Public Document Pack

Environment and Sustainability Committee

Meeting Venue:
Medrus Conference Centre, Penglais Campus, Aberystwyth University

Meeting date:
Thursday, 20 February 2014

Meeting time:
10:00

Cynulliad Cenedlaethol Cymru
National Assembly for Wales

For further information please contact:
Alun Davidson
Committee Clerk
029 2089 8639
ES.comm@wales.gov.uk

1 Introductions, apologies and substitutions

2 Sustainable Land Management – Evidence from the Institute of Biological, Environmental and Rural Sciences (IBERS), Aberystwyth University (10:00 – 10:40) (Pages 1 – 19)

E&S(4)-06-14 paper 1

Professor Jamie Newbold, IBERS Director of Research and Enterprise
Professor Iain Donnison, IBERS Director of External Relations

3 Sustainable Land Management – Evidence from Farming Connect (10:40 – 11:20) (Pages 20 – 40)

E&S(4)-06-14 Paper 2

Gary Douch, Head of Farming Connect
Eirwen Williams, Director, Menter a Busnes and Head of Rural Programmes

4 Sustainable Land Management – Evidence from Wales Environment Research Hub (11:20 – 11:50) (Pages 41 – 68)

E&S(4)-06-14 Paper 3

Dr Shaun Russell, Director

5 Sustainable Land Management – Evidence from the Countryside and Community Research Institute (CCRI), University of Gloucestershire (11:50 – 12:30) (Pages 69 – 80)

E&S(4)-06-14 paper 4

Professor Janet Dwyer, Director
Chris Short, Senior Research Fellow

6 Papers to note (Pages 81 – 83)

Minutes of the meeting held on 6 February

Inquiry into the Welsh Government's proposals for the M4 around Newport : Letter from the Minister for Economy, Science and Transport (Pages 84 – 87)

E&S(4)-06-14 paper 5

Document is Restricted

Environment and Sustainability Committee
Inquiry into Sustainable Land Management
February 2014

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

Contributors: Prof Mike Christie, Dr Peter Dennis, Prof Iain Donnison, Dr Richard Kipling, Prof Jamie Newbold, Mr Dafydd Owen, and Prof Nigel Scollan; compiled by Dr Patricia Gongal

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

FARMING connect
cyswllt FFERMIO
08456 000 813

FARMING CONNECT UPDATE – January 2014

Overall Progress

Since the start of the programme in 2007 Farming Connect has provided support to **18,768** unique individuals, either in the form of one-to-one subsidised services, or via Farming Connect events.

There have also been 77,584 attendances at Farming Connect events. These are split across the different periods of Farming Connect as follows:

	Number of attendances
Interim period - 01/04/07 - 31/03/08	7,908
Phase 1 - 01/06/08 - 31/08/11	34,106
Phase 2 - 01/09/11 - 31/012/13	35,570
TOTAL	**77,584**

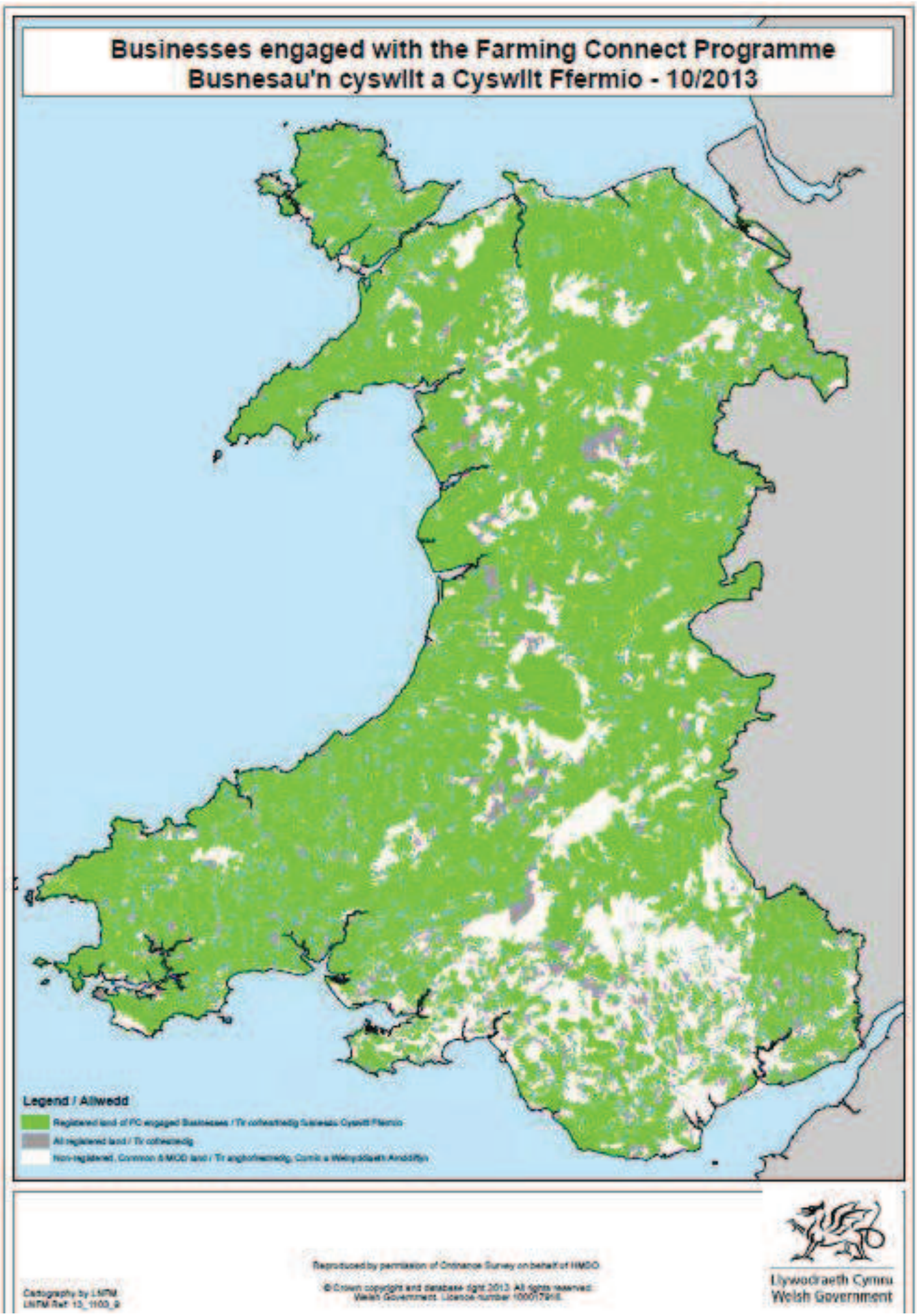
8,230 (31 Dec 2013) farm and forestry businesses have now registered with Farming Connect, which is also supporting other Welsh Government schemes such as Glastir Entry, Glastir Efficiency Grants and the Young Entrant Support Scheme.

The total number of subsidised services application and claim forms approved since the start of the programme to 31 Dec 2013 is outlined below:

	Application forms approved	Claim forms approved
Skills Development Programme	7700*	4926*
Whole Farm Plan	4348	2965
Farm Advisory Service	1689	1316

* During the interim period 01/04/07 - 31/03/08 an additional 5,945 applications for training were approved and funded.

A geographical spread of businesses engaged with the Farming Connect programme is shown in the map below:


Businesses engaged with the Farming Connect Programme
Busnesau'n cyswllt a Cyswllt Ffermio - 10/2013
Legend / Allwedd
Reproduced by permission of Ordnance Survey on behalf of HMSO
Llywodraeth Cymru
Welsh Government

The Farming Connect programme delivers on a number of Welsh Government policy priorities and contributes to the action plans of several indepent reports, some of the most recent ar esummarised below.

Working Smarter Report
Working Smarter is a report of recommendations by Gareth Williams to the Welsh Government on better regulation in farming and includes 78 recommendations on how to ensure better regulation within an appropriate framework, improved customer service for the farmers and a sector with increased profitability from a business perspective.

Working Smarter is most importantly of all a state of mind and especially an attitude to change; it's about the attitude of Government towards farmers and farming, the attitude of stakeholders and farmers towards the government and regulation and about preparing properly and in good time for change.

Farming Connect in contributing to the delivery of recommendations 6, 24, 43 & 48 as described below and is helping the industry prepare for this change.

Recommendation 6 – to research and develop business models to emphasise to customers the business benefits of good regulatory compliance
Recommendation 24 – Welsh Government RPW to organise with FLS on-farm events for farmers to explain inspections and in so doing improve farmer preparedness and reduce the fear factor
Recommendation 43 – Environmental 'water' priorities (basic standards) should be incorporated into all environmental advice communicated on-farm by all of the organisations delivering regulatory advice and controls on farms including slurry storage, slurry application, disposal of chemicals, poaching of river banks, soil compaction and management of river banks.
Recommendation 48 – NEF (Natural Environment Framework) starting to approach environmental regulation from a business model perspective. This is commendable and many robust examples are now needed to demonstrate that good environmental practice is fully compatible with food production whilst enhancing business performance and profitability.

Cross Cutting Themes
The Farming Connect Programme delivers support to the industry on the Welsh Government cross-cutting themes of environment and climate change, animal health and welfare, health and safety, biosecurity, effective use of ICT, women and young entrants.

Climate change is an overarching theme for the Knowledge Transfer Programme and the programme is appraised at the development stage to ensure that appropriate opportunities for action on climate change are highlighted at all Farming Connect events.

Resilience
The Kevin Roberts Review of the resilience of farming in Wales focused in particular on the beef and sheep sectors in the uplands and hills. The report recommends that an integrated package of measures be considered for the

uplands in the next RDP that will help improve farming and environmental performance and which, in time, should provide resilience to the industry. The Farming Connect Knowledge Transfer Programme should contribute to this work and resilience will be introduced as an additional cross cutting theme in 2014.

Young Entrant Support Scheme
Farming Connect contributes to The Young Entrant Support Scheme, the team of Regional Co-ordinators support applicants through the process by explaining scheme requirements, liaising with YESS Welsh Government officers, accessing 80% funding towards the business plan, and completing Skills Assessments with applicants who were encouraged to complete the online Skills Assessments in order to comply with the scheme's requirements. In many cases, the Regional Co-ordinators were the first port of call for interested and potential candidates.

Young entrants are encouraged to attend all events under the Knowledge Transfer Programme however a number of Discussion Groups for young people have been established across Wales to support young entrants to establish successful farming businesses. A total of 15 young entrants' groups are currently being facilitated across Wales on a range of themes across sectors including innovative farming practices and developing opportunities and alternative income streams for younger farmers.

Glastir
Glastir is supported through Farming Connect with fully funded one to one surgeries to assist farmers to select the best options for their farms, 80% subsidised mentoring to look at the full business implications of entering Glastir, and Glastir Efficiency Grant supporting documents can be provided by Farming Connect mentors and advisors also 80% funded. All mentors/advisors who deliver these services have been on a compulsory training event prior to delivering. Failure to attend the event resulted in the mentor/advisor not being able to offer their services to farmers wishing to access the 80% funding. The aim was to improve the service provided, and reduce the time it takes to approve Glastir Efficiency Grant applications.

Analysis and Evaluation
Farming Connect have procured a number of independent evaluations which have now been completed, along with analysis by Welsh Rural Observatory (WRO) of knowledge transfer and innovation in Wales. These will contribute to the evidence base for development of the successor programme in the 2014-2020 Rural Development Plan for Wales.

The following independent analysis and evaluation reports have been completed:

- Knowledge Transfer and Innovation in the Wales Rural Development Plan (RDP) and European Innovation Partnership 2014-20 carried out by the Welsh Rural Observatory (WRO)

- Evaluation of the Agrisgôp Management Development Programme carried out by SQW Ltd

- Evaluation of the Farming Connect Development Programme carried out by SQW Ltd

- Evaluation of Farming Connect Events carried out by ADAS UK Ltd

- Evaluation of Farming Connect Subsidised Services carried out by SQW Ltd

The evaluations indicated that Farming Connect has been successful in achieving its key objectives of improving business and environmental performance, raising skill levels, and supporting greater emphasis on animal health and welfare and the use of ICT. They also support the current direction of travel in terms of ongoing development of the service. Farming Connect has already started to implement many of the policy findings from these reports under current contracts which have been in place since September 2011.

Branding services as part of Farming Connect helped to avoid confusion amongst farmers, and the Farming Connect Subsidised Services Evaluation noted that Farming Connect was seen as an independent 'trusted provider' of support and advice. The evaluations identify a continuing need for this type of support in the future, and provide a sound, independent evidence base to support proposals for developing the next RDP.

Specifically the Knowledge Transfer & Innovation work undertaken by WRO calls for greater collaboration across and beyond the RDP, with a continuing need for knowledge transfer through visual and applied methods, and incorporating links to applied research.

The WRO report also highlights a number of points of good practice in knowledge transfer; including the importance of 'selling' the business benefits of participating in knowledge transfer (particularly when communicating environmental and regulatory issues), adapting communication for regional/local contexts, and the need for greater prioritisation of professional development and training within the land economy. These will be important considerations in the design of knowledge transfer interventions under the next RDP.

Farming Connect Unit
Agriculture and Rural Affairs Division

FARMING connect
cyswllt FFERMIO

FARMING CONNECT

Report on the Cross Cutting Theme
ENVIRONMENT AND CLIMATE CHANGE

DURING THE PERIOD 1 SEPTEMBER 2011 - 31 JANUARY 2014

Cronfa Amaethyddol Ewrop ar gyfer Datblygu Gwledig: Ewrop yn Buddsoddi mewn Ardaloedd Gwledig
The European Agricultural Fund for Rural Development: Europe Investing in Rural Areas

menter a busnes

Llywodraeth Cymru
Welsh Government

1. Farming Connect - Background

Farming Connect is an integrated, high profile, Wales-wide service for farming families and forestry businesses. It is funded through the Rural Development Programme 2007-2013 which is financed by the European Agricultural Fund for Rural Development and the Welsh Government. Its main purpose is to help farmers, foresters and their families to run their business more efficiently and to safeguard the future of their farm. It is an integrated programme for all sectors including Red Meat, Dairy, Land-use and Organic and delivers support to the industry on the cross-cutting themes of environment and climate change, animal health and welfare, health and safety, biosecurity, effective use of ICT, women and young entrants. The main elements of the programme can be summarised as follows:

- *Knowledge Transfer Programme.* The aim of this programme is to ensure that information is available to help producers adopt new practices, benchmark performance, share ideas, address market needs and encourage innovation
- *Subsidised Services.* The Whole Farm Plan provides one-to-one mentoring on a range of options designed to support agricultural and forestry businesses grow and develop including Animal Health Planning; and the Farm Advisory Service offers one-to-one, confidential on-farm advice aimed at supporting farm and forestry holders to improve the sustainable management of their holdings in relation to SMRs, GAECs and standards relating to occupational health and safety.
- *The Skills Development Programme* aims to up-skill individuals who work in the farming and forestry sectors in Wales to improve working practices, comply with legislation and to encourage diversification.
- *Farming Connect Industry Development (Event Management)* disseminates strategic messages and key topical issues via a range of mechanisms including seminars and surgeries. The contract allows the Welsh Government the flexibility to disseminate strategic messages in whatever format, frequency and location that is required to achieve maximum impact and uptake.
- *Agrisgôp* is a Management Development Programme which works with groups of approximately eight farmers. It is based on the concept of Action Learning and aims to stimulate a culture of innovation and entrepreneurship.

