

Managing Land Uses for Environmental Benefits



Understanding the combined impacts of land use on environmental benefits could better inform decision-making and land management frameworks. This POSTnote summarises the challenges of managing landscapes on a large scale to deliver multiple environmental benefits, the evidence needed, and the policy approaches that could be used to achieve this.

Background

The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) 2019 Global Assessment Report identifies changes in land and sea use as the largest driver of biodiversity loss.¹ Increasing pressures such as climate change, population growth and habitat fragmentation (driven by human land use) are affecting the natural environment and the benefits it provides to society.^{2,3} For example, many small patches of UK semi-natural habitat are isolated within land intensively used for agriculture, which is 72% of total land area.⁴ Isolated habitat patches are the most vulnerable to damaging events and degradation, and species may be unable to readily migrate between them ([PN-300](#)). The 2010 Lawton review highlighted that such fragmented approaches to managing the UK landscape are insufficient.⁵ The UK will fail to meet most of the Convention on Biological Diversity global 2020 targets, including halting the loss of species and degradation of land ([PN-617](#)).^{6,7} Without changing current land uses the UK's 2050 net-zero emissions targets may also not be met.⁸

In England, the planning system applied by local government regulates development, but not wider land management. Land use is shaped by individual attitudes and values, market demands and policy incentives. Management responsibilities can lie with individual or multiple parties, making coordination between public, private and government sectors difficult.³ The Natural Capital Committee (an independent government

Overview

- Fragmented land management approaches have failed to protect the biodiversity that underpins the provision of multiple benefits essential for human health and well-being.
- There have been initiatives to integrate management choices across landscapes to provide environmental benefits.
- A key challenge is encouraging partnerships between organisations, communities and landowners, to deliver multiple desired benefits from the same areas of land.
- The Environment and Agriculture Bills contain measures that may provide opportunities to support benefit provision at the landscape scale, such as the Nature Recovery Network and the Environmental Land Management scheme.

advisory body) states that fragmented approaches to managing land without coordination contribute further to environmental degradation.^{9,10}

Safeguarding the benefits of natural systems will require a shift from policies that have fragmentally managed land use and its impacts on nature to more integrated approaches.^{3,11} For example, delivering the aims of the 25 Year Environment Plan (25 YEP) will require integration across land uses,¹² including the provisions relevant to land use set out in the Environment¹³ and Agriculture Bills.¹⁴ The UN Sustainable Development Goals for 2030 have also identified the importance of integrated approaches to "achieve a better and more sustainable future for all".³ Several relevant terms exist in the literature on integrated approaches to managing land,¹¹ including the widely used 'ecosystem approach'¹⁶ ([PN-377](#)).¹⁷ For instance, there is an ecosystem approach checklist for Areas of Outstanding Natural Beauty partnerships to aid integrated delivery of benefits.¹⁸

Managing land for environmental benefits

Delivery of environmental benefits, such as clean water, carbon storage and provision of food, depends on the number and variety of animals (biodiversity) and their physical habitats, such as soil.¹⁹ Interactions between these sustain the structure, functions and processes of ecosystems ([PB-26](#)).²⁰ These benefits can be assessed using a natural capital framework (Box 1), where stocks of capital deliver flows of ecosystem

Box 1: Benefits from the environment

- An **ecosystem** is a community of living organisms (plants, animals and microorganisms) interacting with each other and the physical environment.²⁰
- **Natural capital** is the “elements of nature that directly or indirectly produce value to people, including ecosystems, species, freshwater, land, minerals, the air and oceans”.²¹ Natural capital stocks, such as the amount and quality of soil, provide flows of benefits such as nutrients and water. Benefits are either produced by the living system (pollination), by the physical environment, (minerals) or by interactions between living and physical systems (water quality). The **value** of a natural capital asset is the overall benefit it adds to society; determined by both the extent and the quality of the asset.^{22,23}
- **Ecosystem services** are the benefits provided by ecosystems that contribute to human well-being. There are four categories: **supporting** (e.g. soil formation), **regulating** (e.g. climate regulation), **provisioning** (e.g. food) and **cultural services** (e.g. recreation).²⁴
- **Nature’s contribution to people** is a new international framework that builds on the ecosystem service concept, with a more central focus on social and cultural aspects of the natural environment.²⁵ Defined as “all the positive contributions, losses or detriments” from nature for the quality of life for people.²⁶
- **Nature-based solutions** are defined as “actions to protect, sustainably manage, and restore natural or modified ecosystems, that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits”.²⁷

