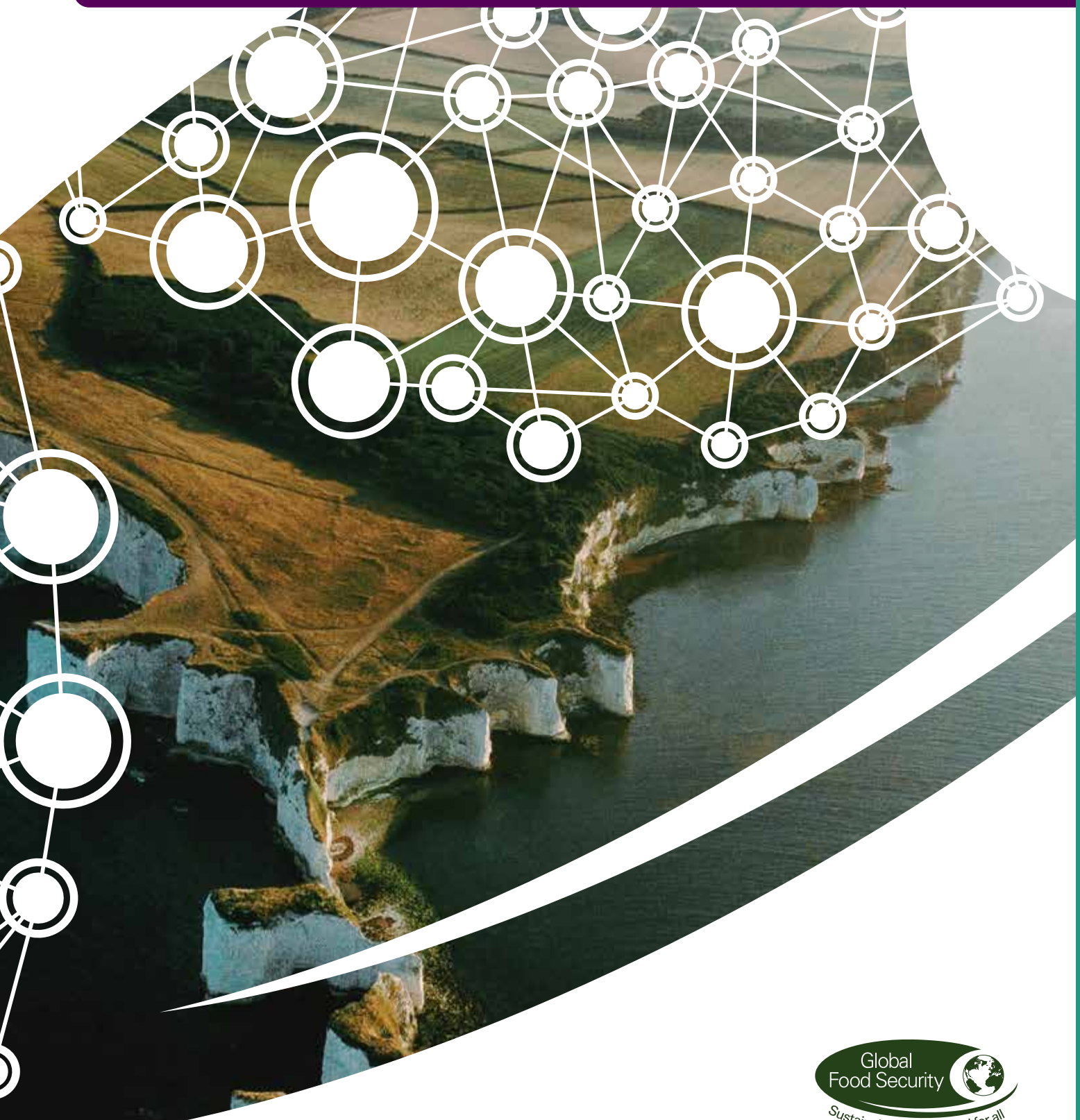
POLICY LAB REPORT

Multifunctional landscapes in the UK: tools for policy and practice



Global Food Security

Sustainable, healthy food for all

Contents

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This report should be cited as:
Franco S.C., Keane J.B., O'Connor R.S., Scott-Brown A.S., Wade R. (2020).
Multifunctional landscapes in the UK: tools for policy and practice.
Report produced for the Global Food Security Programme. March 2020.
Available online at www.foodsecurity.ac.uk/publications/multifunctional-landscapes-in-the-uk.pdf

Executive summary

Ensuring food supply meets future demand will require transdisciplinary thinking to develop robust new policies, steer behavioural change and encourage the development and uptake of innovative technological solutions. The multifunctional landscapes (MFL) approach recognises that, in addition to food, UK landscapes provide a range of natural resource provisions and ecosystem services. In the absence of MFL thinking, increasing the provision of one ecosystem service can come at the expense of others. An MFL approach could ensure that decisions are made to sustainably manage multiple ecosystem functions and services, so that their provision is optimised.

There will be challenges in adopting an MFL approach to managing UK land-use systems. These range from defining the appropriate scale of an MFL, through to engaging with local communities. This report explores these challenges and highlights the tools and approaches relevant to MFL implementation and management. It concludes with a series of considerations on the best ways to support development of the MFL approach in the UK.

Key findings

- The MFL concept requires a socio-ecological, transdisciplinary approach to ensure objectives are met and to promote long-term cooperation in landscape management.
- Ecosystem functions and services present a useful framework to value goods and services provided by the natural environment, analyse trade-offs and synergies, and help define management strategies for optimum joint ecosystem service supply.
- Valuation of ecosystem services and exploratory tools are useful to map and model services within landscapes, guiding interventions to achieve a desired outcome. Such tools include GIS, land-use change models, scenario planning and mixed models.
- The implementation of the MFL approach often follows strategies to optimise landscape pattern or structure, and/or the quality of functions and land-uses. Approaches to implementing MFL will differ according to the objectives set, with methods including comparative analysis, adaptive experimentation and landscape scenarios. Case studies are vital to understanding the range of possible interventions.
- The development of MFL management strategies requires a case-by-case approach, however it can be guided by common principles that have been drawn from existing initiatives. These relate to adequate organisational structure and functioning, participatory approaches and stakeholder engagement, governance and incentives, and performance assessment.

