PRIFYSGOL ABERYSTWYTH UNIVERSITY

IBERS
Athrofa y Gwyddorau Biolegol, Amgylcheddol a Gwledig
Institute of Biological, Environmental and Rural Sciences

Environment and Sustainability Committee
Inquiry into Sustainable Land Management
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Overview

Within Aberystwyth University, the Institute of Biological, Environmental and Rural Sciences (IBERS) is an internationally-recognised research and teaching centre and a hub of scientific expertise. With 360 members of staff, IBERS conducts basic, strategic, and applied research from genes and molecules to organisms and the environment. We therefore provide a unique base for research in response to global challenges such as sustainable resource and land development and are grateful for the opportunity to provide our perspective for this consultation.

In our view, sustainable land management in Wales needs to be forward-looking. Wales must embrace the knowledge that research on land use and ecosystems is providing and the opportunities provided by advances in plant and animal biotechnology. Our future farm must provide more nutritious food (in quantity and quality) in a way that is both carbon-neutral and recognises and respects that biodiversity and ecosystem services are inter-dependent. The overarching challenge to meet this goal is the need to balance the competing priorities of resource supply security, economic development, and environmental conservation.

Barriers to Sustainable Land Management

Current policy, demographics, and environment

The barriers to sustainable land management are multi-fold. First, Wales currently lacks a land use strategy, and this is essential to identify the most appropriate use of land based on production and environmental outputs and to establish the right policy incentives to make it happen. In addition, farming forms only a small part of future land use, especially for marginal agricultural land. Current advisory organisations are too sector-focused and narrow in scope to facilitate the effective delivery of agricultural, environmental and conservation objectives by landowners and farmers. We require a more integrated research and advisory approach to land management.

Further, the current demographics of the sector are not optimal for innovations in land management. Social studies demonstrate that older groups generally do not invest and innovate, despite the socioeconomic factors in their favour, chiefly access to capital. Innovation and adaptation to new business, environmental and societal challenges depends upon the vitality of a farming population with an even spread of ages, but there are few opportunities for young farmers to enter the industry. Socio-economic barriers, such as the lack of access to capital and high land prices, inhibit bright, young, energetic graduates in agriculture. To increase future agricultural innovation, it is necessary to overcome these complex barriers.

The current state of the Welsh uplands and mountains are also a major barrier to reach a state of sustainability. The vegetation, soils, and watercourses over much of

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these areas are severely degraded. This reflects the legacy of decades of excessive stocking with livestock and closely-planted monocultures of commercial forests in previously unforested land. To maintain underlying ecosystem services and to minimise soil, soluble nitrogen, carbon losses, and pathogens downstream, Wales must find the right balance between future land use options for production and conservation measures. To restore wetlands and native woodland, it may be necessary to zone higher altitude sites according to downstream human settlement and land use patterns, in order to improve water and carbon storage and retention. Production must be carefully zoned to avoid steep slopes and watercourses, in order to minimise soil erosion, dissolved organic carbon and nitrogen pollution.

Progress in sustainable land management best practices

There is a need for technical progress that is transformational rather than incremental. To achieve a sustainable industry and environment, we need to learn how to balance the security of supply of farm outputs, with farm economics and wider ecosystem services. This will require detailed knowledge of the systems involved as well as how they are affected by perturbations such as climate change and changes in agricultural policy incentives. In addition to understanding the ecological, industrial, and economic systems, we need to ensure that the next incarnation of “farming connect” is truly driven by innovation. To develop these new, transformational approaches to land use and management, Agri-Tech, DEFRA and Research Council funding should be harnessed.