Menter a Busnes has been responsible for the delivery of Farming Connect since September 2011, and between 1st Sept 2011 and 31st December 2013, a total of 32,695 attendees have attended our events, with 11,985of these unique beneficiaries.

2. Knowledge Transfer Programme

The Cross Cutting theme paper on the environment identifies that the environment is our key asset. It recognises the valuable role that the industry has in the future management of the environment and sustainable use of resources and also that sound environmental management is borne out of good business management. Environmental messages should be integrated into every element of the Farming Connect programme with an emphasis on wise use of natural resources as an essential and integral part of good business management.

The Climate Change Cross Cutting theme paper identifies that the Farming Connect Programme should aim to encourage farmers to adopt practices that will lead to reduced GHG emissions and, in the medium to longer term, raise awareness of the opportunities and risks posed by a changing climate. Many practices, it is identified, can also enhance the profitability of the business, for example, efficiencies in farming production through more efficient livestock husbandry will achieve reduced levels of GHG (mainly CH_4) per unit product (e.g. litre of milk or kg of beef / lamb) and managing the use of nitrogen fertiliser and slurry/manure will also reduce the levels of GHG emissions.

Climate change is an overarching theme for the Knowledge Transfer Programme and the programme is appraised at the development stage to ensure that appropriate opportunities for action on climate change are highlighted at all Farming Connect events.

Annex 1 summarises the knowledge transfer programme activity on Environmental and Climate Change cross cutting themes and their relation to Welsh Government objectives during the period 1st September 2011-31st January 2014.

Digital media and the Farming Connect website provide the opportunity for Knowledge Transfer; short podcasts are filmed at events and are promoted via Gwlad online and mail chimp email campaigns. Farming Connect have also worked in conjunction with Natural Resources Wales to provide an online soil temperature map coupled with written technical articles to provide information the timely use of resources such as fertilizers. This resource attracted 3000 unique page views between February and October 2013.

CASE STUDY – 'Improving water quality together' – The Olway Catchment project (Knowledge Transfer)

RIVER OLWAY CATCHEMENT AREA

Simple, cost-effective improvements can often be sufficient to enable livestock farms to comply with pollution regulations designed to protect Wales' watercourses. At Great House Farm, near Usk, beef producer Peter Williams had examined options for dealing with dirty water run-off and these included potentially building a £25,000 slurry store.

But, following guidance from Farming Connect, Mr Williams is implementing a series of alternatives costing less than £7,000 in order to satisfy pollution prevention legislation. Great House Farm is one of a number of farms that fall within the River Olway Catchment Area. Sampling by Natural Resources Wales had shown that the river is failing to meet Water Framework Directive requirements. Through Mr Williams' work as a Farming Connect Demonstration Farm, he underwent a mock assessment focussing on the Silage Slurry and Agricultural Fuel Oil Regulations and this highlighted a series of potential areas of improvement relating to dirty water run-off.

He has since worked with Keith Owen, senior buildings and environmental consultant at ADAS to look at ways of addressing these issues resulting in Mr Owen producing a detailed report advising on what could be done to prevent dirty water run-off. "Peter was initially looking at creating a new slurry store but his isn't a slurry problem, and the key issue relates to the management of dirty water. That is the case for a lot of farms and if Peter had built a lagoon it would simply have collected contaminated rainwater which would then have had to be disposed of at considerable cost and effort. Because Peter has no existing slurry storage facilities he would have needed to create a store with a minimum of four months capacity to comply with the SSAFO regulations,'' Mr Owen explained.

Improvements at Great House Farm include creating a concrete 'lip' as a barrier to prevent seepage from loose cattle housing onto the farm yard. "Any contaminated seepage onto a clean yard is regarded as pollution, the amount might be negligible but during a SSAFO visit it is something that will be picked up. "Something simple like creating a concrete lip which costs as little as £20 will resolve the issue of containing any contaminated liquid within the stock housing preventing any leaking onto clean yards.' Mr Williams will also improve the collection of effluent from the silage clamp, keep stock undercover at housing and divert rainwater falling onto shed roofs to prevent it mixing with animal waste.

Other farmers in the area have visited Great House farm to see the work that Mr Williams is undertaking and have also received one hour of confidential free advice on their own farms through Farming Connect Clinic. Owen urged farmers to confront any potential issues on their farms. "There are farmers who bury their heads in the sand and hope that the problem will go away but it won't.

A lot of it is simply separating clean water from dirty water.'' He said it was better for farmers to be in a position where they are proactive rather the face potential enforcement action from NRW. "Many farmers are too afraid to face the problem because they only see a big bill for an expensive new slurry store but in reality it can mean just a few simple improvements that will save them a lot of expense and worry,'' said Mr Owen.

3. Industry Development

Activities under the Industry Development programme addressing the environment and climate change have included Glastir Drop in Sessions and Glastir on farm events. Diversification seminars with a particular focus on renewable energy have been held as well as one to one Planning Surgeries, providing advice on regulations relating to slurry storage, roofing for slurry pits and waste management and potential renewable energy projects. Please see Annex 2 for further information on events.

4. Whole Farm Plan, Farm Advisory Service & Skills Development Programme

4.1 Whole Farm Plan

The Whole Farm Plan provides one-to-one mentoring on a range of options designed to support agricultural and forestry businesses grow and develop including:

- environmental protection and enhancement
- Alternative energy and energy conservation – improving profitability
- Maximise returns within sustainable farming systems
- Woodland management – making better use of woodland

Table 1 below shows the Whole Farm Plan applications made between 1st September 2011 and 31st January 2014:

Total number of application forms approved for WFP	2383
Total number of days approved for WFP	7013
Number of application forms approved for Alternative Energy+ Diversification	155
Percentage of WFP applications that were for Alternative Energy+ Diversification	7%
Number of application forms approved for Environment	853
Percentage of WFP applications that were for Environment application approved	36%

4.2 Farm Advisory Service

The Farm Advisory Service (FAS) offers one-to-one, confidential, on-farm advice. It is flexible and can be tailored to the needs of the farm. The aim of the service is to allow farm and forestry holders to improve the sustainable management of their holdings in relation to Statutory Management Requirements (SMRs) and Good Agricultural and Environmental Conditions (GAECs). Examples of advice include:

Land management

- Nutrient Management Plans (including soil analysis)
- Managing soil – compaction, erosion, structure
- Avoiding either under or over grazing

Environmental protection

- Advice on Nitrate Vulnerable Zone (NVZ) Regulations
- Managing slurry and silage facilities on farm
- Clean/dirty water separation
- Management of farm chemicals, sheep dip, crop sprays, disinfectants

Table 2 below shows the number of Farm Advisory Service applications made between 1st of September 2011 and 31st January 2014 for the Land Management, Environmental Protection and Environmental Management categories:

Total Number of Approvals for Land Management FAS[1]	983
Percentage of FAS approvals that were for Land Management	92%
Total Number of Environmental Protection applications for FAS	95
Percentage of FAS applications that were for Environmental Protection	9%
Total Number of Environmental Management applications for FAS	140
Percentage of FAS applications that were for Environmental Management	13%

4.3 Skills Development Programme

The Skills Development Programme provides 80% funding to farmers towards short accredited courses, a number of these courses address environmental and climate change topics and issues, and these include:

- Pesticide / crop spraying
- FACTS/ BASIS
- Mole and Pest Control
- Dry – stone walling
- Fencing
- Hedge-laying
- Coppicing
- Woodland management

CASE STUDY - Nutrient Management Planning under the Farm Advisory Service (FAS)

Soil analysis proves a sound investment

Garnedd Hir, Golan, Garndolbenmaen is a livestock farm of 80 acres with 300 acres of rented unimproved mountain pasture, which rises to around 500 ft overlooking the bay at Porthmadog. Farmer Glyn Williams and his son Alan have a Welsh black suckler herd put to Charolais as well as a flock of 300 sheep. The farm entered Glastir at the start of 2014.

Glyn Williams had always tried to be on top of his grassland management. He was spreading his own manure and feeding a phosphate-based artificial fertiliser but wondered whether he might be neglecting lime. He decided to seek advice from Elliw Evans, his Farming Connect regional co-ordinator, which resulted in him applying for technical advice through Farming Connect's Farm Advisory Service. Approved mentor David Peers of ADAS was called in to investigate and advise on a nutrient management programme.

Mr Peers said: "Mr Williams is a good farmer but he was concerned that grassland productivity was not as good as he hoped. Our soil analysis showed very low levels of Ph. A lot of grasses and clovers were struggling with a Ph as low as 5.2 while the phosphate content was above target levels."

Mr Williams was advised that he could save money by cutting back completely on phosphate, which would have the added benefit of reducing pollution from surface waters. Cutting back had benefits for both the farm and the environment.

The focus then turned to manure produced from the cattle and how best to maximise its nutrient and monetary value and where best to apply it.

"This was a very worthwhile exercise. It was an expense to have to lime the whole farm, but that meant everything else fell into place. The nutrient from the manure could work more efficiently and I can save money by not needing to buy in phosphate fertilizer." Said Mr Williams.

5. Agrisgôp

Agrisgôp is a management development programme for farming families. It brings together individuals and families at a local level to discuss and take forward business ideas. Working together as a group, Agrisgôp members can learn new management skills, access specialist information and explore and develop viable futures for themselves, their families and their businesses. Based on the concept of Action Learning, Agrisgôp provides the opportunity to progress skills and confidence, which will in turn assist group members to identify ideas and opportunities for their businesses. Agrisgôp was responsible for bringing together the Cambrian Mountains Lamb group.

Many Agrisgôp groups are considering renewable energy options including wind, solar and anaerobic digesters as means of carbon footprint reduction and increasing incomes. A group in mid Wales are specifically considering the reduction of the greenhouse effect through evaluating their business's carbon footprint. One pan Wales Agrisgôp group with strong ties to the Wildlife Trust organisation is exploring marketing opportunities linked to sustainable farming systems.

Agrisgôp Case Study - New income from renewable energy investment

Renewable energy from wind and solar power is the focus of a group of eight young farmers from the Denbigh area. Four are milk producers and four are beef and sheep farmers but all shared the same concern – rapidly rising energy bills that hit their businesses in 2011 for a total of more than £50,000 a year. With help from Farming Connect they formed themselves into an Agrisgôp group that met regularly – sometimes every fortnight – to look into the possibilities of diversifying by producing electricity from renewable.

They shared knowledge and experience and investigated the Feed In Tariff scheme that ensures a steady income from renewable. A renewable expert and a specialist planning consultant visited each farm and produced a site survey that explored the potential for investments that would cut costs and provide an alternative source of income.

Met Office wind reports purchased for each site showed that wind generation was not feasible in some locations, but there was the potential for electricity generation from solar panels or anaerobic digesters. A special finance day helped to secure the necessary funds.

The outcome has been impressive. Meilir Jones, who farms 260 acres with his father Dei at Farming Connect demonstration farm Gop in Trelawnyd is already producing electricity from a 35 kilowatt array of solar panels. Over at Maes Tyddyn, in Clawddnewydd, Ruthin, beef and sheep farmer Gwion Owen has a wind turbine up and running, and dairy farmer Aled Morris also has a wind turbine at Marian Mawr, Cwm,Rhuddlan. For a total outlay of £1,275,000 the group has secured an income totalling no less than £230,000 a year - guaranteed for 20 years.

And further investment is planned. One of the group members is looking into installing another 150KW of solar panels and another is looking at options for an anaerobic digester.

Local Agrisgôp leader Elaine Rees said, "It's been a sizeable investment but it has improved profitability and safeguarded energy costs for each business as well as reducing the carbon footprint and helping meet Welsh Government renewable targets."

6. Environmental and Climate Change – future activity

Future activity will include continuing with the provision of advice for farmers under the Whole Farm Plan and Farm Advisory Service, as well as funding towards Skills Development and training. Thorough Environmental Reviews are currently being undertaken on all Demonstration Farms, the aim of the reviews is to provide confidential, one to one advice and guidance to Farming Connect Demonstration Farmers on environmental management in line with regulatory cross compliance – this includes FYM/Slurry storage, silage, clean-dirty water, fuel oil etc. The reviews also provide the opportunity for the identification of projects that promote best practice and that emphasise to farmers the business benefits of good regulatory compliance which will be featured at future events.

In 2014, we are hoping to be able to provide practical information to farmers on the business benefits of good regulatory compliance. The aim is to provide practical information to farmers on an aspect of environmental management, for example, the construction and compliance of slurry and silage storage systems, clean/dirty water separation etc.

A number of activities, including discussion groups and on farm events will address climate change and discuss the suitability and feasibility of renewable energy. These events will provide information and develop knowledge on renewable energy technology.

A series of six events will be arranged on bio-mass boilers to raise awareness and develop knowledge on biomass boilers as an opportunity for farming businesses with high energy usage to include provision of technical and economic feasibility information. In addition to this we plan to hold a series of three events on Buildings and yards providing guidance on SAFFO regulations and how to design building and yards in order to optimise performance.

Workshops which aim to raise awareness and develop knowledge of the economic benefits of adopting a targeted approach to fertilizer use and managing the use of nitrogen fertilizer and slurry/manure to reduce levels of GHG emissions and have taken place across Wales in early 2013 and will be repeated with new farmer groups in 2014.

Good soil management which is key to profiting from fertilisers, manures and new leys will also be included in event planning in 2014. Events promoting the benefits of grassland based farming systems through reseeding and sward renovation, the utilisation of new varieties, control of weeds and use of clovers for more efficient livestock production and effective nutrient management will be included in the programme for 2014.

The optimum utilisation of grassland has never been more important with the cost of purchased feed and fertiliser higher than ever. The aim is to promote the benefits of grassland based farming systems and efficient use of grass to improve profitability and increase sustainability.