Knowledge gaps

- Synthesis of best-practice and lessons learned from the UK and UK-relevant case studies and projects.
- Extensive comparative analysis of existing and emerging tools relevant to MFL management.
- Review of metrics and development of new approaches to monitor and evaluate the performance of MFL, with particular focus on socio-economic metrics.
- Mapping of 1) existing management processes and structures that could be useful for promoting MFL approaches, 2) entities that could be responsible for MFL management and key stakeholder groups to be involved, and 3) best management systems to apply in different land-use contexts.
- Analysis of incentives and financing options to support the long-term sustainable application of the MFL approach in the UK.
- Evaluation of stakeholder engagement methods with higher potential for use in MFL approaches and use of pilot projects to test and improve stakeholder engagement practices.

Recommended actions to facilitate change

- Form an expert working group and multi-stakeholder advisory board to drive, develop and deliver the MFL agenda and support dialogue and collaboration between different actors.
- Develop a strategic plan for the implementation of MFL in the UK.
- Create a dedicated funding stream to support research in critical subjects, implement initiatives and develop innovation sites, programmes and pump-priming mechanisms that support testing of a diverse range of approaches in local contexts.
- Create a website and repository of resources for practitioners and the public, consisting of key reports, case studies, a UK forum for discussion, and links to experts or key stakeholder groups.
- Raise awareness, increase community buy-in and generate dialogue on MFL through public engagement projects.

Part 1:
A new approach to landscape management

Providing healthy and sustainable food for everyone is one of the greatest challenges faced by modern society, exacerbated by rapid environmental change and the changing diets of a growing global population. Natural capital, climate stability and social interactions are essential factors affecting food production globally, as well as the annual and seasonal stability of supplies, the availability of nutritionally diverse foods and financial access. Although more than enough food is currently produced per capita to feed the current global population[1], 825 million people were not food secure in 2019[2], highlighting the need to consider food use, access and availability, as well as production patterns and barriers to stable distribution.

Over the past several decades, there has been a global shift from traditional agricultural practices towards intensive food production. Intensification has contributed to environmental degradation and land-use segregation, reducing the resilience of vulnerable rural communities to external shocks. This, in association with the increase in global demand for land and aquatic resources, has heightened the urgency to transform our food systems for health and sustainability using the principles of an ecosystem-based approach.

An understanding of the interdependency of core food production sectors (i.e. agriculture, livestock production, aquaculture and fisheries) and landscape functions is essential to achieving this goal. However, the interactions that exist between these factors are complex. Taking a nexus approach to landscape multifunctionality allows the recognition of services provided by the natural environment, the analysis of trade-offs amongst them and the identification of win-win scenarios, which will be key to developing the policies required to guide long-term, sustainable food-production.

Food security and landscape management within the UK context

From a UK perspective, the combination of limited natural resources, a growing urban population and a food system heavily influenced by external markets and food imports, makes sustainable landscape management an increasingly relevant issue. Historically, changing from low intensity production to highly intensive agricultural systems came at the detriment to the wider environment, which has had negative impacts on human health, biodiversity, water and soil quality[3]. It is clear that paradigm-shifting approaches are needed to reverse current trends.

Following the UK's decision to leave the European Union in 2016, there have been calls for evidence for successors to both the Common Agricultural Policy (CAP) and Common Fisheries Policy (CFP), presenting an opportunity to improve the system of financial incentives and land-use policy. Amendments to current policies could enable the UK to plan and implement long-sighted visions for sustainable growth for the benefit of future generations, through the restoration and diversification of valued ecosystem services. Several of these initiatives are already in the pipeline, such as the Sustainable Intensification Platform 2017[4] and the Well-being of Future Generations Act 2015[5].

Food provision is dependent on numerous ecosystem services within the landscape, and the supply, quality and impact of these associated ecosystem services are highly dependent on landscape management. With 71 % of land in the UK currently under agricultural production[6] the continuation of business-as-usual is incompatible with the rebalancing of ecosystem services[7].

Defining multifunctional landscapes: landscapes, functions and services

The Multifunctional Landscapes (MFL) approach has emerged as a potential tool to better conceptualise landscapes, encompassing their natural resource provisions and ecosystem services to inform decision-making on how valued services should be managed to maximise potential benefits within a defined area. The MFL approach embraces diverse methodologies to characterise, value, manage and monitor land-use, and is grounded in the recognition that each landscape is a unique environmental, economic and socio-cultural system. For this reason, each landscape requires tailor-made management strategies that are sensitive to current and future land use needs.

The term MFL is used to characterise the notion that functions and services are delivered by a given landscape or large area (such as a catchment), which can encompass a mosaic of multiple and interacting natural, semi-natural, agricultural and/or urban ecosystems. Catchments (areas where water is collected by the natural landscape) are a common unit of consideration for landscape approaches because they are large enough to include ecological structures, yet small enough to capture the essence of sense-of-place. The structures and processes within a landscape which arise from interactions between its biological, chemical and physical components, determine the functions it delivers. When these functions provide goods and services to humanity these are commonly referred to as ecosystem services. These can range from provisioning services (e.g. food production) and regulating services (e.g. flood prevention), to cultural services (e.g. wellbeing) and supporting services (e.g. biodiversity).

