacity building through training courses.

6.10 Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES). IPBES was set up in 2012 as an independent intergovernmental body for assessing the state of the planet's biodiversity, its ecosystems and the essential services they provide to society. Its first work programme (2014-2018) aims to further strengthen the science-policy interface on biodiversity and ecosystem services.

7 Key references

ANDREWS, J.E., SAMWAYS, G. & SHIMMIELD G.B. 2008. Historical storage budgets of organic carbon, nutrient and contaminant elements in saltmarsh sediments: Biogeochemical context for managed realignment, Humber Estuary, UK. *Science of the Total Environment*, 405, 1-13.

BELLAMY, P.H, LOVELAND, P.J, BRADLEY, R.I, LARK, R.M & KIRK, G.J.D. 2005. Carbon losses from all soils across England and Wales 1978-2003. *Nature*, 437, 245-248.

BRAAT, L., TEN BRINK, P., BAKKES, J., BOLT, K., BRAEUER, I., TEN BRINK, B., CHIABAI, A., DING, H., JEUKEN, M., KETTUNEN, M., KIRCHHOLTES, U., KLOK, C., MARKANDYA, A., NUNES, M., VAN OORSCHOT, M., RAYMENT, M., TRAVISI, C. & WALPOLE, M. 2008. *The Cost of Policy Inaction: the Case of Not Meeting the 2010 Biodiversity Target*. Brussels: European Commission.

BRADLEY, R.I., MILNE R., BELL J., LILLY A., JORDAN C. & HIGGINS, A. 2005. A soil carbon and land use database for the United Kingdom. *Soil Use and Management*, 21, 363-369.

CAREY, P.D., WALLIS, S., EMMETT, B.A., MASKELL, L.C., MURPHY, J., NORTON, L.R., SIMPSON, I.C. & SMART, S.M. 2008. *Countryside Survey: UK Headline Messages from 2007*. (CEH Project Number: C03259). Wallingford: NERC/Centre for Ecology & Hydrology.

CHRISTIE, M., HYDE, T., COOPER, R., FAZEY, J., DENNIS, P., WARREN, J., COLOMBO, S. & HANLEY, N. 2011. *Economic Valuation of the Benefits of Ecosystem Services Delivered by the UK Biodiversity Action Plan* (Defra Project: NE0112). Final Report. London: Defra.

CONNOR, D.W., ALLEN, J.A., GOLDING, N., HOWELL, K.L., LIEBERKNECHT, L.M., NORTHEN K. & REKER J.B. 2004. *The Marine Habitat Classification for Britain and Ireland* Version 04.05. Peterborough: JNCC. URL: www.jncc.gov.uk/page-1584

DASGUPTA, P. 2007. Nature and the Economy. *Journal of Applied Ecology*, 44, 475-487.

DEFINE RESEARCH. 2007. *Public understanding of the concepts and language around ecosystem services and the natural environment*. Defra research report: NR0115. Defra: London.

DEFRA. 2007. *An Introductory Guide to Valuing Ecosystem Services*. London: Defra.

DEFRA. 2010. *Valuing environmental impacts: practical guidelines for the use of value transfer in policy and project appraisal*. London: Defra.

DEFRA. 2011. *The Natural Choice: securing the value of nature*. London: Defra.

Natural England Access to Evidence Information Note EIN006

Summary of evidence: The ecosystem approach

DIXON, M., MORRIS, R.K.A., SCOTT, C.R. BIRCHENOUGH, A. & COLCLOUGH, S. 2008. Managed coastal realignment: lessons from Wallasea, UK. *Maritime Engineering*, 161, 61-71.

EASAC (European Academies Science Advisory Council). 2009. *Ecosystem services and biodiversity in Europe*. London: EASAC.

EMMETT, B.A., REYNOLDS, B., CHAMBERLAIN, P.M., ROWE, E., SPURGEON, D., BRITAIN, S.A., FROGBROOK, Z., HUGHES, S., LAWLOR, A.J., POSKITT, J., POTTER, E., ROBINSON, D.A., SCOTT, A., WOOD, C. & WOODS, C. 2010. *Countryside Survey: Soils Report from 2007. Technical Report No. 9/07 NERC/Centre for Ecology & Hydrology*. (CEH Project Number: C03259).

ENVIRONMENT AGENCY. 2010. *Flood and coastal erosion risk management appraisal*. Bristol: Environmental Agency.

EUROPEAN COMMISSION. 2010. *Attitudes of Europeans towards the issue of Biodiversity. Draft analytical report Wave 2*. Flash Eurobarometer 290. European Commission; Brussels. URL: www.ec.europa.eu/public_opinion/archives/flash_arch_en.htm

EVERARD, M. 2009. *Ecosystem Services Case Studies – Science Report*. Bristol: Environment Agency.

FLEMING, A. & INWOOD, H. 2013. Assessing and evaluating the cultural services of the South Pennines ecosystem services pilot. Natural England Commissioned Reports, Number 128. Sheffield: Natural England. URL: <http://publications.naturalengland.org.uk/publication/4612053188739072>

FORESIGHT LAND USE PROJECT. 2010. *Final Project Report*. London: Government Office for Science.

FULLER, R.M. 1987. The changing extent and conservation interest of lowland grasslands in England and Wales: a review of grasslands surveys 1930-1984. *Biological Conservation*, 40, 281-300.