In addition events and activities to enable farmers to reduce their reliance on brought in feeds and to provide information and develop knowledge on topics such as silage management to reduce dry matter losses/improving silage yield and making the silage nutritive value for the stock fed to increase profit and improve efficiency and growing and feeding home-grown crops including establishing and utilising forage crops, cropping to reduce winter feed costs and highlighting the benefits which include extending feeding supplies, reducing overall feeding costs and meeting environmental targets.

We will continue to provide advice on farm woodland as part of demonstration farm events in order to attract a wider audience.

Annex 1 Summary of the knowledge transfer programme activity on Environmental and Climate Change cross cutting themes and there relation to Welsh Government objectives during the period 1st September 2011-31st January 2014.

Welsh Government Objectives	Knowledge Transfer activity type and count (Please see annex 1 for key)																Total number of KT activities	Examples of activity
	CF	OD	DG	WS	FE	FW	ST	FEC	BC	AA	MM	CL	PD	SH	FS	TA		
Wise use of natural resources is an essential and integral part of good business management		5	15	22	3		1						2		3	16	68	1. Soils Workshops (Workshops) 2. The benefits of Nutrient Management Planning (Discussion Groups) 3. Soil, muck and money (Farm events) **In addition** Nutrient Management Plans have been carried out on all demonstration farms
Increasing the arable/alternative forage crops to improve sustainability with less reliance on bought in feeds The development of an organic arable sector		10	12		5	3			1			2	2		7	6	48	1. Crop Focus - the benefits of growing alternative forages (Demonstration Farm Open day) 2. Growing crops in marginal areas (Technical article) 3. Home grown feeds clinic – (Clinic)
Efficient use of grass to improve profitability and increase sustainability Management of grassland as a carbon store		17	50		3	20	1		2		2	12	4		7	18	136	1. Rotational Grazing Study tour to France (Study Tour) 2. Grassland management and utilisation (Discussion group) 3. Mileage in silage bulletins (Technical articles)
Renewable energy options including anaerobic digestion Increased implementation of			16		4	2					1	8	3	1	2	2	39	1. Anaerobic Digestion (Farm event) 2. Wind Turbines for farms (Factsheet)

alternative energy																		3. Renewable energy clinic (Clinics)
Soil carbon management Improved soil management Adoption of soil practices that protect and enhance the carbon store **see environment and climate change above**		6	15		4	1					1	8	2		2	5	44	1. Getting soils ready for spring - visual indicators of soil health (technical article) 2. Soil Management and the IBERS PROSOILS project (Discussion group meeting) 3. Nutrient management and soil compaction issues (Demonstration Farm open day)
Expand horticulture production by encouraging others in the agricultural industry to see horticulture as an opportunity		2	12	1	1	1							2		4	2	25	1. Soil Analysis Workshop for horticulture (workshop) 2. Field-scale fruit and fruit tree production in Wales (Demonstration Farm Open day) 3. Protected cropping in horticulture (Factsheet)
Reduced energy use Reduced energy use and improved energy efficiency																1	1	1. Tractor Fuel Efficiency (Technical article)
Increased clover use to reduce fertiliser use			9	1													10	1. The case for clover (Discussion group meeting) 2. The case for clover and sulphur workshop results (workshop)
Organic Production The development of an organic horticulture sector			3														3	Future of Organic Production in Wales (Discussion group meetings)

Sustainable use of resources & Reducing environmental footprint			2	1								3					6	1. Sustainable Intensification (Workshop) 2. Environmental clinic 3. Olway catchment project on farm event - Environmental regulations
Efficient use of inputs Improve efficiency of use of on-farm resources Increased water efficiency			2													1	3	1. Efficient Winter feeding (Technical article and Discussion group) 2. Demonstration Farm Project - 3. Energy efficiency in the dairy (Ifton Hill)
Increase woodland cover in Wales The management of woodland & trees more closely related to other land uses Increased woodland establishment and management Opportunities to develop woodland related enterprises		2	2		1								1				6	1. Farm woodland management (Discussion group) 2. Practical Orchard Management with Health and Safety (Demonstration Farm open day) 3. Practical orchard management (podcast)
High Sugar Grasses																1	1	7. The benefits of High Sugar Grasses (Technical Article)
Improved energy efficiency		1	1														2	8. Energy - Resource management (Demonstration Farm Open day) 9. Efficient use of energy and renewable energy sources (Discussion Group)

Key to Farming Connect Knowledge Transfer activity types

Key	Event title
CF	Conference
OD	Demonstration Farm Open Day
DG	Discussion Group
WS	Workshop
FE	Farm Event
FW	Farm Walk
ST	Study Tour
FEC	Farmer Enterprise Competition
BC	Business Clubs
AA	Agri Academy
MM	Merched y Maes
CL	Clinic
PD	Podcast
SH	Shows
FS	Factsheet
TA	Technical Article

Annex 2 Industry Development activity 1st September 2011 – 31 December 2014

Activity Type	Number	Description
Diversification Seminar with a focus on Renewable Energy	4	Allowing farmers to assess the viability and suitability of renewable energy projects on their farms
Planning Surgeries		One to one sessions with a planning consultant - advice on planning regulations relating to slurry storage, roofing for slurry pits and waste management and potential renewable energy projects
Focus on Business events	6	These events included a presentation from a renewable energy consultant
Glastir Drop in sessions	48	One-to-one guidance was provided for farmers considering applying for Glastir Entry.
Glastir on farm events	17	Farm open days including a farm walk, demonstrating practical ways of undertaking sustainable land management options.

National Assembly of Wales, Environment & Sustainability Committee

Inquiry into Sustainable Land Management

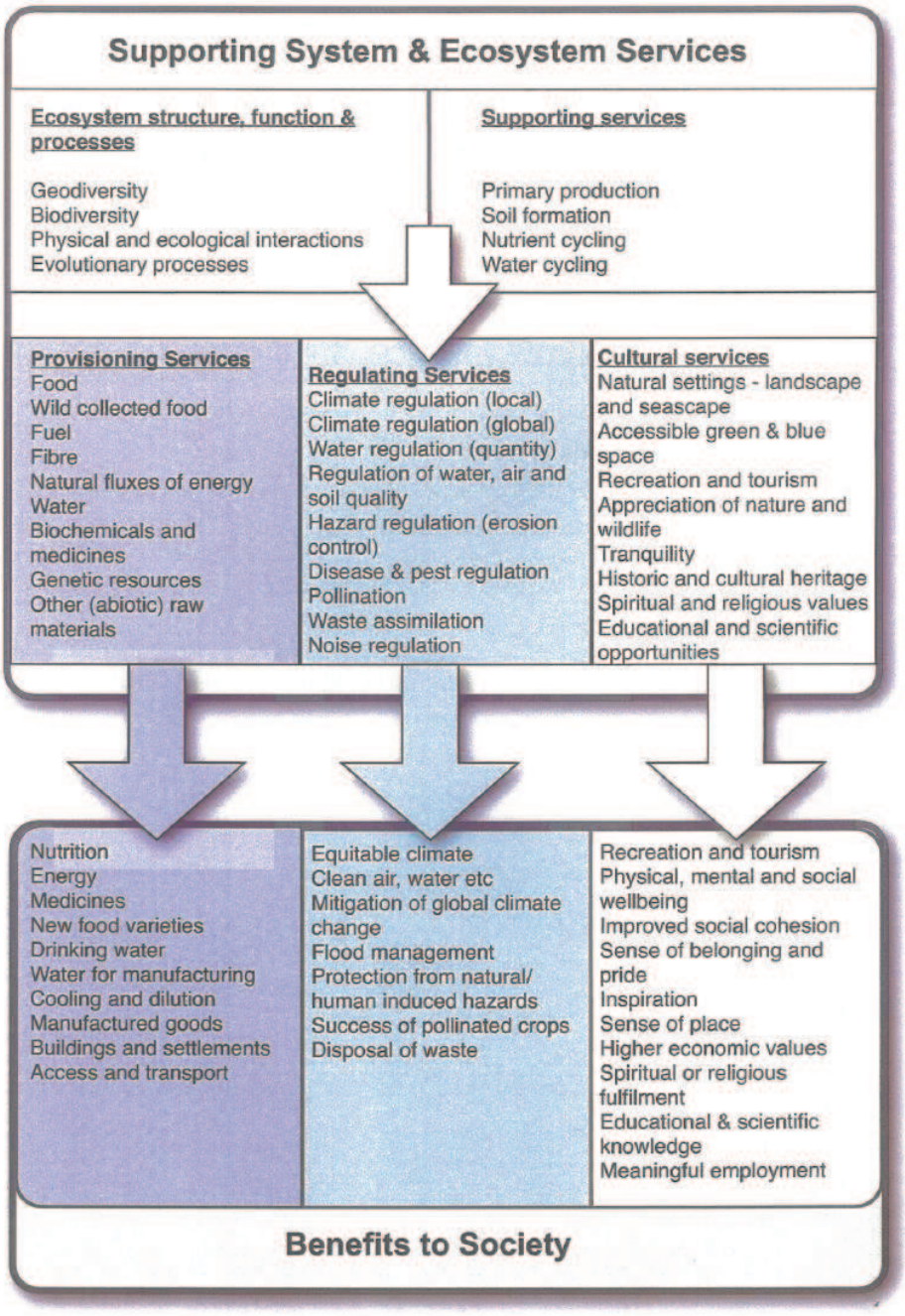
Evidence submission from Dr Shaun Russell

Dr Shaun Russell is Director of the Wales Environment Research Hub (WERH) a Welsh Government-sponsored unit with a science-into-policy remit, hosted at Bangor University (see Appendix 2). WERH is currently working on evidence provision in support of the Welsh Government's proposed Environment Bill and Biodiversity Strategy, and for the implementation of "integrated natural resource management" by the statutory environmental body – Natural Resources Wales. WERH collates existing published and non-published information and presents it to end users (predominantly government and academia) in a neutral and non-prejudicial manner. As this Inquiry seeks to contribute to the complex issue of the future wise management of land in Wales, it may have to take into account opinions and recommendations, as well as hard evidence and certainties. The views expressed here are therefore those of Dr Russell as a private citizen, and are not an "official position" of the Wales Environment Research Hub. **Dr Russell also wishes to acknowledge the advice of colleagues: Dr Tim Pagella (Bangor University) and Charles Falzon (Environmental Consultant) in preparing this submission.**

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

Some background on "ecosystem services" is given in Appendix 1. A functional and effective classification of the World's ecosystem services was adopted by the global "Millennium Ecosystem Assessment" (2005) and was followed in 2011 by the UK National Ecosystem Assessment (UK-NEA). Wales' statutory environment body - Natural Resources Wales - has adapted this classification for local relevance and use in Wales (Fig. 1). This scheme is adequate and can be adapted for different tasks and purposes (education, natural resources assessment, development planning and implementation). Some other examples of visual schemes for ecosystem services are shown in the accompanying document of supporting diagrammatic material.

Figure 1. Representation of Ecosystem Goods and Services prepared by Natural Resources Wales.



Natural Resources Wales uses the UK National Vegetation Classification and “Phase One” habitat survey as a basis for ecosystems (habitat) classification. The UK-NEA based its “Broad Habitats” on this system (Fig. 2).

Figure 2. Broad Habitats of the UK National Ecosystem Assessment

Natural Resources Wales has adapted this classification for use in Wales, by differentiating the marine habitat and allocating lowland heathland with grassland (Fig. 3).

Figure 3. Ten Broad Habitats for Wales

The 10 Broad Habitats for Wales			
Freshwater and wetlands	Urban	Marine Inter-tidal	Coastal Margins
		Marine Inshore	
		Marine Offshore	
Upland	Heathland and Grassland	Arable	Woodland

Ecosystems can occur at any scale and land management outcomes may be shaped by processes operating at different scales. All ecosystems that contribute to the livelihoods of people in Wales should therefore be considered in policy and decision-making, including ecosystems outside Wales where our demands are felt, e.g. food, fodder and fibre imports.

2. ***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.***

In Wales during the past 20 years, the UK-NEA estimated that 20% of habitat ecosystem services improved, while 49% deteriorated. Problem areas include marine fisheries, wild species diversity and some of the services provided by soils (Fig. 4). Examples of the kinds of "trade-offs" that we have made in Wales during the past century include the draining of peat moorlands for forestry, the conversion of most of our semi-natural grasslands to improved pasture, and the losses of sand dune areas to agricultural land, forestry, housing and tourism.

Figure 4. Poor land management can lead to soil loss and silting of water courses (B. Vaughn, NRW).

The UK-NEA (2011) provides a snapshot of status and trends in the condition of habitats and ecosystem services in the UK including Wales. Processes and sites relevant for sustainable land management in Wales are monitored by many organisations, e.g. NRW and the Centre for Ecology and Hydrology ("State sector"); RSPB and Local Records Centres (NGOs); Dwr Cymru/Welsh Water (private sector). Monitoring itself is monitored by the UK Environmental Observation Framework: http://www.ukeof.org.uk/ . Monitoring is still biased in favour of traditional targets such as species presence/absence or air/water quality for example. To provide baselines and robust trend data, there is a need to broaden the scope of measurement and monitoring of ecosystem services (e.g.

soil carbon and nutrient cycling). We especially need to map the ***flows*** of services from source to beneficiaries, if we are to inform wise choices and trade-offs for sustainable land management.

In measuring progress we will need to have defined objectives for sustainable land management, from which key indicators can be derived. We will need to continuously monitor the state of our ecosystems and their services against the state of human health and well-being. There is presently an over-reliance on traditional economic indicators of human progress and well-being. There needs to be more effort expended on monitoring human social and cultural variables, alongside environmental parameters. With one or two exceptions we have little expertise or capability in Wales for environmental economics, ecosystem services valuation and whole-cost environmental accounting.

Almost all natural resource management interventions are likely to change the balance of "winners" and "losers", but "losers" will always be present. Social equity will therefore continue to be an important issue for policy and decision-makers.

3. 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?

Over 75% of the land and sea area of Wales has some kind of environmental or conservation designation, reflecting the high value placed on its natural and cultural features by our citizens, and by the millions of visitors to Wales. There is therefore a need to think more broadly about what we mean by "productive" land management, when incentivising land managers to protect and enhance a full range of ecosystem services for their own viability and the greater social good.