services. This can provide information on the impacts of land use that could inform decision-making. This POSTnote summarises approaches to integrating policy and practice for multiple competing land uses, through the implementation of adaptive and integrated management systems,^{28,29} including:

- Ways in which the benefits from areas of land are measured, including natural capital and ecosystem service frameworks.
- The challenges of delivering environmental benefits at the landscape scale, such as managing land use.
- Policy approaches that could be used to integrate land use.

Measuring the benefits of land use

The natural capital and ecosystem services framework is the current main approach for considering the benefits provided by the UK natural environment (Box 1). This is summarised below.

Natural capital

Natural capital describes nature as a stock of assets that can be renewable and non-renewable (such as fossil fuels).²² These produce a flow of benefits that include ecosystem services, as well as benefits from the physical environment (minerals, Box 1). Monetary and non-monetary valuations can be assigned to natural capital (based on both market or non-market values, [PN-542](#)). A number of different natural capital approaches have been implemented in the UK.³⁰⁻³³ The Office for National Statistics has valued natural assets at nearly £1 trillion, but this reflects a partial or minimal amount as only some benefits are valued in monetary terms.³⁴ Advocates argue that monetising natural capital may reduce over-exploitation of assets for short-term gains, and encourage maintenance for long-term benefits.³⁵ For example, draining peatlands to extract peat for

financial gain has long-term impacts on natural benefits, such as carbon storage.³⁶ Although the economic cost of soil degradation has been estimated at £1.2 billion per year in England and Wales,³⁷ physical measures of natural capital, such as tonnes of carbon sequestered or soil lost, can also be used.³⁸

A natural capital approach seeks to include the complex interactions between the economy, nature and society in decisions.³⁹⁻⁴² Mapping and modelling the natural capital provides an evidence base for planning decisions, to see how natural capital assets will be impacted and identify opportunities for management (Box 2).⁴³ The 2022 update to the 2011 UK National Ecosystem Assessment will assess the state of assets and highlight where management interventions may be required.¹² Critics of the natural capital framework suggest that economic valuations and framing of natural capital deal poorly with natural and social systems, as they obscure the complexity and diversity of the ethical and social values ([PB-34](#)).^{39,44} However, without such valuation, decisions are unlikely to account for these values at all. Valuation methods can pose several challenges. Market valuation reflects the current price for the tradeable commodity, which can change over time. By contrast, benefits without a market value can be difficult to quantify, such as mental health and well-being.^{45,46} Attempts to value social assets include the Social Cost Benefit Analysis in the HM Treasury Green Book.⁴⁷

Ecosystem services

Ecosystem services are the benefits nature provides for human well-being, which flow from natural capital stocks (Box 1). While assessments of natural capital focus on the quality, quantity and location of the assets, the interaction between ecosystem services and how land use affects these interactions