Considering MFL from an ecosystem service framework can be a useful approach to inform land management decisions, which should be based on the following operational principles:

- Landscapes are composed of multiple land units which deliver multiple functions that can interact and that connect ecological systems with human value systems.
- Management requires the adoption of transdisciplinary and participatory approaches, by considering, weighing and adopting decisions with the input of stakeholders living in or utilising the landscapes.

There are various challenges to implementing these principles, for example describing and quantifying the functions, services and goods provided within a landscape, as well as characterising their interactions. In order to understand the degree and types of trade-offs that occur between ecosystem services and identify where so-called "win-wins" can be achieved in managing multiple ecosystem services, it is necessary to address these challenges. *Figure 1* depicts a conceptual framework suggested by Mastrangelo *et al*. (2014)[8] that aims to quantify and optimise this joint supply of environmental services.

Part 2 of this report will explore some of the tools that can be used to assess landscape functionality through quantifying and optimising the joint supply of ecosystem services, from the valuation of ecosystem services to scenario planning. The mapping of multiple ecosystem services is a useful tool for 1) reconciling food security and environmental sustainability demands, 2) assessing trade-offs and synergies, and 3) identifying prioritisation hotspots. If used to inform land management decisions (e.g. in the design of agri-environment schemes), the MFL approach has the potential to sustainably integrate both production and landscape use, maintaining ecosystem function, service flow and biodiversity (see *Figure 2*).

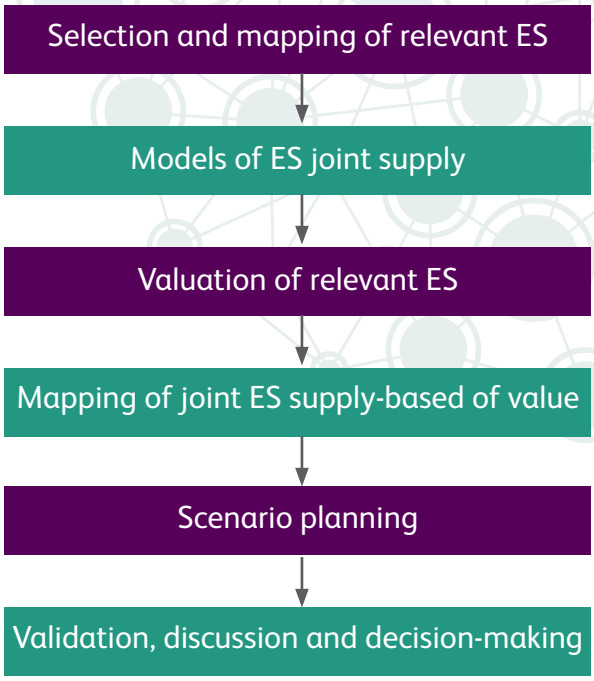

Figure 1. Key stages in the assessment of landscape multifunctionality based of joint ecosystem service (ES) supply. The dark boxes indicate stages at which stakeholder participation is critical. Adapted from Mastrangelo *et al*. (2014) conceptual framework.

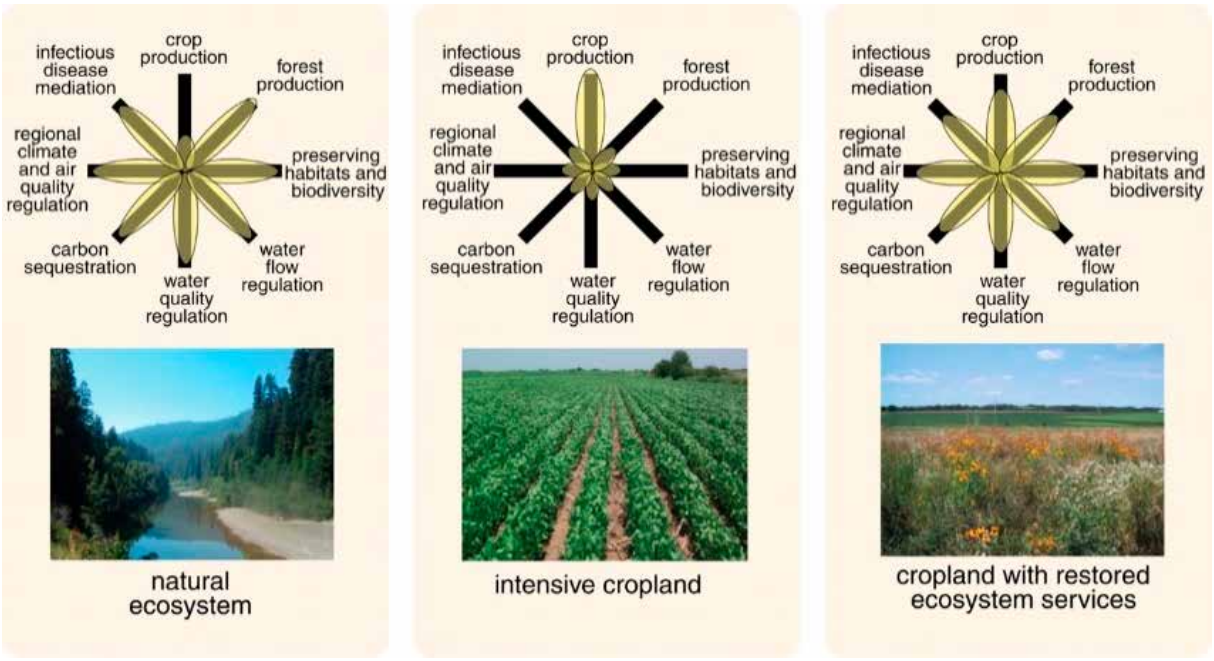

Figure 2. Flower diagrams as framework for comparing land use and trade-offs of ecosystem services (from Foley et al. 2005[9]). The condition of each ecosystem service is indicated along each axis and a range of hypothetical landscapes are compared for illustrative purposes. In this hypothetical scenario the trade-offs are clear, with the natural ecosystem able to support various ecosystem services, but not food production, in opposition to the intensively managed cropland.