Incentives should be provided at all levels. Examples include:

- Supra-State – e.g. European ERDF, ESF, Horizon 2020, Life+ and CAP/RDP "greening" funds
- State - e.g. the Welsh Government's "Nature Recovery" and "Ecosystem Resilience" Funds
- Private sector – e.g. Dwr Cymru/Welsh Water's "Water Framework Directive" fund
- NGOs and civil society – volunteering, "citizen science", membership and project funds. For example, the "Pont Bren" farm-based ecosystem services initiative in mid-Wales, and the Community Land Advisory Service Wales, both secured funding from the Heritage Lottery Fund:

http://www.pontbrenfarmers.co.uk/project_background.html

http://wl.communitylandadvice.org.uk/

A range of options for incentivising land managers to adopt more sustainable practices was tabled at the Wales Environment Research Hub's workshop on "Missing Markets for Ecosystem Services" in 2010: **http://www.werh.org/EcosystemServicesMissingMarketsWorkshop.php**

An overview of how this might work, with some policy adjustment in a Welsh context, was provided by Paul Sinnadurai of the Brecon Beacons National Park:

> *"A combination of larger landscape-based projects and smaller 'start up' projects. Rather than the Government purchasing ecosystem services (PES) from the farmer or other landowner, the smaller projects would be invited to bid for a smaller start up 'loan' through the agri-environment scheme, in order to incubate new land management-based enterprises in soil, water, renewable energy, woodland and biodiversity management, as a means of improving the farm's marque value of their food and livestock enterprises."*

http://www.werh.org/documents/Sinnadurai-Anewbusinessmodelfordeployingagri-environmentschemes.pdf

Snapshots of applied ecosystem services projects, including "Payment for Ecosystem Services" (PES) schemes across the UK, were provided at the European Conference on Ecosystems Management, co-sponsored by NRW in Bangor in October 2013: http://www.wisenetwork.org/eeac2013/

The presentation for England highlighted the Countryscape Ecosystem Approach Toolkit; the Local Environment and Economic Development Toolkit; Natural England's work on mapping ecosystem services; the Ecosystem Services Transfer Tool; the Upland Ecosystem Service pilot projects at Bassenthwaite, South Pennines and in the South West Uplands; and the Defra project on Place-based Payments for Ecosystem Services: http://www.wisenetwork.org/wise/wp-content/uploads/ESS-England_web.pdf

The presentation for Scotland highlighted the Scottish Strategic Research Programme (Ecosystems Theme) and flagged 20 ecosystems management projects across Scotland. Special attention was paid to the "Carse of Stirling" project and the Scottish Land Use Strategy Pilot Projects on carbon and climate change, recreation and tourism, and timber provision: http://www.wisenetwork.org/wise/wp-content/uploads/ESS-Scotland_web.pdf

The presentation for Wales by Dr Emyr Roberts, provided a background to Natural Resources Wales and flagged the following ecosystems management case studies: Anglesey & Llŷn fens; Berwyn & Migneint SACs; the Cambrian Mountains Initiative; the Pontbren project; Fish Map Mon; Larch in Wales; "Catchment Connectivity"; the Cwm Rhaiadr Forest, and the "Rainscape" and "First Milk" projects: http://www.wisenetwork.org/wise/wp-content/uploads/ESS-Wales_web.pdf

A promising methodology for applying PES to sustainable land management has been the "reverse auction" process. In the "River Fowey Improvement Auction" conducted in England, farmers bid progressively for ecosystem improvement funds from the South West Water company, for investment in items such as slurry stores and fencing, to improve water quality and so reduce the cost of drinking water treatment. This project was reported at the "Ecosystem Approach for Biodiversity and Human Well-being" workshop held in North Wales on 4-6 February, 2014:

http://www.werh.org/PlasTan%20Y%20Bwlch/2014/Plastanybwlch2014.php.en

The Wales Rural Observatory's study of "Farmers Decision Making" (2011), sounded-out farmer's responses to the idea of: "an integrated approach to the challenges of conservation, climate change adaptation and food security". It found that: "Small, niche businesses, with a strong local consumer base, were particularly resilient and seen as an important model in the move towards low carbon economies". It noted that: "A small grant scheme to support targeted conservation work on farms that are not appropriate for full inclusion in the Glastir agri-environment scheme, would provide an instrument for engaging more farmers with agri-environmental objectives".

The report's recommendations included:

- Encouragement for farmers to develop local markets for some of their produce
- A need to build local markets/outlets and increase support for branding products
- A need to bring back systems of planting, coppicing, use of local timber products, wood chipping and small scale hydro to feed into community systems
- Diversification into non-food products
- Small grants for field edge improvements, relocation of gates, separation of effluent/water run-off (sustainable drainage)
- More collective grant aiding, with insurance companies and water companies as potential sources of income.
- The handicaps that Welsh farmers face should be recognised and payments should reflect this.

Because of its geology, soils and climate, Wales can never be self-sufficient in food production at current population and consumption levels; we will always have to rely on imports. We should, however, be able to improve our import-export food balance and food chain efficiency, through a combination of efforts to lower consumption (with concomitant health and well-being benefits) and increases in production. During both World Wars arable production was doubled in Wales (Fig. 5), and "sustainable intensification" in the rural environment could provide similar benefits in the 21st Century. There is also great potential for "peri-urban" and "intra-urban" agriculture, aligned for example with recreation and biodiversity corridors in our urban landscapes. The expanding work of the Federation of City Farms and Community Gardens, and many other "allotments" organisations in the UK, are signs of interest and progress in this area.

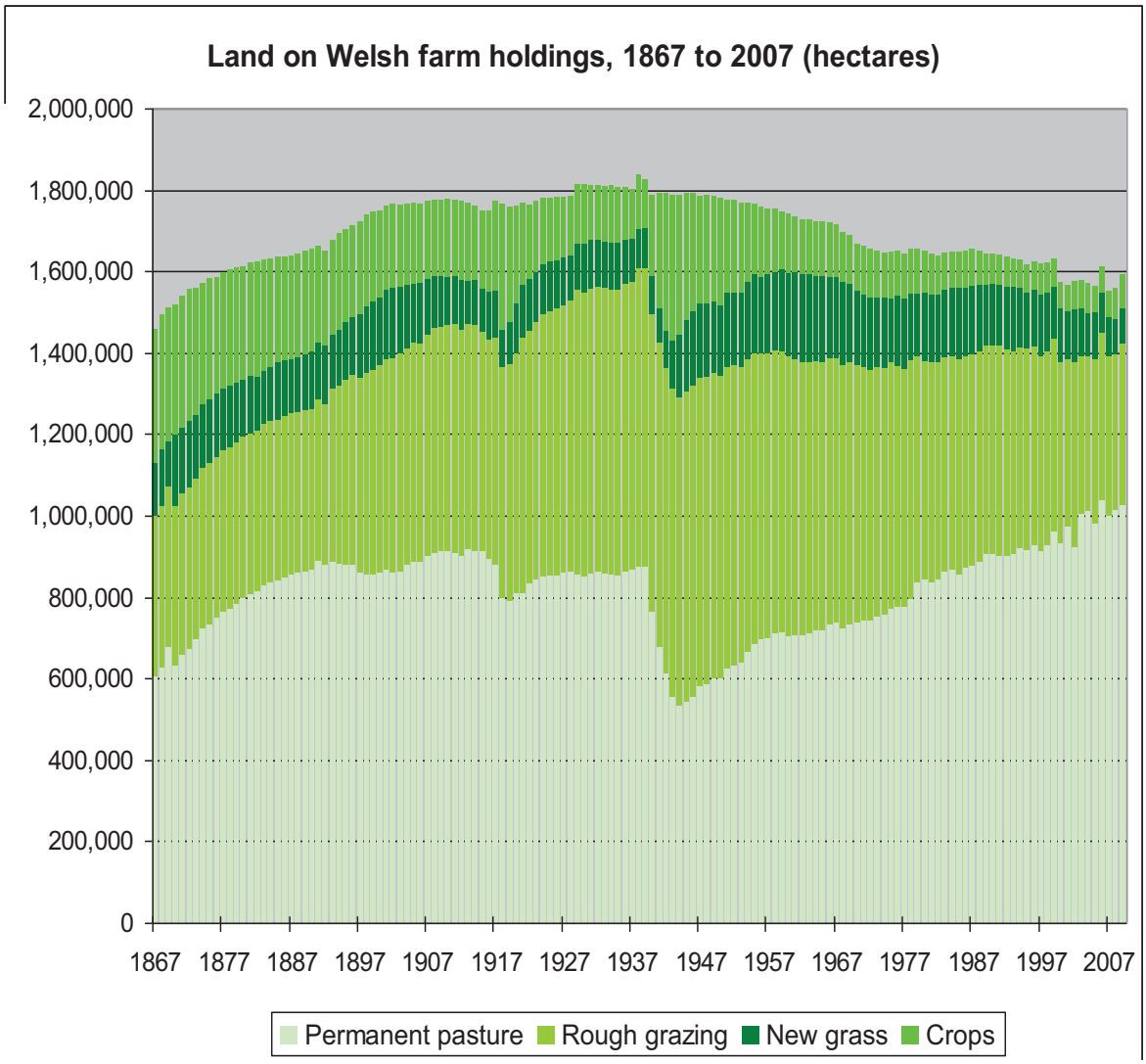


Figure 5. Land on Welsh farm holdings, 1867 to 2007 (hectares) – (Welsh Agricultural Survey, 2008)

Sustainable intensification was also favoured in the 2009 report of the Land Use and Climate Change sub-Group of the Climate Change Commission for Wales. Again, diversification of the rural economy was recommended, with expansion of horticultural and greenhouse crops, and renewable energy generation from small-scale hydro, wind, biomass, solar, photovoltaic and ground-source heat. A major programme of woodland planting was envisaged alongside: "extensive mixed farming systems, maximising resource efficiency from on-farm production of feedstuffs, and reduction of fertiliser inputs. This reduction of inputs would be balanced by reduced demand for animal products through a reduction in consumption, and reduction of waste in the food chain. Such systems are often associated with greatly enhanced local food chains, greater self-reliance, and are seen as increasing environmental and social sustainability over time". A controversial suggestion was fully housed, zero-grazing systems for stock animals, with methane capture to combat carbon emissions.

To mainstream and embed an ecosystem approach for sustainable land management in Wales will require: "a shift in ecological thinking that recognises the social as part of the ecosystem and the need for participatory approaches to identify and integrate 'traditional' human activities into conservation management". Ways and means of achieving this have been piloted using the Farming and Wildlife Advisory Group's "Integrated Local Delivery model (ILD) in Walmore, Gloucestershire. This rural initiative has similarities with the "community-led planning" approach familiar in urban environments.

A report on the ILD approach: “Inspiring and Enabling Local Communities: an integrated delivery model for Localism and the Environment” was prepared by the Countryside and Community Research Institute in 2010, and is also available through the Bangor European Ecosystems Management conference website: http://www.wisenetwork.org/wise/wp-content/uploads/Jenny-Phelps.pdf

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

Perhaps there need to be measurable criteria for “vibrancy” and viability of rural communities, e.g. numbers of jobs, schools, shops, clinics, pubs, post-offices, chapels, cultural events, community projects, visitors etc.

Support training to ensure that sustainability is built into agricultural curricula.

Encourage collaborative farming systems that support local communities through a range of products including energy and recreational access as well as food.

Support experiments in new and traditional crop production, including at small scale for local markets.

Support on-farm and local processing of primary products.

Use planning policies to promote synergies between producers and local community outlets

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

There are three scales at which decision making about ecosystem services provision are likely to be made:

Local scale - this is the scale at which ground level decisions about change in land use are made. The main actors at this scale are farmers, forest managers or other land users. It encompasses fields and farms up to a landscape scale of 10–1,000^2 km at which ecosystem services initially manifest (e.g. sub-catchments or habitat networks), and may be managed, through farmer co-operatives or other collectives covering a contiguous land area.

Regional scale - is defined as the scale between local and national. This is the scale at which many policy decisions relating to ecosystem services provision are currently made and is generally over 1,000 km2, but sub-national.

National scale - is defined as the scale at which strategic decisions about ecosystem services are made. This encompasses supra-national, transboundary contexts in some locations (e.g. some major lakes and protected area networks). Assessments at national scale tend to use aggregated national datasets, which are generally very coarse in their spatial resolution. But ultimately, policy needs to be delivered at all scales where decisions are made.

NRW's "Landmap" tool is a good starting point for natural resources mapping, but deserves far greater resourcing for development and enhancement in support of decision-making that will need to consider ecosystem service stocks and flows.

6. ***Are there key actions we can take to deliver short-term 'quick wins' and which actions should we be taking for the long-term?***

Although it may be administratively more challenging, promote links between local community as consumers and local farmers as producers.

Encourage a diversity of products.

Build on the work of the Cambrian Mountains and Pontbren initiatives.

Identify areas where ecological complexity can be reintroduced without impacting on farmer's livelihoods (at Pontbren for example, 120,000 trees were planted in 1000ha with no negative impacts on farming production).

Reduce the costs of farmers travelling to markets & selling direct - see the Farmers Markets in Wales website: http://www.fmiw.co.uk/

Consider the role of major supermarket chains in supporting or undermining local producers.

Use the planning system to discourage farm development that is disproportionate in scale to its environment in sensitive areas (e.g. "super-farms").

INQUIRY "KEY QUESTIONS"

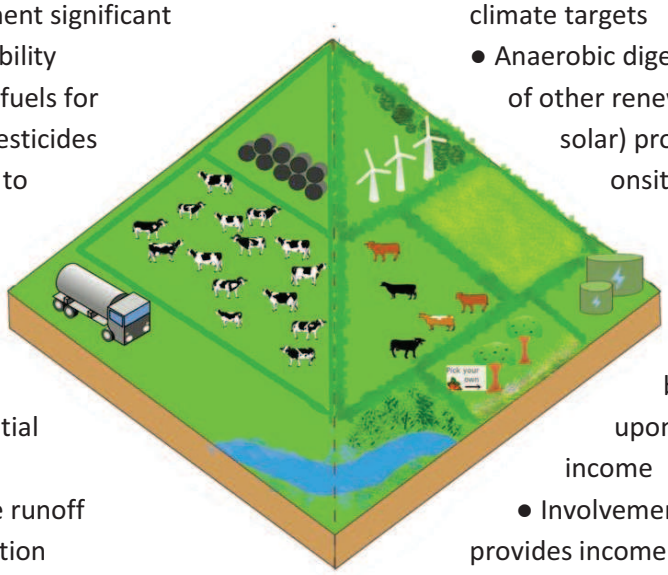
What do we want sustainable land management in Wales to look like?