Box 2: Examples of planning natural capital

- Liverpool City Region Natural Capital Working Group: the creation of a Natural Capital Baseline helps to understand the services provided by its natural assets. This spatial modelling approach (EcoServ-GIS), creates an asset map and ecosystem service map based on available data.⁴⁸ The outputs help to target areas of interest, monitor changes and provide economic valuation of the services.⁴⁹
- Local Natural Capital Plan (LNCP): the Oxford-Cambridge Arc was created to promote economic growth in the area linking Oxford, Milton Keynes and Cambridge.⁵⁰ LNCP main objectives are to protect and enhance the environment, which can be achieved through producing a natural capital baseline. The 25 YEP commits to LNCP.^{51,52}
- Bicester Green Infrastructure Project: this NERC innovation project tested several tools and methods for planning and evaluating green infrastructure ([PB-26](#)) and the services they provide. A key output was the ‘ecosystem service scoring’ method, which assesses and scores 18 services based on habitat type.⁵³ For instance, arable land is of high value for food provisioning, but low value for most regulating and cultural services. This informed natural capital mapping of Oxfordshire.^{43,54}
- Natural Capital Strategy for North Devon: this work trialled a natural capital approach to improve environmental benefits across the landscape. Challenges for delivery at the landscape scale were identified, including establishing clear responsibilities and shared commitments for land management outcomes.⁵⁵

may need to be considered (PN-281). For example, trade-offs may arise if one service is prioritised, such as food production, at the expense of another, such as soil formation.^{56,57} Land use choices can cause trade-offs in the type, number and scale of benefits delivered,⁵⁸⁻⁶⁰ and climate and land management intensity can affect service delivery.^{56,61} For example, managing a flood-plain to increase biodiversity may increase flood and carbon storage, and encourage tourism.^{62,63} However, there can also be drawbacks for health, the economy or well-being.⁶⁴ For example, urban tree planting may provide attractive outdoor space, but impacts could include pollen allergies.⁶⁵

Integrated approaches to land use

A 2010 Government Office for Science Foresight report stated that integrated approaches are vital to achieve large-scale improvements to land use.³ To integrate management, areas that can contribute the most to environmental objectives are identified and wider societal objectives are reconciled with those of land managers. The benefits of integrating land uses on a large scale include increased resilience to extreme weather events and changing climate, and enhanced long-term sustainability of agricultural systems (PN-600).^{3,66} Nature-based solutions could be used to meet emissions targets and adapt to climate change, but require monitoring and evaluation of environmental and social outcomes (Box 1, PN-617).⁶⁷⁻⁶⁹

Partnerships across landscapes

Integrated landscape approaches aim to promote partnerships that work to minimise conflicts and optimise benefits. For example, a Royal Society for the Protection of Birds project looking at the decline of the curlew species found that the conservation of this bird can only be addressed by tackling the drivers of its decline at a large scale.⁷⁰ This would involve addressing the loss of its grassland breeding habitats and looking at the role of forestry and game bird management in increasing the numbers of predators. Minimising conflicts and optimising benefits includes working with widespread communities, sufficient mapping and modelling of landscapes, and continued monitoring while management is underway. These inform management of the multiple current and future economic, social and environmental benefits provided,^{71,72} with initiatives to implement such approaches in the UK (Box 3).

Working with people

Context matters

Understanding the social, economic and local factors in land use and management are necessary for successful landscape approaches. Reasons for participating and engaging in landscape management processes for environmental benefits can vary from personal incentives, reducing risks to business, and adhering to legislation.⁷³⁻⁷⁶ For example, the Scottish Land Use Strategy states that people should have opportunities to participate in debates and decisions about land use that affect their lives and their future.⁷⁷ Reasons can also include the relationship that people have with components of nature in landscapes (see nature's contribution to people, Box 1).⁷⁸

Spatial scale

Natural boundaries rarely coincide with administrative boundaries, which can result in a mismatch. For example, targets for water quality might be set at a river catchment

Box 3: Managing landscapes for multiple benefits

- **Futurescapes**, Royal Society for the Protection of Birds: this landscape scale conservation aims to develop partnerships, make space for nature, drive nature conservation and create adaptive management plans.⁷⁹
- **Living Landscapes**, the Wildlife Trusts: over 100 UK schemes aiming to restore, recreate and reconnect urban and rural wildlife through partnership working.⁸⁰
- **Wholescape thinking**, Natural Capital Initiative: aims to encourage communication across spatial scales (the land, coast and sea) through a natural capital approach.⁸¹
- **Bassenthwaite Upland Ecosystem Service Pilot**, Natural England: this 2009 pilot set out to demonstrate how multiple benefits can be delivered through partnership working, focusing on the ecosystem service approach.⁸²
- **Glasgow and Clyde Valley Green Network**: aim is to provide high quality connecting habitats with a multi-function use in urban and rural areas. This includes creating over 500 km² of new wildlife habitats.⁸³