Operational models are also useful to visualise how the MFL approach can be implemented in a real-world context to transition from current landscapes to landscapes designed to optimise benefits and minimise trade-offs. *Figure 3* illustrates the processes from the assessment of landscape functions, services, uses and priorities, to action planning in alignment with participatorily-set goals and periodic reviews of performance.

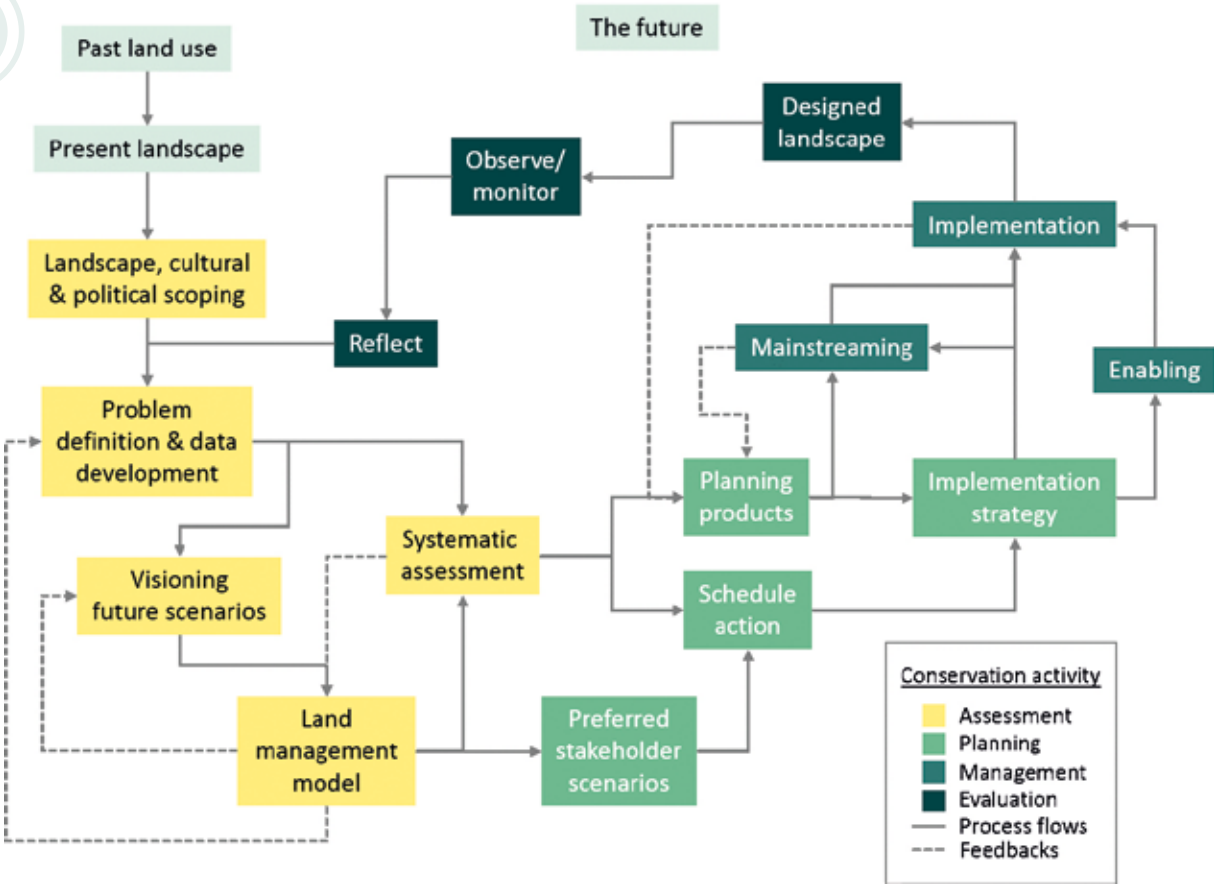

Figure 3. Operational model for conservation planning (adapted from Knight et al. 2006[10]). This model shares similarities with the implementation of the MFL approach, and can be used to guide planning initiatives by helping stakeholders understand how the various phases and processes are linked. Continuous lines represent flows and dash lines represent feedback loops.

IN SUMMARY

THE MULTIFUNCTIONAL LANDSCAPE APPROACH

- Food production is inextricably linked to landscape productivity, with growing pressures and competition for ecosystems services threatening long term sustainability.
- The MFL approach is a framework that can be used to characterise, value and manage landscapes at catchment level.
- Ecosystem services are a useful tool to recognise goods and services provided by the natural environment, analyse trade-offs and identify win-wins.
- Managing landscapes for the optimal supply of ecosystem services is dependent on transdisciplinary and participatory approaches.
- Operational models can help visualise MFL implementation, by illustrating process flows between assessment, planning, management and review phases.

Part 2:
From concept to implementation

The implementation of an MFL approach requires a detailed understanding of:

- the links between ecological structures, related ecosystem functions and associated ecosystem services within a landscape
- the knock-on effects of specific management actions on landscape-derived benefits or values
- the ecological and socio-economic trade-offs associated with management decisions

The approaches and tools that are used to increase this understanding can be divided into those that are used for exploring, characterising and valuing landscapes and their functioning, and those that are used to manage landscapes to increase benefits from a pre-defined set of services. Underpinning this is the need to establish participatory approaches to inform assessment and planning phases.