A diagram illustrating some of the shifts in emphasis needed for sustainable land management, is presented in Fig. 6, from Northern Ireland Environment Link: http://www.nienvironmentlink.org/cmsfiles/policy-hub/files/documentation/Agri/Documents/AFSB-presentation-FEB-2013FINAL.pptx

Figure 6. A comparison of current and ecosystem services based approaches to farming in Northern Ireland.

Current farming approach:

- Specialisation – heavy influence upon livestock producing meat or milk
- Intensive agriculture, driven by subsidy conditions
- Single output leads to vulnerability to disease and market fluctuations
- CAP Single Farm payment significant determinant of farm viability
- Dependence on fossil fuels for energy, fertilisers and pesticides leaves farms vulnerable to price changes and security of supply
- Expensive management of animal wastes uses water and wastes potential energy and nutrients
- Phosphate and nitrate runoff contribute to river pollution



The ecosystems approach:

- Mixed farming – multiple outputs and goals
- Permanent pastureland acts as carbon store
- Crop rotation allows natural soil nutrient regeneration and reduces the need for pesticide application
- Use of land to store carbon helps to meet climate targets
- Anaerobic digestion of animal waste and use of other renewable energy sources (e.g. wind, solar) provides energy that can be used onsite or sold to the community
- Renewable generation provides energy, jobs and market drivers
- Alternative crops (e.g. biofuels, fruit) reduce reliance upon livestock as a single source of income
- Involvement in agri-environment schemes provides income to carry out environmentally beneficial practices including enhancement of archaeological and natural heritage sites
- Downstream flood risk minimised by river and flood plain management
- Rehabilitated hedgerows provide pollinators and natural pest control
- Income from providing access for recreation and tourism

What outcomes do we want to deliver in the short, medium and longer terms?

We need to fully reflect the true long term value of ecosystems and their services in decision making, i.e. maximising the benefits for people by looking at the whole range of environmental goods and services, while maintaining the integrity and functioning of ecosystems to avoid rapid and undesirable ecological change.

We should ensure a future where land and sea are managed for a "basket" of long-term benefits, rather than just one or two primary products with short-time horizons. We need a balance of nature conservation and "nature at work" providing for a greater diversity of business opportunities than under single-commodity subsidy regimes, while maintaining the resilience of nature to adapt to future threats such as climate change.

Application of the ecosystem approach could see a Wales with sustainable food and fibre production in the countryside, and with marine resources protected and harvested within viable limits at sea. More green space would improve the quality of life in towns, with ponds and reed beds balancing storm flow and providing sustainable drainage options. Further tree-planting would improve air quality along busy roads and provide a range of water, carbon and biodiversity benefits on valley sides. Diversified, renewable energy sources would be carefully sited on land and at sea, and "environmental mitigation measures" for road schemes would be designed for multiple ecosystem benefits. There would be no backsliding on protected landscapes and nature reserves, but progress towards building biodiversity and conservation enhancements across the entire landscape, through sympathetic planning regimes that balance attractive places to work with spaces for rest, recreation and enjoyment. This would, in turn make Wales a healthier and more desirable place to live, work, and visit, not least for the expanding tourism sector of the Welsh economy.

The ecosystem approach is a way to achieve a "Living Wales" that balances the needs of all sectors of society, while sustaining the underlying natural systems upon which we all depend for our survival. How successful the new approach turns out to be will depend on how willing we all are to engage with the concept and embrace its inclusive and long-term vision in our everyday lives.

Figure 7. Applying the ecosystem approach to land use.

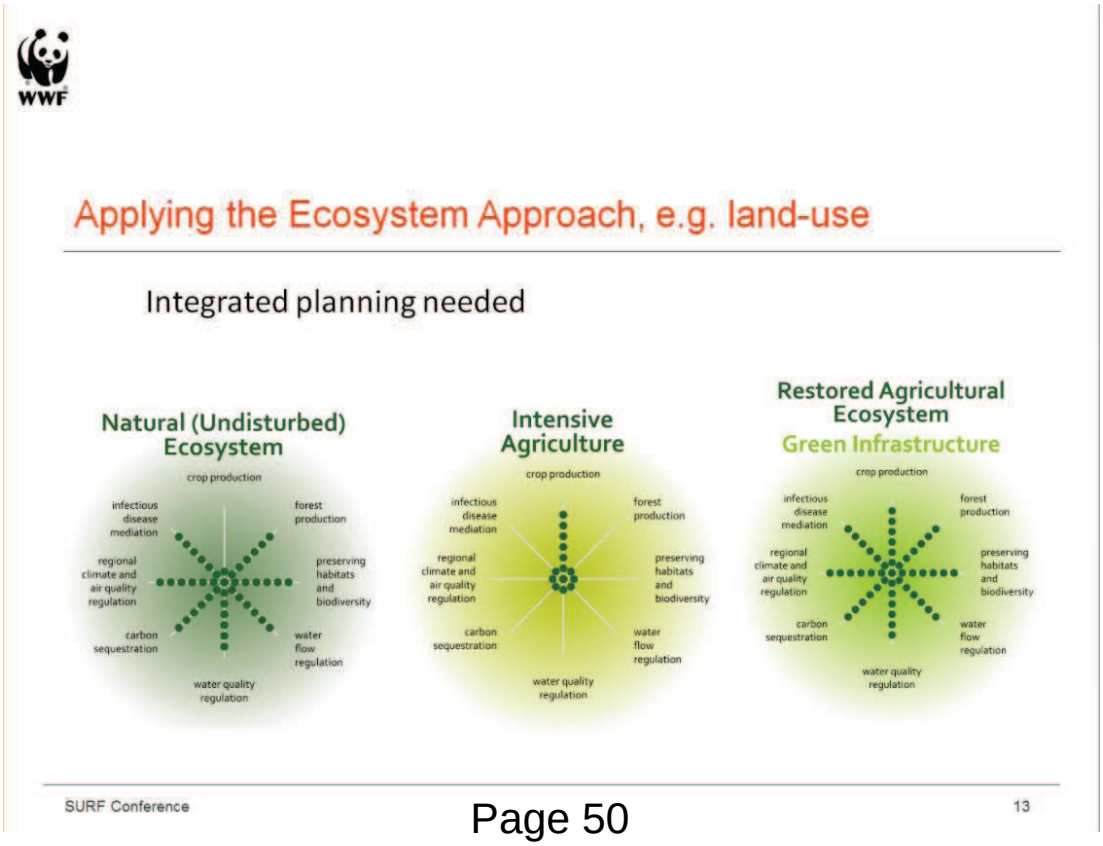
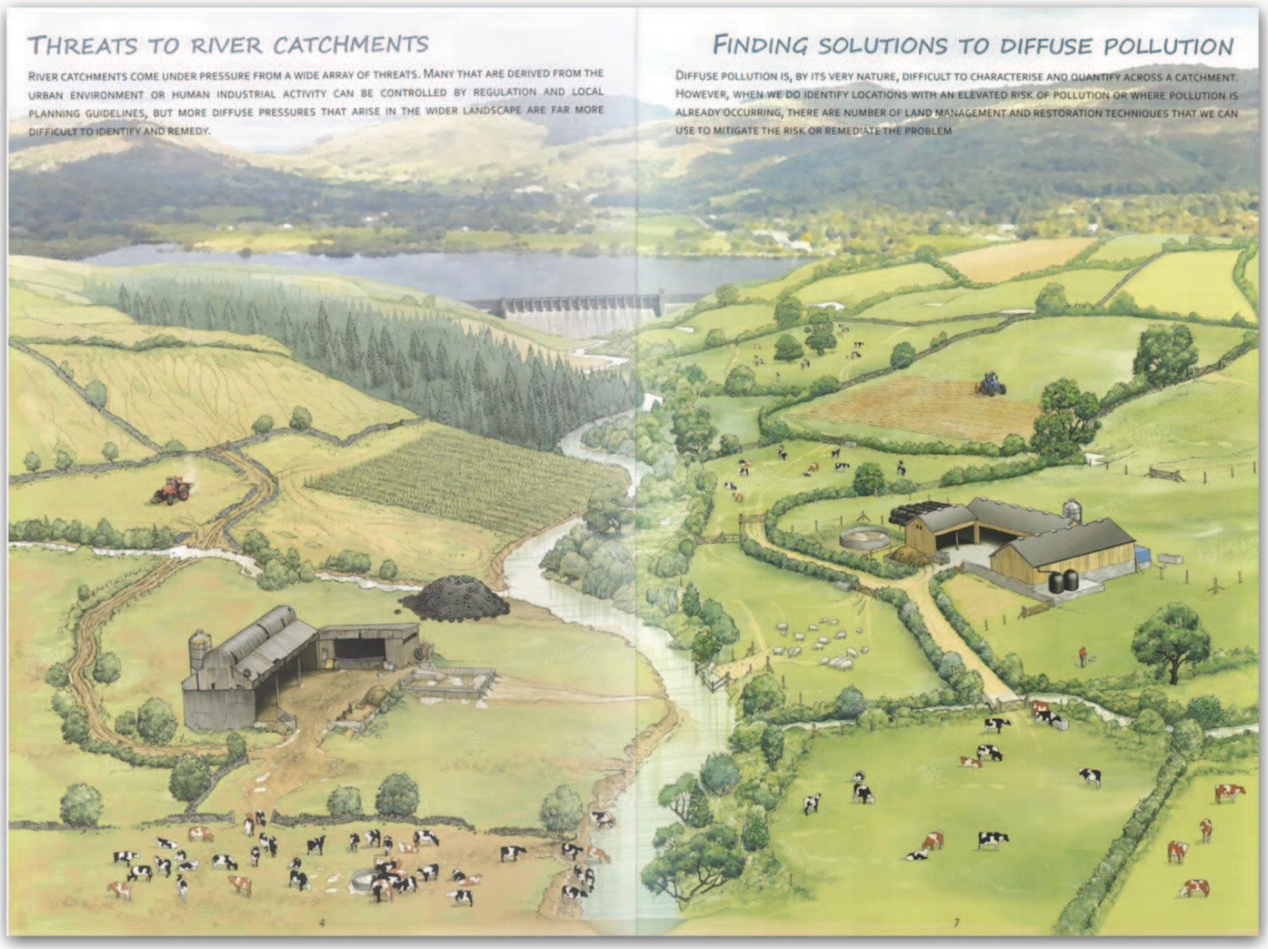


Figure 8. "Spot the difference". Ten damaging approaches to land management in the left-hand half of the illustration, and ten actions that enhance ecosystem services and sustainability to the right (West Country Rivers Trust).



What are the barriers preventing us from delivering these outcomes now?

Entrenched and outdated views, laws and regulations.

An enlightened view on the environmental/societal problems that we face, and means by which we can overcome them, was provided by Bangor University graduate Professor Jacquie McGlade (former Chief Executive of the European Environment Agency and now Senior Adviser to the United Nations Environment Programme) at the recent European Conference on Ecosystems Management: http://www.youtube.com/watch?v=rtXd2ccvMzw&list=PLnEOoLwKbaUMBh2Ub7-KwtUxJIrsgf279&index=4

Prof McGlade also co-authored the lead "Comment" article in the journal "Nature" on 16th January 2014, on alternatives to traditional GDP-based measures of human progress that have relevance for Wales, as a: "small, green country, leading by example on sustainable development" (Attachment).

How do we overcome these challenges?

The ecosystem approach means fully reflecting the true long term value of ecosystems and their services in decision making, i.e. maximising the benefits for people by looking at the whole range of environmental goods and services, while maintaining the integrity and functioning of ecosystems to avoid rapid and undesirable ecological change.

Education of policy-makers, their agents and wider society is required to embed the ecosystem approach.

Identify wellbeing requirements and assess current and future risks, while bringing this into the public sphere (through education and the media). Capitalise on debates around natural resource management issues such as flooding, to open up the debate

Rules will need to change. Two small examples:

1) More flexibility in applying the rules regarding planting of non-native tree species in Wales, so that fast-growing species may be employed for energy generation and bio-fuels, and for adaptation to environmental change.
2) Glastir agri-environment payments to be flexible and adaptable to specific farm and field-level needs.

What are the main policy drivers?

Direct drivers are those which directly impact on biodiversity and ecosystems, e.g. land use and climate change. Indirect drivers are those which influence the direct drivers of change, e.g. economic and population growth resulting in increased demands for food, fibre, water and energy (UK NEA 2011). The range and nature of drivers affecting the Welsh environment are numerous, and many are shared with other areas of the UK.

Direct drivers include:

- the impacts of global warming and the environmental consequences of climate change such as sea-level rise, changes in temperature and precipitation and extreme events such as storms, drought and floods, which may trigger irreversible changes of state in systems
- habitat destruction—direct physical loss due to land-use conversion by the plough, the axe and the bulldozer
- habitat degradation—due to neglect, overgrazing, fertiliser and pesticide use
- non-native species—alien introductions and invasives
- eutrophication—on land mainly due to fertilisers; more complex sources in fresh water and the sea

- air quality—e.g. particulates, nitrogen oxides, sulphur dioxide, etc
- wild harvesting—e.g. damage to marine fish stocks by overharvesting and by-catch effects
- toxic chemicals—pollutants and new substances with little-known effects, e.g. nanoparticles
- soil erosion and compaction.

Indirect drivers include:

- social and demographic change, e.g. population growth and movement, increased affluence and consumption
- national and supra-national policies, e.g. European agricultural subsidies
- competition for financial resources to support environmental initiatives.

Policy drivers in Wales include the full range of legislation (economic, social and environmental) that impacts on the ecosystems of Wales (European Directives, UK and Welsh government statutes, regulations and bye-laws, frameworks, strategies, “route-maps”, plans, guidance and advice notes).

How can these policy drivers be shaped to overcome these challenges?

By continuing work in international fora, in Europe and at Westminster, and on the floor of the Assembly, to re-align policy priorities towards true sustainability and through applying the ecosystem approach as a “policy gateway” and in policy impact assessment.

Appendix 1. Background on "Ecosystem Services".

We have become used to the words "environment" and "ecology" in our mainstream vocabulary, and we have started to see jargon words such as "biodiversity" (the wealth of life with which we share the planet) coming into regular use. Now the terms "ecosystem services" and the "ecosystem approach" are being heard more frequently, and the former Welsh Environment Minister John Griffiths stated his priority to implement the new "ecosystem approach" in communities across Wales. So what is the ecosystem approach and how might it affect the management of our landscapes and seas in Wales in the future?