scale,⁸⁴ but carbon targets at a national level.⁸⁵ Boundaries for management vary with land use, habitats, political boundaries and partnership design. Natural Resources Wales addressed this challenge by creating seven area statements, underpinned by the Environment (Wales) Act 2016. The area statements take a 'place-based approach', reflecting the needs of people and addressing Well-being of Future Generations Act goals.⁸⁶

Partnership approaches to governance

A key aspect of the landscape approach is encouraging widespread partnership engagement from the start,^{72,87} by understanding participants' expectations,⁸⁸ the benefits the land provides, and future potential land uses.¹¹ This engagement is underpinned by facilitation, cooperation and compromise.¹¹ Activities such as interviews and forum groups can help to build trust between those involved.^{72,82}

The structure of the partnership design can influence the environmental outcomes,⁸⁹ but partnership engagement may also be affected by the type of approach. Top-down approaches can lead to unintended impacts or failed implementation,^{90,91} whereas bottom-up approaches can face challenges such as a lack of strong leadership,⁹² limited financial resource,⁹³ and unequal benefits.⁹⁴ There is a growing interest in approaches where multiple governing bodies interact to create and propose guidelines, encourage redistribution of power and promote engagement to create solutions.^{41,95} For example, the Glasgow and Clyde Valley Green Network encompasses eight regional authorities and several agencies. The partnership staff are employed by one of the local authorities and operate under agreed Terms of Reference (Box 3).⁸³ Another example is the Liverpool City Region Natural Capital Working Group where the public and private partners work with other stakeholders to protect and enhance natural capital (Box 2).⁹⁶

A key challenge for the implementation of management is using the evidence and tools from both natural and social sciences.⁹⁷ Commentators suggest that without understanding the values and beliefs that shape attitudes and behaviours, changes may not be adopted. There is also a need to understand the interactions between drivers of change, such as how people are responding and adapting to rising sea levels.^{74,98} Other

challenges include understanding the power gaps between organisations,⁹⁹ the length of time taken for trust to develop within partnerships,⁷⁵ and the delay in sharing lessons learnt.⁸²

Mapping and modelling

A means of planning multifunctional land uses would allow increasing pressures on environmental benefits, such as climate change and a growing population, to be addressed.^{3,71,100}

Mapping and modelling can be used to determine the current economic, social and environmental benefits provided by each area of land and assess future scenarios,^{71,72} such as optimal locations for nature-based solutions (Box 1).¹⁰¹ There are multiple mapping tools,^{48,102-107} the outputs of which vary depending on the type of data and calculation method. Maps need to incorporate different habitat types (woodland, grassland), land use (farmland, recreational) and other natural capital assets such as soil type or quality or groundwater resources.¹⁰⁸ For instance, Natural England's National Natural Capital Atlas maps key properties of natural assets to show the quantity, quality and location of assets in England.¹⁰⁹

Opportunity mapping of habitats can then be used to identify gaps where services could be enhanced to meet local demand, such as suitable locations for natural flood management ([PN-623](#)).