When technical advances are available, ensuring their uptake and application by farmers and other landowners is an additional challenge. Many of those active in agriculture lack the knowledge and understanding necessary for optimal management and decision-making. In addition, many farmers depend on an outside source of income, which reduces the hours they have available for land management. In this case, they may not have the time to maximise the value of an investment in skills and technology, and thus decide not to invest. Sectoral entrenchment can prevent best practice in sustainable land management from being realised. In some cases, agricultural payments continue to subsidise suboptimal management choices. This discredits the wider, professional sector and denies land to new entrants. Payments should be reviewed so that poor practice is no longer rewarded, while incentivising land management that protects and enhances the provision of ecosystem services.

In many cases, farmers may be open to integrating alternative, research-based land uses into traditional agricultural practice, but may be inhibited by a lack of confidence or training. One potential solution to this information barrier is an outreach and advisory service that is both informed by and feeds into research. True exemplars of this idea are demonstration farms. More effective education would increase practitioners’ appreciation of the ecological underpinning of agricultural production (e.g., biodiversity maintains soil fertility), the environmental limits to productivity, and the costs to society when these limits are exceeded (e.g., flood damage and pollution).

Promoting best practice requires effective engagement with farming communities, and this can only be achieved through an understanding of the social networks and

information sources utilised by farmers when making management decisions. Policy can only improve the uptake of novel technology if the drivers of sub-optimal management choices are correctly identified. These drivers may include a lack of information or training, the existence of perverse incentives, or a lack of resources required to make long-term investments.

Climate change

There are many challenges to sustainable land management posed by on-going climate change, such as an increased frequency of extreme events, increased rainfall, more frequent storms, and the emergence of new vector-borne diseases for both plants and animals. Without measures to mitigate these changes, they will have a significant effect on Welsh productivity.

To address the challenges of climate change will require advances and innovation in both fundamental plant and animal science and land management. For example, to mitigate new plant and animal diseases, we need to better understand the fundamental biology behind how these diseases spread in different climatic conditions. To mitigate increased rainfall and prevent flooding, we need to better understand how water is retained in different regions; water retention changes depending on an area's ecology. A different climate may require shifts in land use and exploitation of natural resources, and so have economic and social implications. Policy to address the challenges arising from climate change, therefore, should be aware of technical advances (e.g., disease resistance in crops) and a comprehensive, spatially-sensitive view of land use and planning.

Policy drivers to address the challenges

Sustainable growth and maximising resource efficiency depends on maintaining ecosystem services. This requires appreciation of land areas that are appropriate for cultivation, pastoral use, and those which simply should not be farmed.

Specific policy measures could help address this ongoing challenge. Overall, policy must reflect the socio-economic consequences of production for land and water health, both positive and negative. This has been partly developed under the integrated catchment management agenda (Natural Resources Wales). There are societal benefits to integrating land management for ecosystem services into traditional farmland, including renewable energy, greenhouse gas sinks and stores, regulation of water flow rates and purity, wildlife conservation, scenery, heritage, and recreation. There should therefore be greater financial incentives for the uptake of better land management practices. Likewise, the negative consequences for society of poor management must be better reflected in the economic costs to those responsible. The costs of mitigating adverse consequences should be borne by the sector, rather than by other private or public sectors.

How do we define the key ecosystems and ecosystem services in a way that makes sense for Wales?

Ecosystems in Wales have already been defined, based on the study of specific plant and animal communities in different geographical areas.

In contrast, rationally defining ecosystem services requires balancing priorities. These may be defined differently in different areas, depending on the specific use of land. For example, agricultural practices may conflict with ecosystem services such as the conservation of carbon in ecosystems (important for biodiversity and productivity), water filtering and purity, recreation (e.g. clean beaches and coastal waters), and flood prevention. Defining ecosystem services in a specific area therefore requires weighing the relative priorities of land use in ecologically linked areas.

There therefore needs to be a rational zoning of land to reflect and balance the potential for production and the vulnerability of the land. Vulnerability is defined by potential detrimental effects on the land status, in terms of how carbon is sequestered and stored, how water is retained and its purity, and whether priority habitats and wildlife are conserved. Well-planned zoning would also improve biosecurity of crops and livestock, that is, inhibiting disease transmission.