"Ecosystems" are the webs of life found in habitats (fields, woodlands, rivers, beaches) and the non-living components of those habitats, such as soil, water, air and sunlight. Ecosystem services are the benefits that humans receive from these ecosystems, including goods such as food, water, fibre, biofuels and medicines, which are often valued and traded as commodities. Other benefits from nature are less obvious, but no less important, such as the cleansing of water supplies by filtration through soils, protection from flooding by sand dunes, marshes and woodlands, the creation and purification of the atmosphere by plankton and vegetation, the locking-up of carbon in peatlands, grasslands and forests, and the pollination of food crops by insects.

These so-called "regulating services" keep the Earth's whole ecosystem functioning, but they rely on even more fundamental supporting processes including the cycles of water, carbon and nitrogen. Many scientists also regard biodiversity as a supporting service, as it underpins most if not all other ecosystem services.

Nature also provides a range of cultural benefits for humans, such as spiritual upliftment and aesthetic pleasure, and the health and educational benefits of leisure, recreation and tourism.

We now know that much human progress has come at the expense of damage to our ecosystems. We have been using up our store of "natural capital" faster than the Earth can replace it, partly due to our view of many natural resources as "free goods" with no direct monetary value. Recently, efforts have been made to assess the damage we have caused to ecosystems and to place a value on the natural assets that we have left. The UN-sponsored "Millennium Ecosystem Assessment" estimated that 60% of the Worlds' ecosystems were in a damaged or declining state. The UK Government has sponsored a more detailed "National Ecosystem Assessment" (NEA), which reported in 2011 that about 20% of the services delivered by the UK's main ecosystems were improving, 50% were in neutral condition and 30% were declining.

In Wales during the past 20 years, the NEA estimated that 20% of habitat ecosystem services improved, 31% showed no net change and 49% deteriorated. Problem areas include marine fisheries, wild species diversity and some of the services provided by soils. Examples of the kinds of "trade-offs" that we have made in Wales during the past century include the draining of peat moorlands for forestry, the conversion of most of our semi-natural grasslands to improved pasture, and the losses of sand dune areas to agricultural land, forestry, housing and tourism.

Would we make the same decisions if we had a better understanding of the full value and range of benefits that we receive from ecosystems? The annual value of the World's ecosystem services used as "free goods" by society is estimated at double the level of global GDP. The damage to ecosystems and biodiversity is costing the global economy trillions of dollars annually, and in the UK our habitats and ecosystem services are worth billions of pounds every year to the economy. In Wales, the environment has been estimated to

contribute £8.8 billion annually to the Welsh economy, a figure that would be much higher if the full range of values of ecosystem services to Welsh society were included. Studies are now underway in Wales and internationally, to estimate the "true environmental costs" of human development and progress.

The "Living Wales" Green Paper proposed the adoption of an "ecosystem approach" in Wales. Put simply it means fully reflecting the true long term value of ecosystems and their services in decision making, i.e. maximising the benefits for people by looking at the whole range of environmental goods and services, while maintaining the integrity and functioning of ecosystems to avoid rapid and undesirable ecological change.

Through its "Living Wales" programme, the Welsh Government intends to develop a clear set of national priorities, including institutional and regulatory changes, and to drive a system of integrated local delivery mechanisms for the management of our natural resources. Changes are already afoot to simplify regulatory regimes in Wales and a Single Environment Body "Natural Resources Wales" has been created to undertake this work. A series of pilot projects will test how the ecosystem approach will work and how to balance priorities around issues such as water quality, water resources, biodiversity, planning and development.

Appendix 2. Wales Environment Research Hub (WERH)

WERH is a science-into-policy evidence-gathering unit, funded by the Welsh Government and hosted by Bangor University and the Centre for Ecology and Hydrology in Bangor. Its Steering Board is composed of representatives from those organisations and Natural Resources Wales. At present, WERH has two members of staff (a Director and an Administrator) and is currently recruiting a science communications officer. WERH organises workshops and conferences to bring scientists and policy makers together to share the latest information on environment and sustainability issues in Wales. WERH also carries out briefings and reviews on policy-relevant environmental topics. WERH was established in 2007 and initially worked to the themes of the Welsh Government's 2006 Environment Strategy (climate change; sustainable resource use; distinctive biodiversity, landscapes and seascapes; local environmental quality and environmental hazards). It was therefore not encouraged to work in the area of land management (which came under the separate Department of Rural Affairs) or duplicate the effort of the Wales Rural Observatory. WERH's recent work has focussed on ecosystem services, integrated land management, climate change and environmental monitoring.

The Director of WERH - Dr Shaun Russell - has a background in training and research in the environmental sciences, including biodiversity conservation, protected area management, environmental impact assessment and responsible tourism. After an early career spent in Africa, he worked for the British Antarctic Survey, the British Council, the Durrell Institute of Conservation and Ecology at the University of Kent, the International Centre for Protected Landscapes at Aberystwyth University and the Centre for Arid Zone Studies at Bangor University. He has been the Director of the Wales Environment Research Hub since the unit was established in 2007.

Ecosystem Services (benefits to humans from nature)

Supporting services

- soil formation
- nutrient cycling
- water cycling
- primary production

Regulating services

- climate
- hazard control (flood/erosion)
- pests & disease
- pollination
- pollution (noise/toxic)
- air/soil/water quality

Raluca Dan, WWF Rumania

Provisioning services

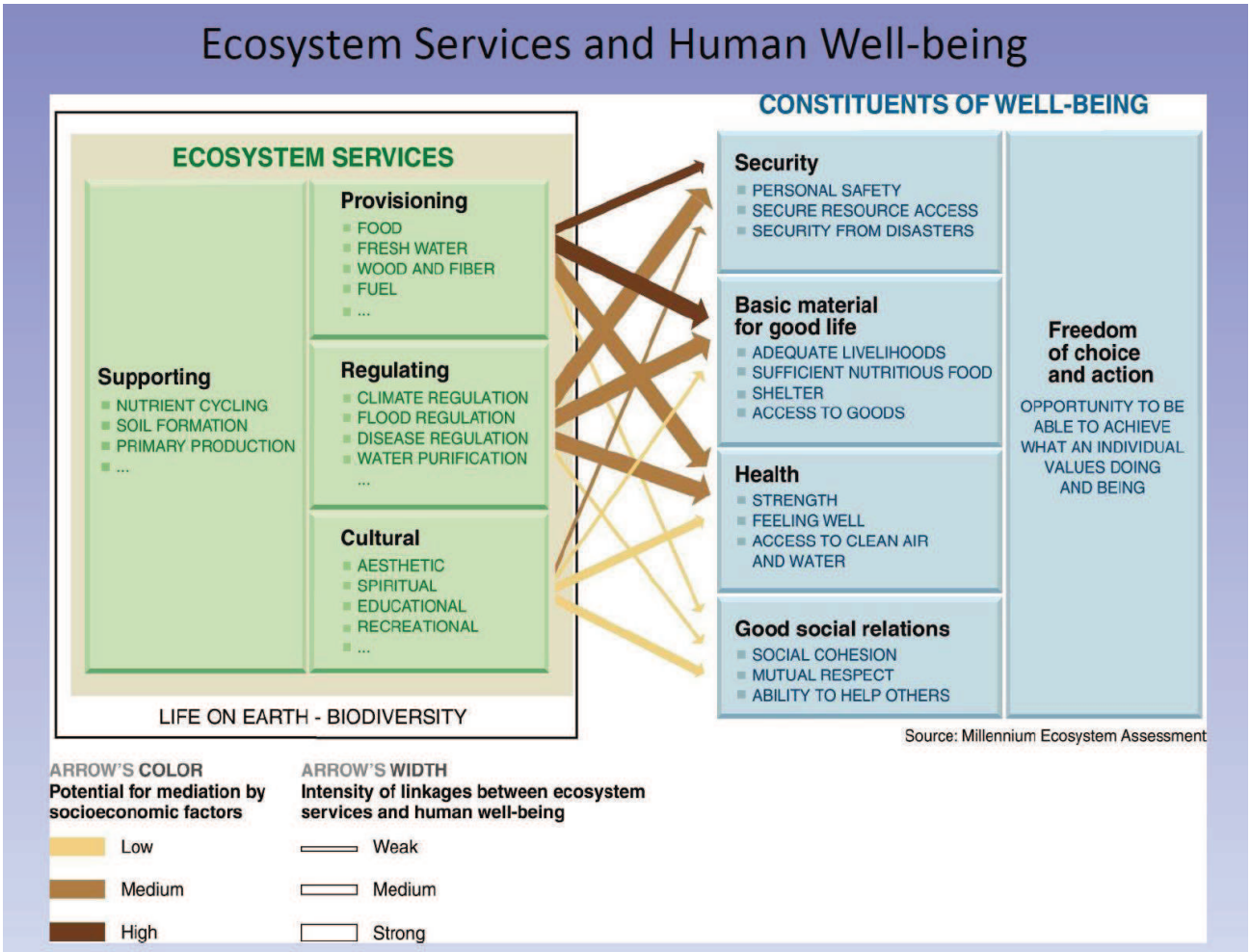
- food
- fibre
- fuel
- bio-materials
- water

Cultural services

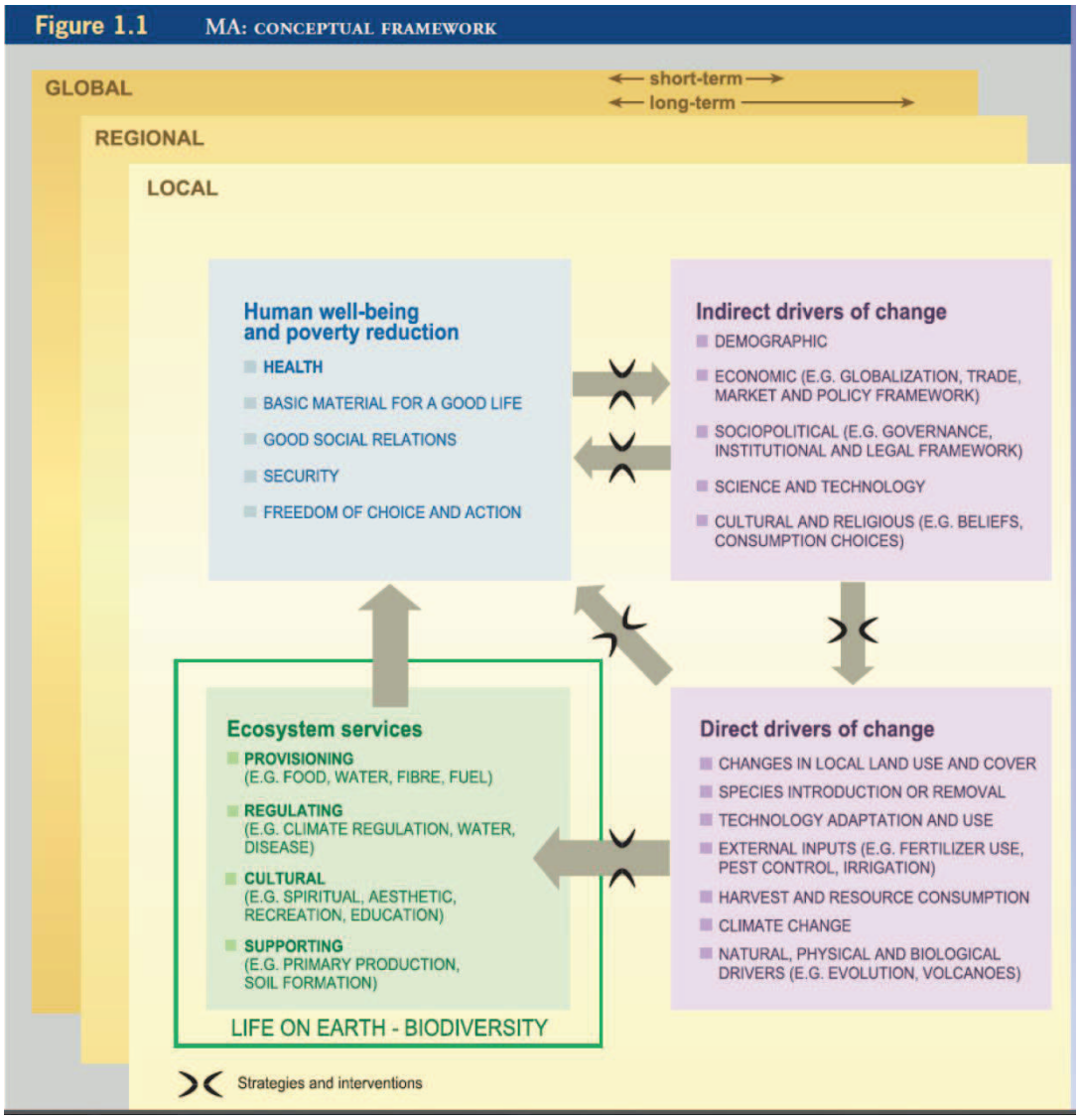
- aesthetic
- cultural heritage/ sense of place
- education
- health
- recreation
- spiritual/religious
- tourism

UK National Ecosystem Assessment

Ecosystem Services listing (UK National Ecosystem Assessment) and diagram (WWF).



Relationships between ecosystem services and human health and wellbeing (from the Millennium Ecosystem Assessment)



Relationships between ecosystem services, human wellbeing and drivers of change (Millennium Ecosystem Assessment).