HARLOW, J., HOPKINS, J., STONE, D., WATERS, R., LOVETT, J. & DORLING, A. 2010. *No Charge? Valuing the Natural Environment: Technical Report*. Natural England Research Report NE 0032. Sheffield: Natural England. URL: <http://publications.naturalengland.org.uk/publication/9024>

HM TREASURY. 2003. *The Green Book: Appraisal and Evaluation in Central Government*. London: TSO.

HOPKINS, J. J. & KIRBY, K. J. 2007. Ecological change in British broadleaved woodland since 1947. *Ibis*, 149 (Suppl.2), 29-40.

JACKSON, D.L. 2000. Guidance on the interpretation of the Biodiversity Broad Habitat Classification (terrestrial and freshwater types): Definitions and the relationship with other habitat classifications. URL: [JNCC Report, No. 307](#). Peterborough: JNCC.

KIRBY, K.J., SMART, S.M., BLACK, H.I.J., BUNCE, R.G.H., CORNEY, P.M. & SMITHERS, R.J. 2005. *Long term ecological change in British woodland (1971-2001)*. English Nature Research Report 653. Peterborough: English Nature. URL: <http://publications.naturalengland.org.uk/publication/94019>

McCAULEY, D. J. 2006. Selling out on nature. *Nature*, 443, 27-28.

Natural England Access to Evidence Information Note EIN006

Summary of evidence: The ecosystem approach

MEA (MILLENNIUM ECOSYSTEM ASSESMENT). 2005. *Ecosystems and human well being: synthesis*. Washington: Island Press.

NATURAL ENGLAND. 2008. *State of the Natural Environment 2008*. Sheffield: Natural England. URL: <http://publications.naturalengland.org.uk/publication/31043>

NATURAL ENGLAND. 2009a. *Global Drivers of Change to 2060*. Sheffield: Natural England. URL: <http://publications.naturalengland.org.uk/publication/48004>

NATURAL ENGLAND. 2009b. *England's natural environment in 2060 - issues, implications and scenarios*. Sheffield: Natural England. URL: <http://publications.naturalengland.org.uk/publication/31030>

NATURAL ENGLAND. 2010. *Experiencing Landscapes: capturing the cultural services and experiential qualities of landscape*. Natural England Commissioned Report NECR024. Sheffield: Natural England. URL: <http://publications.naturalengland.org.uk/publication/48001>

NATURAL ENGLAND. 2011. *Experiencing Landscapes: Towards a judgement-making framework for 'cultural services' and experiential qualities'*. Natural England Commissioned Report NECR045. Sheffield: Natural England. URL: <http://publications.naturalengland.org.uk/publication/162029>

NERC/CEH. 2009. *Countryside Survey: England Results from 2007*. Wallingford: NERC/Centre of Ecology and Hydrology.

O'CONNELL, P.E., BEVEN, K.J., CARNEY, J.N.R., CLEMENTS, O., EWEN, J., FOWLER, H., HARRIS, G.L., HOLLIS, J., MORRIS, J., O'DONNELL, G.M., PACKMAN, J.C., PARKIN, A., QUINN, P. F., ROSES, C., SHEPHERD, M. & TELLIER, S. 2004. *Review of impacts of rural land use and management on flood generation. Impact study report*. R&D Technical Report FD2114/TR. London: Defra.

RODWELL J.R. 1991- 2000. *British Plant Communities Volumes 1-5*. Cambridge: Cambridge University Press.

SMITH, P, CHAPMAN, S.J., SCOTT, W., BLACK, H. I. J., WATTENBACH, M., MILNE, R., CAMPBELL, C. D., LILLY, A., OSTLE, N., LEVY, P. E., LUMSDON, D.G., MILLARD. P., TOWER. W., ZAEHLE, S. & SMITH, J. 2007. Climate change cannot be entirely responsible for soil carbon loss observed in England and Wales, 1978–2003. *Global Change Biology*, 13, 2605-2609.

UK NEA (UK NATIONAL ECOSYSTEM ASSESSMENT). 2011. *The UK National Ecosystem Assessment: Synthesis of the Key Findings*. Cambridge: UNEP-WCMC.

UK NEA (UK NATIONAL ECOSYSTEM ASSESSMENT). 2014. *The UK National Ecosystem Assessment: Synthesis of the Key Findings*. UNEP-WCMC, LWEC UK.

Natural England Access to Evidence Information Note EIN006

Summary of evidence: The ecosystem approach

Further information

Natural England evidence publications can be downloaded from the publications and products catalogue: <http://publications.naturalengland.org.uk/>. In particular see [Natural England summaries of evidence](#). For information on Natural England evidence publications contact the Natural England Enquiry Service on 0845 600 3078 or e-mail enquiries@naturalengland.org.uk.

Author

Author: Ruth Waters ruth.waters@naturalengland.org.uk

We welcome your comments on this summary. Please send them to the author at the above address.

Copyright

This publication is published by Natural England under the Open Government Licence v3.0 for public sector information. You are encouraged to use, and reuse, information subject to certain conditions. For details of the licence visit www.nationalarchives.gov.uk/doc/open-government-licence/version/3.

ISBN 978-1-78354-174-4

© **Natural England and other parties 2015**