Valuation of ecosystem services to explore landscape functions

Ecosystem service valuation is the process of assigning a value to ecosystem services, by measuring or estimating how important nature-derived goods and services are to people in given contexts. These values are commonly categorized as ecological, socio-cultural and economic, and can allow the comparison of seemingly incomparable factors and the analysis of trade-offs associated with different management choices.

Various economic and non-economic valuation methods can be used to support decision making. 'Total economic value' offers a useful framework for analysis by considering both *use values* (which involve direct or indirect interaction with the resource) and *non-use values* (benefits derived simply from the knowledge that the ecosystem service is maintained). Marketable- and tradable ecosystem services, often associated with provisioning services such as food production, are generally easier to value than regulating- or cultural services, which are harder to translate in financial terms. The Natural Capital Coalition has developed a standardized framework for businesses to identify, measure and value their impacts and dependencies on natural capital[11]. However, each of the tools and methods used to map and evaluate ecosystem services comes with limitations as well as strengths, so the suitability is determined by cost, expertise requirements and the availability of data. It is important to note that metrics and indicators provide an essential tool for benchmarking, as well as accounting for spatial patterns and the assessment of impact on landscape structure-related ecosystem services, but these are not covered in the scope of this report.

Integrative exploratory tools for landscape assessment and planning

To understand landscapes, their functioning and the trade-offs associated with specific management actions for derived benefits, a series of integrative exploratory tools can be used to build on ecosystem services valuation. These tools range from Geographical Information Systems (GIS), which integrate spatial socio-economic and ecological data to map the spatial distribution of landscape functions and services, to land-use change models, which map the impact of economic and environmental factors on natural resources and ecosystem services without considering the effects of management strategies and biodiversity. Another helpful tool is scenario planning, which explores a range of future states, outcomes and alternatives (defined from qualitative and quantitative data and models) to establish a communication pathway on alternative futures, key drivers, desired states and ideal landscapes. Mixed-models, which bring together more than one of the previous exploratory and valuation tools, are also widely used. Examples of these include the ARIES model[12], the InVEST model[13] and the SELS model[14].

IN SUMMARY

TOOLS AND APPROACHES FOR ASSESSMENT AND ACTION PLANNING

- A number of approaches and analytical tools are needed to understand the functions and services provided by socio-ecological systems, as well as to explore the consequences associated with landscape changes and management decisions.
- Stakeholder participation is essential to the MFL approach, serving as a means to gain buy-in at community and stakeholder levels, and to secure engagement from the start.

Participatory approaches and stakeholder consultation

Stakeholder input is essential to support analytical tools, and in the context of developing MFLs it is important to consider these two elements together. Stakeholders can include the general public, specialist interest groups, businesses and academics. They can be receiving benefits from landscape ecosystem services locally, nationally or internationally, or simply have an interest in it.

Participatory approaches are valuable as they can provide a rapid assessment of ecosystem services, particularly in data-poor areas where use of mapping tools can be limited. This can affect reproducibility and accuracy however, so it is essential to combine local knowledge with objective metrics and land management expertise to avoid these issues. This approach is already being applied at the UK level through the Natural Capital Explorer[15] to enable the valuation of the natural environment and specific land uses, facilitating informed decision-making and dialogue between stakeholders.

Methods to collect stakeholder information include (but are not limited to) open interviews, informal conversations with key informants, observations of stakeholder behaviour and questionnaire-based surveys. Workshops allow stakeholder groups to present their views, propose management solutions, and then discuss them in mixed groups. This can help identify local interests and map different issues to facilitate discussion, find consensus and help define sustainable use levels.

Participatory approaches can also be important in assuring buy-in from stakeholders, minimizing competitive behaviour and fostering cooperative behaviour. Facilitators can be employed in workshops to mitigate conflicts of interests between stakeholder groups and ensure that landscape benefits and values are represented in a fair way. The prioritisation of ecosystem services can differ greatly between stakeholders, highlighting the need for inclusive approaches and early discussions between different groups.

Setting the ground for implementation: Learning from real-world examples

After weighing the impact of management decisions on functionality and understanding trade-offs within MFL, implementation should broadly follow two strategies: to optimise 1) landscape pattern or structure, and/or 2) the quality of functions and land-uses.

The Economics of Ecosystems and Biodiversity (TEEB) have collected numerous case studies detailing interventions for integration of ecosystem service approaches within to a range of food production sectors across the globe, and made them publicly available through TEEB's library of resources[16]. Other notable contributions and resources have been generated by the Ecosystem Services Partnership (Wageningen University)[17] and the Satoyama Initiative (United Nations University)[18]. At a UK level, several projects have explored MFL-related approaches for specific purposes, such as the Catchment Based Approach (DEFRA)[19] which focuses on water quality improvement at catchment levels, and the Nature Improvement Areas (DEFRA and Natural England) for improved ecological resilience.

On-the-ground implementation approaches and actions vary greatly between situations and according to strategies set. Therefore, it is important to consider case studies in order to understand the range of possible interventions, in terms of action plan, actors and objectives. Different methods can be used during implementation, such as comparative analysis (useful for example in land-use change or biodiversity restoration), adaptive experimentation (often used in long-term ecological restoration programmes), and landscape scenarios (such as in InVEST).

Real-world examples are an invaluable resource that can be drawn on to inform current and future decision-making around MFL. On-the-ground implementation approaches and actions can vary greatly depending on the circumstances and objectives, so case studies are useful for highlighting examples of approaches, challenges and lessons learned. *Box 1* and *Box 2* provide case studies arising from work on the North Devon Nature Improvement Area (NDNIA), one of 12 Nature Improvement Areas (NIAs) that were established by the UK Government in 2011[20]. These NIAs aimed 'to create joined up and resilient ecological networks at a landscape scale and to deliver these in an integrated way, enhancing ecosystem services including social and economic objectives', by representing partnerships between local communities and land managers, the private sector and conservation organisations. *Box 1* focusses on the approach taken to co-ordinating advice to local land managers and owners within the NDNIA to achieve landscape-scale change. *Box 2* details the process and challenges of valuing the ecosystem services delivered by Culm grassland, an important habitat within the NDNIA.