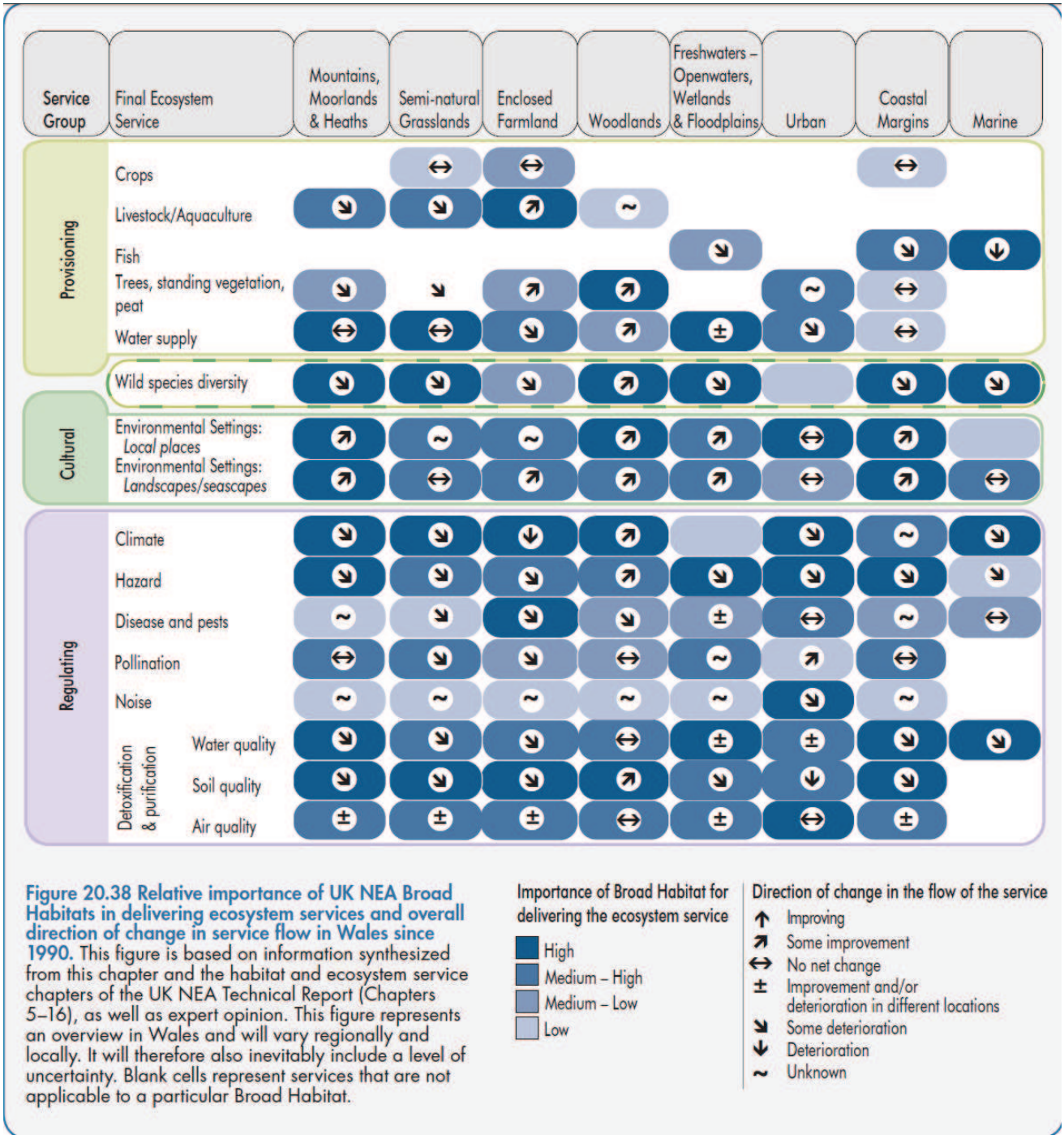


Figure 20.38 Relative importance of UK NEA Broad Habitats in delivering ecosystem services and overall direction of change in service flow in Wales since 1990. This figure is based on information synthesized from this chapter and the habitat and ecosystem service chapters of the UK NEA Technical Report (Chapters 5–16), as well as expert opinion. This figure represents an overview in Wales and will vary regionally and locally. It will therefore also inevitably include a level of uncertainty. Blank cells represent services that are not applicable to a particular Broad Habitat.

Status of ecosystem services in Wales (from UK National Ecosystem Assessment, Chapter 20).

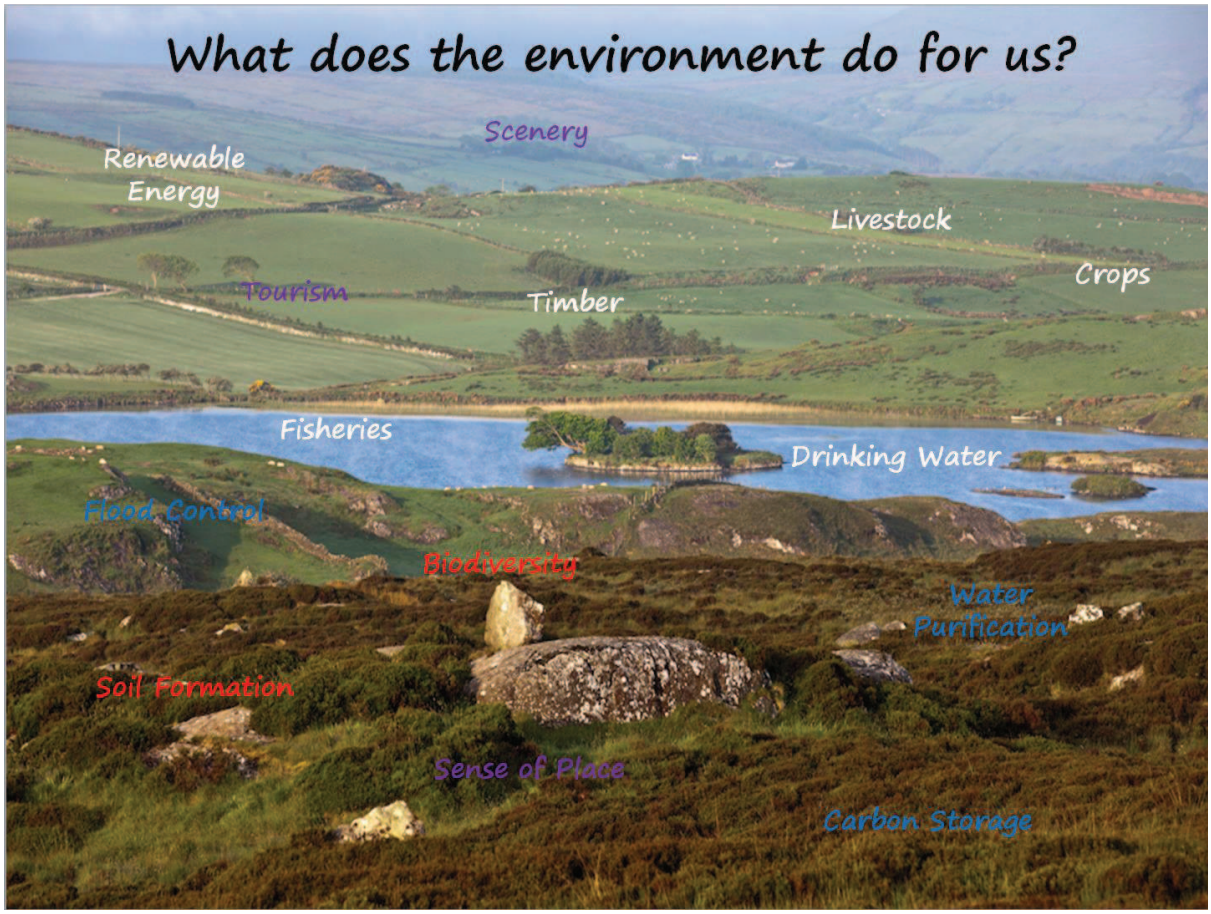
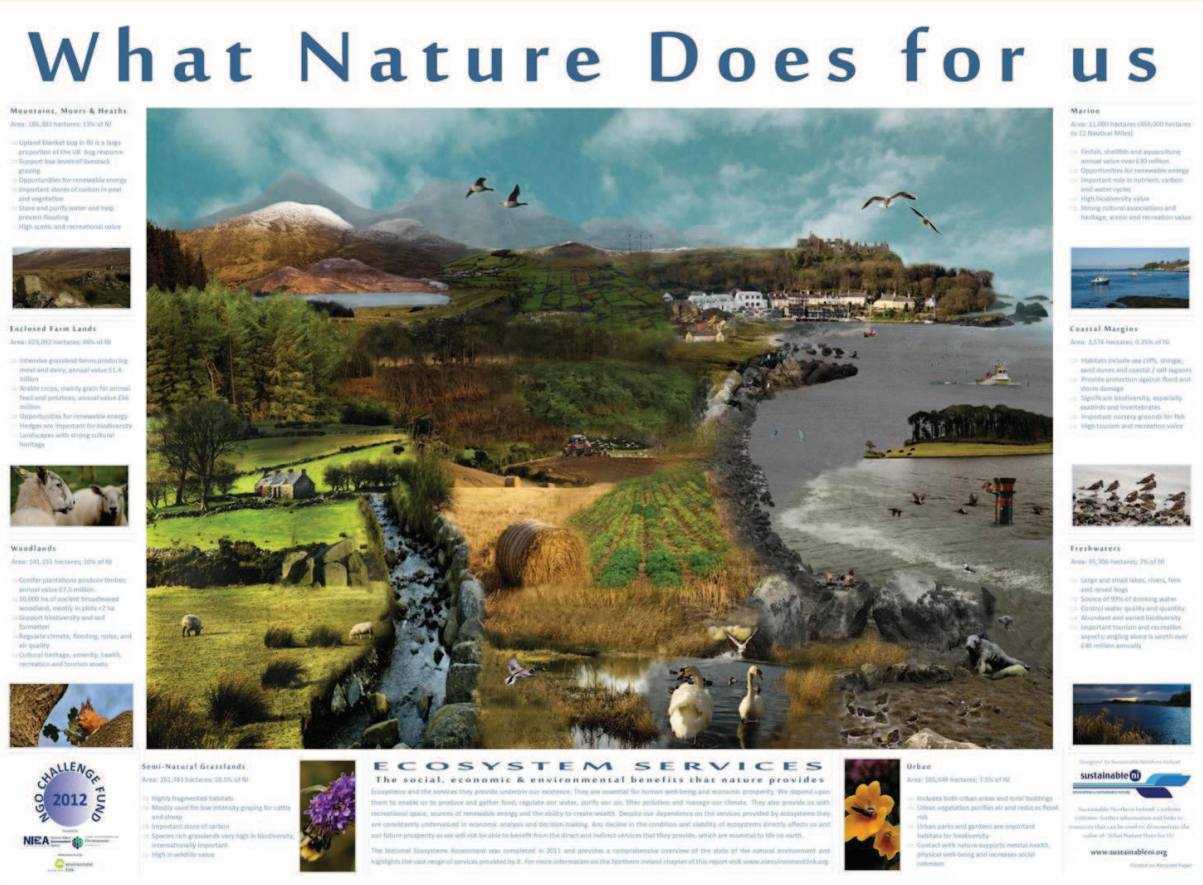
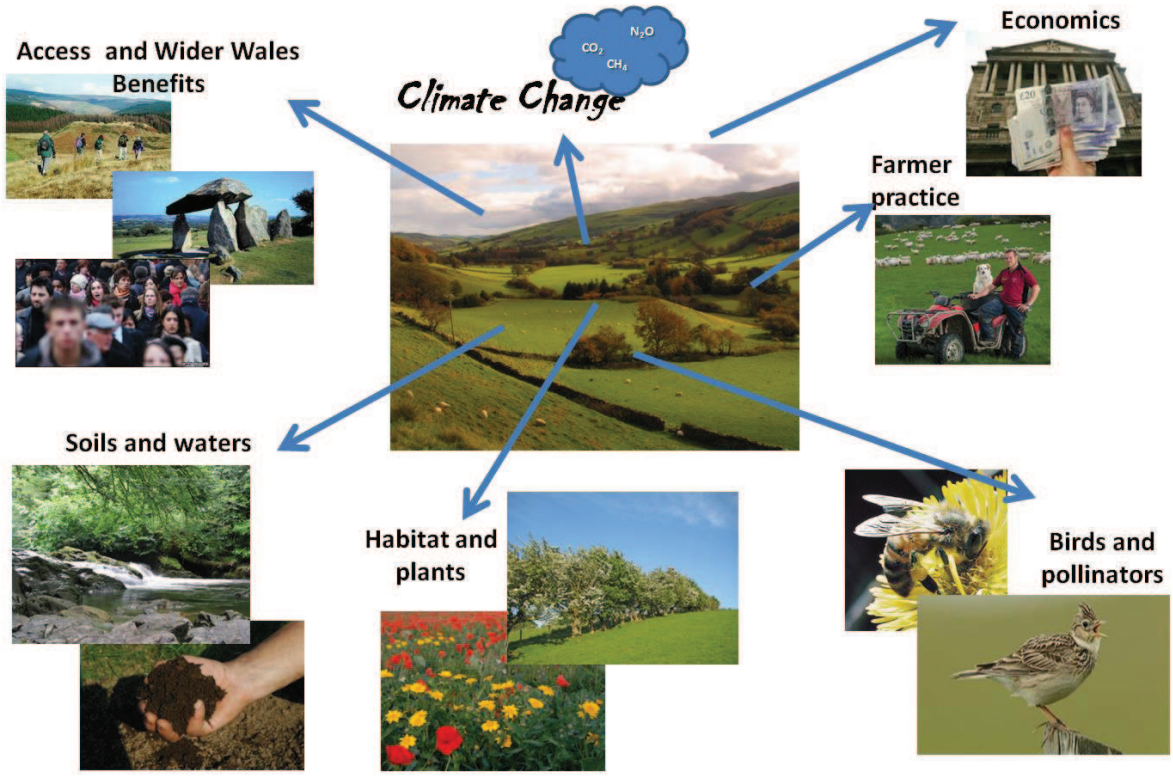


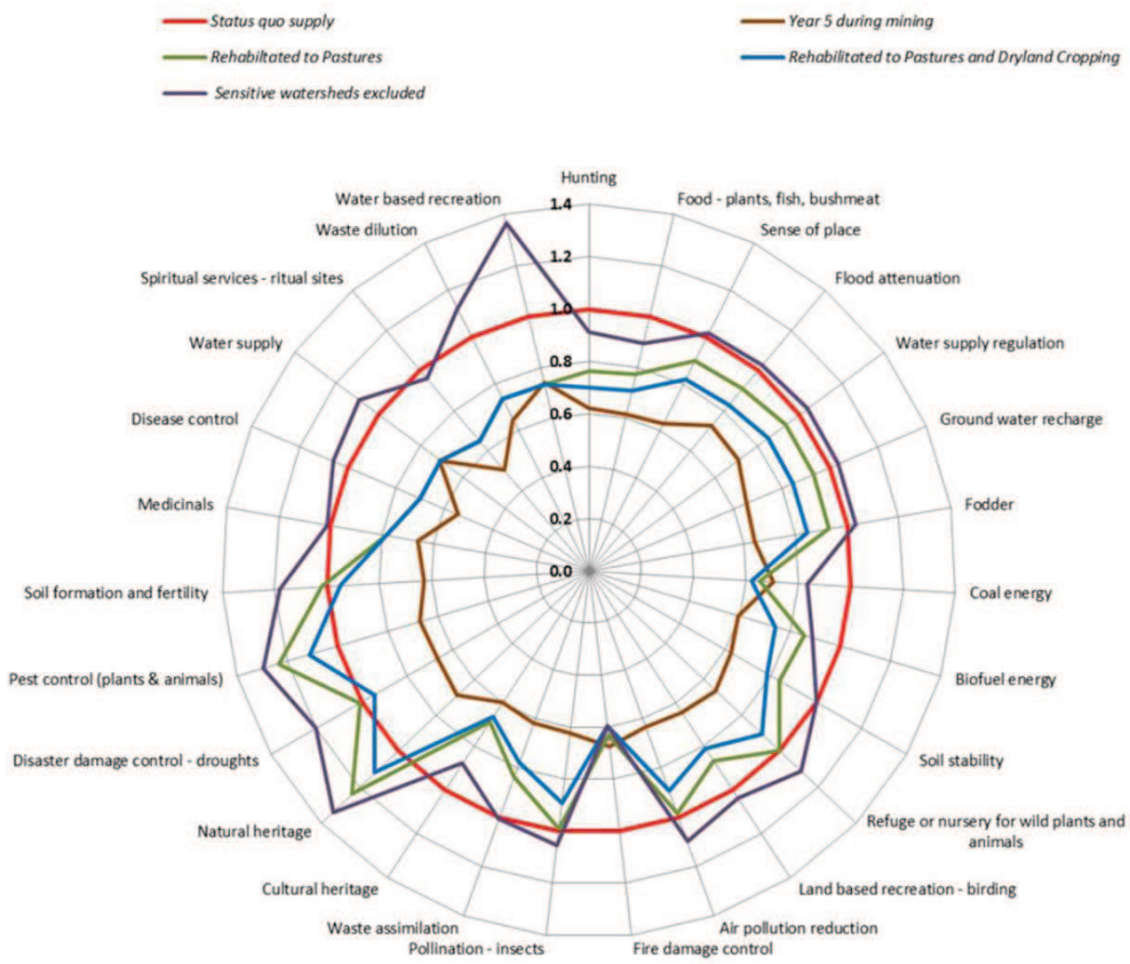
Diagram of ecosystem services in the landscape (Northern Ireland Environment Link).