In summary, we need to expand the current definition of ecosystems services for a more systems-based view. Within Wales, spatially-aware models that account for fluxes and transfers of greenhouse gases and particles (which can also carry pathogens) over landscapes are needed.

How do we develop a baseline from which to measure progress? This includes how we collect, coordinate and use data to support sustainable land management in Wales.

Sustainable intensification is defined as the increasing of yields without increasing the area of land used nor comprising future productivity. While aiming to intensify and increase production, if sustainability is not achieved, degrading ecosystems will rapidly short-circuit economic aspirations.

Therefore, alongside production targets, environmental monitoring is essential to gauge progress towards goals in soil, water, and biodiversity. Monitoring could also inform agricultural managers as to which innovative methods are effective and to clearly indicate where further adaptation and development of techniques is necessary. An added benefit to individuals would be the personal satisfaction of a marked success, as a further incentive. Overall, establishing practical ways to monitor and measure progress in sustainability is critical to effective land management.

Remote sensing technologies and public engagement can contribute to environmental surveillance and monitoring, especially of keystone or charismatic indicator habitats and species (e.g., CobWeb). A validated system for baseline and rolling or intermittent biodiversity monitoring has been developed under the EU BioBio project. Biodiversity is described in terms of genetic diversity (including livestock breeds and crop varieties), soil organisms, wild and domesticated plants and animals and cultivated and semi-natural habitats, and is represented by a basket of indicators. To reduce overall costs, this basket includes surrogate indicators derived from annual agricultural statistics already collected.

Currently, there is a great deal of effort, resources, and expertise being dedicated to the challenge of monitoring. There are both UK and European initiatives, which together aim to establish standard sustainability metrics, coordinate data collection and sharing, and integrate the different approaches to modelling sustainability.

Centre for Agricultural Informatics and Sustainability Metrics

In collaboration with industrial and public partners and the support of the Agri-Tech Strategy, Farming Futures (previously known as the Centre for Excellence in UK Farming) is working to develop the Centre for Agricultural Informatics and Sustainability Metrics. A key objective for the project is to develop a comprehensive, keystone approach to sustainability metrics, which currently does not exist in Europe. Indicators need to cover the three pillars of economics, society, and environment. In current practice, often just environmental sustainability measures are considered, and socio-economic considerations, which are obviously essential for planning and policy, are neglected.

This project aims to move towards UK industry and academic consensus on appropriate, internationally-agreed measures of productivity and sustainability, how to calculate these measures across sectors, and other related practices. These measures will be based on data, for example, on production relative to inputs, and environmental data, such as soil properties. Initial development of this keystone approach is currently underway with one variety of wheat and two varieties of lamb, with the goal of verifying that these metrics remain stable or improve over time.

Modelling European Agriculture with Climate Change for Food Security (MACSUR)

There is a vast amount of agricultural, economic, ecological and socio-economic data coming from research, farming systems, and food supply chains. For policy-makers and stakeholders to be able to interpret and draw conclusions from this data, for example, to set baselines and goals (economic and ecological), data sets can be integrated into agricultural models. These models simplify complex data, allowing a system overview that would help inform policy decisions.

The MACSUR knowledge hub is an EU project designed to develop a pan-European agricultural modelling community. A strong capacity in data collation, sharing and modelling across Europe would enhance our ability to predict the impacts on agriculture from climate and linked socio-economic change. The project will develop integrated modelling approaches that scale livestock, crop and economic modelling to the regional level, in order to provide policy-relevant outputs for the agricultural sector.

What incentives can we provide land managers to develop sustainable practices, and in particular, any new sources of investment we can attract to support these?

Policy incentives that could be effective include placing monetary values on ecosystem services, including on carbon. A system that places values on ecosystem services that is transparent and easily understandable could form the basis for assessing costs and benefits. It will be important to ensure that such a valuation

covers all potential ecosystem services, that the trade-offs between services are taken into account, and that the incentives are sufficient to trigger action.