BOX 1
The Northern Devon Nature Improvement Area: co-ordinating local advice for landscape scale objectives

WHAT AND WHY

The Northern Devon NIA (NDNIA) encompasses the River Torridge Catchment, some 72,000 hectares of land surrounding the river Torridge. The NDNIA partnership is led by the Devon Wildlife Trust and is composed of over 16 organisations, including charities, statutory agencies, local authorities and businesses. The landscape of the NDNIA is predominantly farmed, with soils poorly drained and low in productivity. Farming is a mix of small farming units, intensive dairy farming and conifer plantations. The catchment is also of significant nature conservation interest; it contains two of the ten most threatened species in Europe (the marsh fritillary butterfly and the freshwater pearl mussel), 120 scheduled species, 2,112 ha of recorded priority habitat (as defined by the UK Biodiversity Action Plan), and 35 % of the UK's remaining Culm grassland (a wet, unimproved grassland that supports diverse plant communities).

Figure 4. Hedge laying in Northern Devon NIA.
© Devon Wildlife Trust.

A key objective of the NDNIA was to 'develop a robust and coherent Torridge catchment ecosystem through habitat maintenance, restoration and creation'. The partnership aimed to work with local landowners to have 75 % of priority terrestrial habitats in favourable condition. This related to a second objective of 'realising the Torridge catchment's potential to deliver high quality ecosystem services, particularly water quality, water quantity and carbon sequestration'.

HOW

Key to achieving these objectives was the creation of an integrated and co-ordinated advisory service to landowners. From 2012-2015, two farm advisory officers and one water resource advisory officer worked full time, acting as a 'one stop shop' to local landowners for advice on land and habitat management. They also provided support in the process of applying for funding to undertake

this work, directing landowners to the relevant specialist advisors and lending machinery for some actions. Workshops were held to share expertise between advisors and landowners from around the area, providing opportunities for debate and discussion, as well as the demonstration of specific management techniques. These events promoted more sympathetic management of improved pastureland, with a view to improve water quality and reduce run-off. With the aid of a grant from the Environment Agency two soil aerators were purchased that could be lent to landowners to reduce compaction in pastureland, thereby reducing run-off and improving the grass crop.

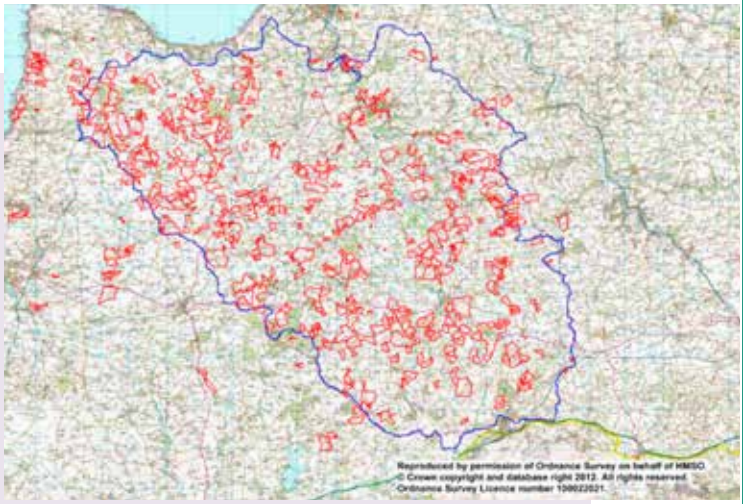

Figure 5. Map showing the extent of the Northern Devon NIA, with all sites visited highlighted in red.

OUTCOMES

By March 2015, 276 farms had received advisory support, with a total of 1,012 site visits, equating to approximately 21 % coverage of the Torridge catchment. With the help of the advisory team, landowners in the NDNIA were successful in applying for £3.7 million to undertake work. This resulted in the restoration 1,487 ha of culm grassland and other grassland habitats, 106 km of hedgerows, and 19 ha of broadleaf woodland. Consequently, land management was positively influenced adjacent to 96 km of the river Torridge. The NIA succeeded in achieving and exceeding most of their targets with regards to habitat restoration and management, with the exception of broadleaf woodland, which was driven by a lack of grant availability and the long-term commitment required of landowners.

CONCLUSIONS AND LESSONS LEARNT

The delivery of a targeted advisory service was successful in facilitating and co-ordinating habitat restoration and management work in the NDNIA, working with individual landowners to achieve landscape scale change. This presented multiple challenges (see further reading) but two factors emerged as particularly important to the delivery and future of the work: 1) the availability of grants for landowners, and 2) maintaining advisory support. Grant availability and funder priorities were crucial factors in enabling landowners to deliver restoration work and securing their commitment to maintenance.

Going forward, the capacity to achieve such co-ordinated management will be determined by funding availability under relevant schemes, so changes to schemes such as Countryside Stewardship will be important. Despite the NDNIA staff working to integrate different approaches, aligning contrasting priorities between various land management grant schemes presented challenges and could also be problematic in future initiatives. It is essential to maintain adequate staffing in order to provide an advisory service, as the advisory support not only helped landowners to secure funding for management, but also with its implementation and maintenance. Additionally, the NDNIA experience suggests that training aimed at broadening advisor skills and improved communication between specialist advisors working in the landscape would also be beneficial for facilitating a more integrated approach to farm management.

FURTHER WORK

Since 2015, the Torridge Headwater Facilitation Fund project has been funded under the Countryside Stewardship Facilitation Fund scheme (until 2020). This agreement covers 2,235 hectares of land and aims to 1) build on the work of the NDNIA to provide advice and support for land owners across the area, 2) encourage an integrated approach to farm scale management, and 3) foster collaboration as well as skills- and knowledge-sharing between land owners.