Multiple mapping and modelling tools exist for species distribution,^{110,111} such as the National Biodiversity Network Atlas that combines information about UK species and habitats.¹¹² These can target the conservation of one species, which provide habitat and services for other animals and plants.¹¹³⁻¹¹⁵ Alternatively, species that are sensitive to change can be grouped together and mapped.¹¹⁶ This typically reflects biodiversity conservation needs rather than ecosystem service delivery.¹¹⁷ While comprehensive standardised survey data are available for some species groups (such as the Breeding Bird Survey¹¹⁸), other species distribution data may lack repeatable, systematic monitoring.¹¹⁹ Modelling based on incomplete data requires validation of the model outputs.¹²⁰

Monitoring outcomes at the landscape level

There has been a lack of systematic long-term monitoring of habitat conditions, as it is labour intensive,^{82,121} but it is a key indicator of levels of ecosystem service provision.^{122,123}

Quantifiable and measurable monitoring data, that can be evaluated, can be used to inform and change management actions on the ground.¹²⁴ Technology can play an important role through online surveys, fixed point photography and citizen science ([PN-476](#)). This adaptive approach allows land managers to learn from successes and failures, and can help to inform policy and practice.^{125,126}

Changing UK land use policies

The UK Government has made several environmental commitments to restore habitats, biodiversity and ecosystem service provision.¹² The Environment Bill sets out measures such as biodiversity net gain ([PB-34](#)), publishing the English Tree Strategy and developing Local Nature Recovery Strategies (LNRS).¹³ LNRS will be led by local authorities, who will map out existing valuable habitats, identify areas for enhancement or creation and agree priorities. This local spatial planning strategy feeds into the national Nature Recovery Network.¹²

The Agriculture Bill (the legislative framework replacing the EU Common Agricultural Policy) provides the powers for financial support to implement land management measures.¹⁴ These include the Environmental Land Management (ELM) scheme, which provides 'public money for public goods' (Box 4). Defra is considering how land managers can address the goals of the 25 YEP and 2050 net zero targets through the financial assistance set out in the Agriculture Bill, with the Nature Recovery Network acting as a framework for aligning payments. It is unclear the extent to which this policy framework can join up these initiatives, facilitate community engagement and partnerships, and be informed by tools such as mapping and modelling. Previously, agri-environment schemes have been a mechanism for funding and delivery, rather than strategically addressing environmental issues across landscapes.¹²⁷ Other concerns about the Environment and Agriculture Bills have been raised,¹²⁸ including that environmental measures may continue to be underfunded and poorly targeted,¹²⁹ and the lack of a land management regulatory framework.¹³⁰

NGO spending will also play a key role in addressing biodiversity loss,² which in the UK has increased by 24% since 2010/11, with an increase of 46% of volunteering hours since 2000.¹³¹ Examples of projects include the Botanical Society of Britain and Ireland's New Year Plant Hunt, which aims to identify how plants are responding to changing autumn and winter weather patterns.¹³² The private sector can also help to address environmental targets through investment. An approach to engaging the private sector highlighted by the Government is the Landscape Enterprise Network framework. This is 'market-led' by identifying the risks and opportunities to individual businesses. By doing so, multiple businesses can work together and invest in nature-based solutions ([PN-617](#)).⁷³ Projects delivered in Cumbria and East Anglia identified the business case for a broad range of sectors to invest in regional natural capital. A further pilot is being run with Natural England in the Hampshire Avon catchment. Another example is the IGNITION project in Greater Manchester, which has used €4.5 million from the EU's Urban Innovation Actions initiative to bring together funding partners from local government, universities, NGOs and business. The project is promoting investment in large scale green infrastructure, such as nature-based solutions (Box 1) for climate resilience.¹³³

Box 4: Environmental Land Management Scheme

The ELM scheme will provide financial incentives for farmers and landowners to provide environmental benefits, which will be underpinned by natural capital principles and payment for outcomes. Defra are proposing a tiered scheme:

- **Tier 1.** Encourage environmentally sustainable farming and forestry through delivery of environmental benefits.
- **Tier 2.** Incentivise land management that delivers locally targeted environmental outcomes.
- **Tier 3.** Secure environmental outcomes by delivering land use change projects at a landscape scale.¹³⁴

This approach was suggested through working closely with stakeholders, and reviewing report recommendations such as the Dame Glenys Stacey review,¹³⁵ and Glover review.¹³⁶ Trials are being undertaken in North Devon, Cheshire and Greater Manchester ahead of the ELM roll out in 2024.¹³⁴

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