An additional key issue to consider is how payments are made for ecosystem service provision. Specifically, for a Payments for Ecosystem Services (PES) scheme, payments could be based on income forgone or on the benefits derived. Basing payments on income foregone is the current mechanism under agri-environment schemes, while basing them on benefits derived may be more difficult to achieve due to EU legislation on payments.

In terms of new sources of investment to fund incentives, leveraging convergence-based funding is currently an under-utilised approach. This could be considered to attract investment from national and EU sources, including from Horizon 2020.

How do we ensure that our sustainable land management policies maintain vibrant rural communities and attract new entrants into the land-based sector?

To encourage vibrant rural communities, land and capital should be available to new entrants into farming and land management, especially for professionally-trained, computer-literate graduates. Support for this demographic could include providing continuous access to a professional development and training system. Access to adequate training would facilitate new entrants' ability to manage the complex production and environmental challenges of land management.

Overlong occupation of land by an aging farming population and land abandonment are two opposite problems that impede the maintenance of vibrant rural communities. These issues must be considered holistically in terms of human geography, culture, and agricultural science. To address these issues at the local level, people must have cultural support as well as technical support. In the case of land abandonment, this support could mean the retention of core services and amenities within reach of rural communities.

What is the most appropriate geographical scale(s) at which we should be delivering sustainable land management policies and practices in Wales?

The most appropriate geographical scale to consider is at the level of catchments. This scale is already well-understood and their geographical features also reflect cultural and community boundaries. This scale is often used in other management schemes. Nevertheless, basing policy on catchments has several important drawbacks that need to be considered.

The integrated catchment management under development by Natural Resources Wales offers a model, but it is important to recognize that such a watershed focus could impede the rational zoning of land use. For instance, upland and montane summits and ridges form an important interconnecting, terrestrial ecosystem; a catchment approach would fragment policy and management applied to this land. These continuous land areas would be subdivided according to the position of headwaters of each separate catchment, risking a loss of coordination of efforts in these sensitive and important land areas. Many water catchments are artificially connected by feed tunnels for reservoirs for hydro-electric schemes and potable

water supply. The land management applied to one watershed may therefore impact on the water flow and quality of other catchments.

Nevertheless, we should be working at multiple scales. While the scale of the catchment is the most appropriate to develop land management policy (with the above considerations), changes and improvements should be monitored at a national scale (with techniques such as remote imaging from unmanned aerial vehicles and satellites), and the local scale should be considered to best assist farmers with the tools for precision agriculture interventions.

If there are key actions we can take to deliver short-term 'quick wins' and the actions we should be taking for the long-term?

Short-term actions

There are several key actions that could be undertaken in the short term to begin addressing these challenges:

- Take steps towards better integration between private agronomists, agricultural scientists, and ecologists for policy, advice, and land consultations and planning. Farmers are likely to respond more positively to different experts if they are provided with consistent, coordinated advice. Increased cooperation would also improve the advice on the broader context and potential consequences of farmers' activities. Coordinated advice on ecological and agricultural consequences for different options would allow for a better balancing of priorities and awareness of downstream impacts of land use.
- Hold an entrepreneurial debate on the future of land use
- End subsidies for poor farming; enforce withholding of Single Farm Payments (SFP) from farmers who breach, at the very least, Good Agricultural and Environmental Condition (GAEC) rules

Long-term actions

We believe a number of actions would improve long-term land sustainability in Wales:

- Development of innovative farming platforms that test and demonstrate systems-based approaches that will be applicable over 30-50 years
- Payments from public funds based on results, rather than on procedures carried out with no individual monitoring of results. Indeed, monitoring of individual operations, for example, for soil carbon, is essential.
- Development of professional accreditation for land managers
- Creation of rewards for innovative land managers who successfully integrate agricultural production while respecting the environmental limits of the location and wider consequences for and objectives of society