Further reading: North Devon Nature Improvement Area -The first three years: 2012-15 Progress and learning so far. *Devon Wildlife Trust* (2015)[21].

BOX 2
Valuing the ecosystem service delivered from Culm Grassland in Devon

WHAT AND WHY

The Culm restoration work in the NDNIA (*Box 1*) built upon work that had already been undertaken by the Devon Wildlife Trust (DWT) and partners. In parallel with the NDNIA, a proof of concept study was undertaken by the DWT and the University of Exeter to measure the chemical and water properties of Culm grassland. Culm grassland was monitored in three locations, where it was compared with woodlands, scrubland or intensively managed grassland. This data was then used to estimate the financial value lost from the historical conversion of Culm grassland for agriculture, as well as the value gained from restoration work since 2008. Although this assessment was limited to water retention and carbon storage, it presents a concrete example of an attempt to measure the economic value of landscape-scale change.

OUTCOMES

Work by Puttock & Brazier (2014)[22] suggested that compared to intensively managed grassland, culm grassland had higher water retention and carbon sequestration capacity, accounting for differences in soil depth and density between the habitats. In addition to higher general water retention, culm grassland released water more slowly in the face of storm events. In fact, models estimated that storm runoff would be 11 times greater from intensively managed grasslands. Cowap *et al.* (2015)[23] estimated that based on water retention and carbon storage capacity alone, the total area of the Culm grassland in Devon (6,418 ha) was to had a value of £14.723 million, and that the 3,984 ha of Culm grassland that has been restored through the work of the DWT and partners up to 2014 had potentially added £9.139 million of value compared to if it had been left as intensively managed grassland.

Figure 6. Culm grassland in the North Devon NIA.
© Devon Wildlife Trust.

CONCLUSIONS AND LESSONS LEARNT

This combination of detailed observation and valuation allowed a financial value to be assigned to the water and carbon storage properties of Culm grassland, providing a real-world example of how such natural capital, and its restoration, might can be valued in economic terms. The study also revealed important challenges in conducting such valuations. For example, water stored by Culm grassland cannot be equated to water that is already in a reservoir as it is not available 'on tap', and the value attributed to water stored in Culm must also account for benefits beyond direct use, such as promoting a more even distribution of water flow into reservoirs or preservation of soil quality and function. For water retention and quality, the study looked to existing valuations, but found variable estimates. Where the National Ecosystem Assessment (NEA) attached a value of £0.05 /m^3 to water, South West Water have estimated a value of £0.23 /m^3. The latter was deemed to be more realistic but did assume that that the water was 'on tap'. Such assumptions and their associated judgements have to be made in valuations where both information and time are limited, but it is important that these decisions and their associated assumptions are communicated when presenting the estimates of value.

FURTHER WORK

The Culm Grassland Natural Flood Management project began in 2016 (until 2020) and is building upon work delivered by DWT trust in partnership with the Environment Agency (EA), Devon County Council (DCC), University of Exeter and Natural England, with funding from the EV, DCC and European Union. The project aims to 1) build a better picture of how Culm grassland stores and releases water (through a PhD research project), 2) increase landowners understanding of the value of Culm through workshops and training, 3) work with landowners to protect and restore Culm through advice, grants and practical work, and 4) share learning locally, across the UK and with the EU.

Further reading: The Culm: A landscape that works. *Devon Wildlife Trust* (2015)[24].

Part 3: Core principles of multifunctional landscape management

There is no single right way to approach the management of multifunctional landscapes, as each one is unique and therefore requires a different approach. However, several principles of MFL management appear to be common across the projects developed in recent years. These principles are discussed here in detail to frame common approaches and latest practice.

Organisational structure and functioning

There are three main commonalities across the organisational structures and functioning of successful MFL projects: the adoption of learning organisations, adaptive management, transdisciplinary approaches, and multi-stakeholder organisations.

Learning organisations are informal groups that are assembled to tackle a problem, as well as share and develop knowledge, resources and ideas towards a common goal. They make research socially relevant and user-informed, serving as a forum to discuss approaches and revisit decisions in an interactive learning process that covers monitoring, evaluation and re-evaluation. Such organisations address problems systematically, try out new approaches, review internal and external successes and failures, adopt best practice from others, consider feedback from stakeholders, and transfer knowledge internally by moving human resources.

These organisations employ an **adaptive management process**, or the process of action-reflection cycles, which requires frequently updating the information being used, flexibility of objectives and actions, and ongoing monitoring of the performance of interventions. This process can be further enhanced by using experimental approaches for assessing the effectiveness of interventions and the use of user-friendly planning products to inform land-management decisions.

Transdisciplinarity is another common theme in the organisational structures of MFL approaches. This involves the collaboration between scientists of different disciplines, practitioners and professionals involved in land use, who share a vision and approach. Economists, ecologists, social scientists and stakeholders from different areas must work together to better understand land-use trade-offs, make their work accessible for collaborative management and planning.

SUCCESS FACTORS

The existence of solid organisational structures, clear objectives, defined timeline, strong facilitators and secure funding. Learning organisations further have built-in flexibility and well-developed monitoring systems, with good feedback mechanisms.

Multi-stakeholder organisations are issue-driven organisations that enable collective action and bring together stakeholders from private, public and non-profit sectors to address gaps in regulation, participation, resources and learning. This approach allows the consideration of competing stakeholder demands, involving groups of various backgrounds and enabling knowledge transfer between different actors to address individual resource gaps that could not be met otherwise. Although participation is voluntary, stakeholder selection is not random, with external stakeholders or partners that act as bridging organisations or boundary organisations often being critical in reaching common targets. Multi-stakeholder organisations also open up governance and local decision-making processes to allow the achievement of complex public policy targets. Their dominant mode of governance can change through the life cycle, varying between network, market or hierarchy.

Participatory approaches and stakeholder engagement

Co-management systems, community engagement and the integration of local knowledge are key to the successful management of MFL.

Co-management systems are an arrangement between governments and local groups (or the result of self-organization) for shared resource management. Co-management overcomes the issue of central ruling being detached from local context and the difficulty of centralised bureaucracies to rapidly respond to social-ecological change, allowing faster and tailored responses to local challenges. There are two forms of co-management: *traditional co-management*, which is an established practice of shared management (e.g. in fisheries and marine protected areas), and *adaptive co-management*, which tests and revises institutional arrangements and knowledge in a dynamic, ongoing, self-organized process of learning-by-doing.

SUCCESS FACTORS

Trust and respect between the community and other stakeholders, common understanding, structures for local influence, motivation by market potential, and the existence of funding.

When managing MFL, **community engagement and local knowledge** are essential to the identification, mapping and valuation of ecosystem services, as well as to support decision-making. Increased public involvement has been linked to conflict reduction, more flexible and efficient management, increased legitimacy, and better use of place-specific knowledge. Therefore, linking actors and stakeholders can ensure long-term programme sustainability by securing community buy-in and assuring that local knowledge is not disregarded. It's important to note that stakeholder interactions with a specific ecosystem service might be spatially distributed (e.g. affecting a limited number of individuals or within-catchment scale communities), or temporally distributed (e.g. benefits to given stakeholders can be under- or overlooked at point assessments).

External governance and incentives

Government (central and local) **and policy** (national and international) play important roles in supporting the self-organisation of multi-stakeholder initiatives and adaptive co-management systems that address societal challenges and serve the common good. They can enable the legislation and funding that are essential in supporting MFL approaches and assure long-term sustainability. They can facilitate the creation of ownership by devolving authority to local authorities, decision-makers or stakeholders, empowering independent decisions and enforcing circumscribed rules. The availability of pump-priming incentives (to kick-start initiatives), follow-on funding (for project development, maintenance, but also long-term adaptation to change) and emergency funding (for exceptional interventions) is also essential, as such initiatives might fail in their absence.

The economic valuation of landscapes enables the development of **payment schemes for ecosystem services** (PES), encouraging sustainable land use and providing financial incentives for the service providers. The success of PES schemes is dependent on correct valuation, as ignoring interactions between different services can result in the elevation of one environmental focus at the expense of another. Payments for bundling and layering of PES can address some of these challenges. It is also important that PES schemes are inclusive of cultural services and account for the range of social groups using and benefiting from an ecosystem service. Place-based PES schemes enable the integration of the full suite of human activities occurring within a defined area, with payments reflecting the shared values of all who may be positively or negatively affected by the scheme.

Performance assessment

The final principle of MFL management is **monitoring for evaluation**. Monitoring is the systematic collection of data to measure change over time in a given variable. Evaluation is the objective assessment of performance against set objectives.

Standardised protocols for both monitoring and evaluation are necessary to assess whether initiatives employing the MFL approach achieved their outcome and should be critical part of planning any MFL initiative. When developing monitoring strategies, there are a number of critical considerations:

- Suitable indicators need to be selected to measure this change overtime. These indicators might be quantitative (for biophysical, chemical or ecological processes), qualitative (for people perceptions or the nature of relationships) or proxy (which do not directly measure

the variable of interest but can be assumed to be associated with change).

- Standardised protocols need to be created or adopted for every indicator, to ensure that data is collected and analysed systematically and consistently over time and is comparable between different landscape initiatives, which can allow for wider benchmarking.
- Resources and capacity need to be in place to support suitable data processing, data analysis, and the interpretation of results, facilitating safe storage of data, its correct usage, minimisation of errors and acting as a platform for collaboration.
- Data collection for any monitoring protocols should begin before interventions are undertaken, to provide baseline data. This is essential to track changes caused by an intervention

Monitoring is a costly and long-term exercise, which can be a barrier for landscape scale initiatives. Therefore, adequate costing should be considered when designing and funding such initiatives. Using local volunteers may present opportunities to reduce costs and may be able to draw upon existing tools (e.g. protocols and smartphone applications) for data collection. Combining scientific and participatory methods can also facilitate stakeholder engagement and sense of ownership and may also integrate educational objectives.

IN SUMMARY

TOWARDS THE MANAGEMENT OF MFL

- No right approach exists to multifunctional landscape management, but a series of common management principles can be drawn from existing initiatives and examples around the world to inform future initiatives.
- Empowerment and participation of stakeholders is essential to establish effective joined-up approaches that consider the diversity of views, knowledge, nature and multiplicity of relations that people establish with landscapes.
- Continuous learning and adaptive design are essential features of MFL management, dependent on flexible governance structures and robust monitoring and evaluation processes to adjust to ever-changing conditions, desired outcomes and external pressures.

Acknowledgements

This work was funded by the Global Food Security (GFS) programme as part of its Policy Lab, in which post-doctoral researchers compete to write a policy-facing report for the programme. This report was edited by Maia Elliott, science writer for the GFS programme.

The authors would also like to acknowledge the BBSRC and NERC project funding that supported their research (NE/P005349/1, BB/P003664/1 and NE/N003152/1). The authors are grateful to their respective host organisations during the development of this work: Newcastle University, Scottish Association for Marine Science, University of Reading - Centre for Agri-Environmental Research, University of Sheffield, University of York, and The Royal Botanical Gardens, Kew. A particular note of gratitude to the Devon Wildlife Trust and Lisa Schneidau for their invaluable support with the NIA case studies.

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