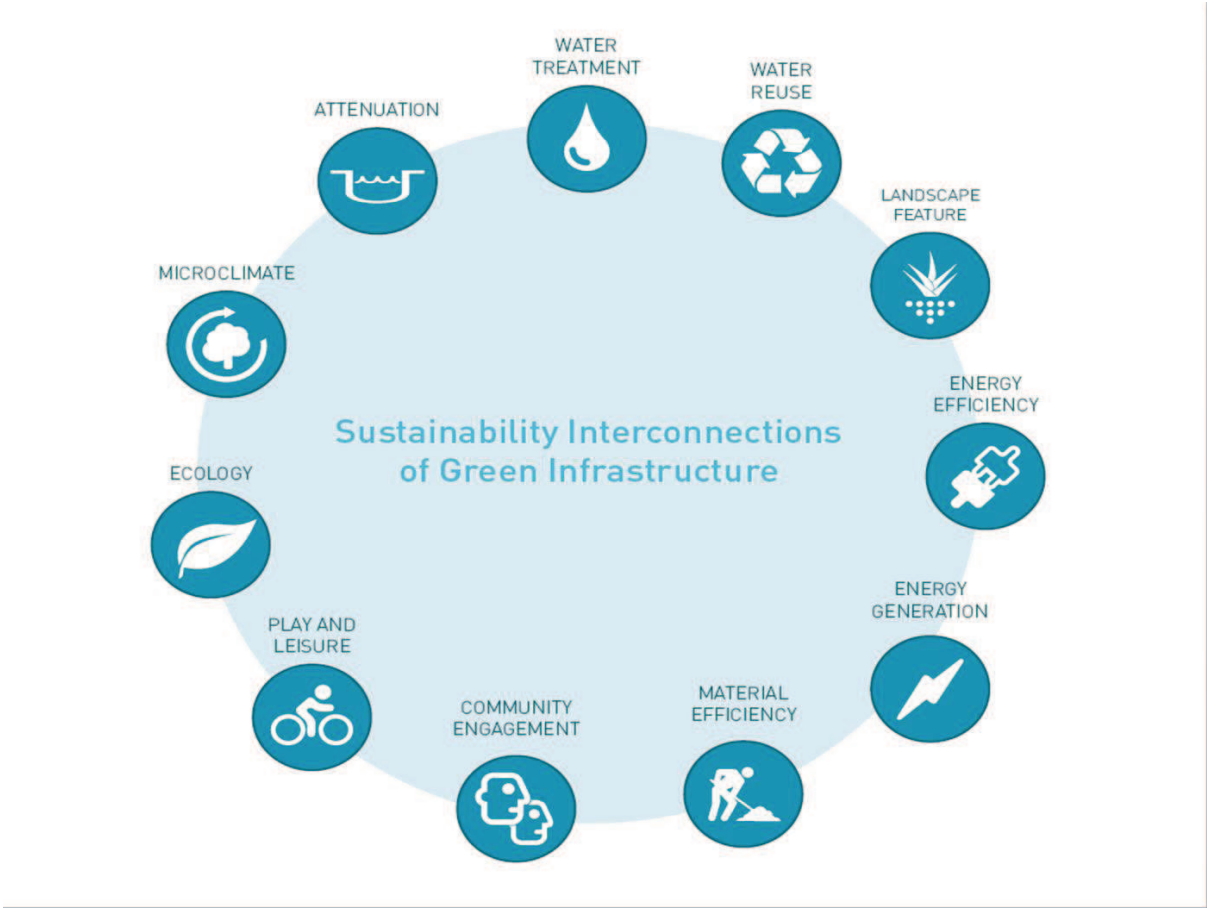
Poster on broad habitats and ecosystem services prepared for Northern Ireland Environment Link).



Rural land management impacts and influences in Wales. Prof Bridget Emmett, NERC Centre for Ecology and Hydrology, Bangor.



Ecosystem services impact “star diagram” for a mining development in South Africa (courtesy, Miles Mander, Futureworks and Eco-futures, South Africa).



Courtesy Gary Grant, The Green Roof Consultancy.

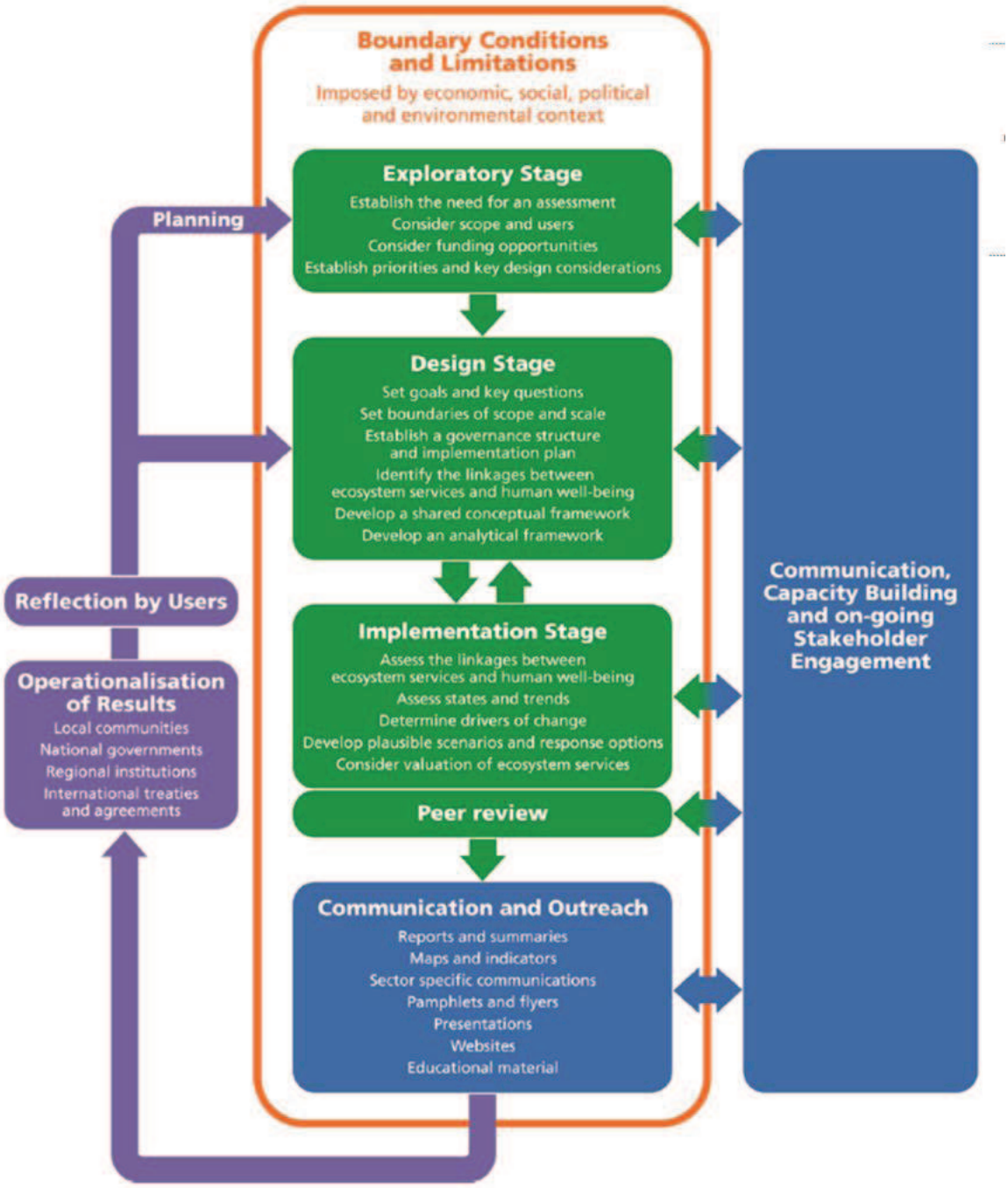
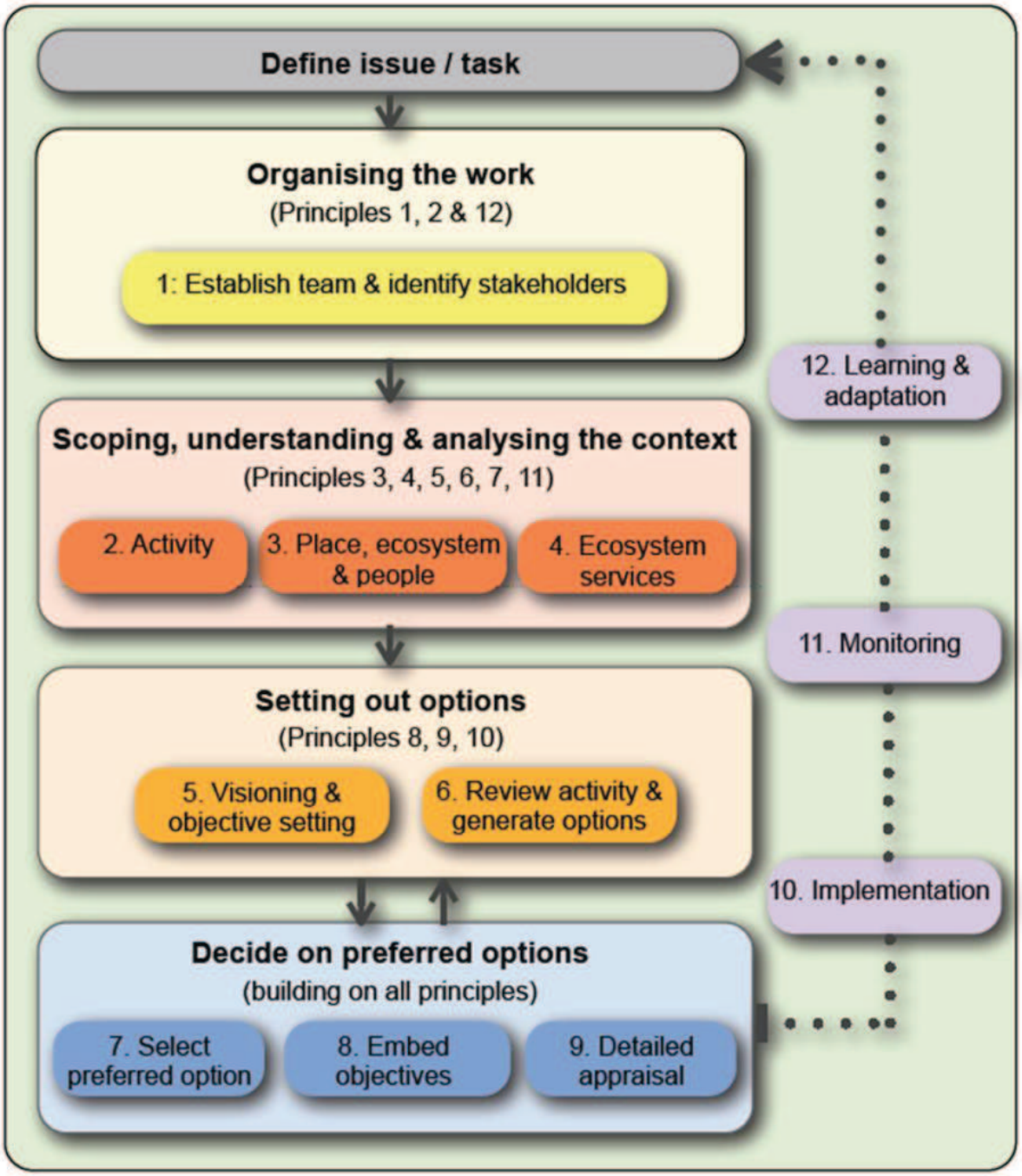


Figure 1. Ecosystem Assessment Framework (modified from Ash et al., 2010).

Ash et al. (2010). Ecosystems and Human Well-being: A manual for assessment practitioners. Island Press. Washington, D.C.



Draft schema for applying the ecosystem approach in the working of Natural Resources Wales (courtesy Steve Spode, Welsh Government).

Environment and Sustainability Committee

Inquiry into Sustainable Land Management in Wales - Response from the Countryside and Community Research Institute (CCRI)

Background – who we are and what we do

1. The CCRI is the largest specialist rural research centre in the UK, having expertise in all aspects of social science and economic research in policy and planning for the countryside and the environment of the UK, Europe and further afield. Our research is organized across four main themes:

- Food, food security and Bio-security
- Economy and society in a changing climate
- Agriculture, Ecosystems and Shared Resources
- Heritage, Landscape and Rural Development.

2. The CCRI has a strong record of academic and financial achievement. It earns a regular annual income of around £1 million from research projects and grants. Some 85% of the CCRI's research is considered, through peer review, to be of international standing, and we are significant consortium partners in seven EU-funded framework projects at present, as well as undertaking work for UK governments and agencies, the OECD, and governments in other EU member states. A key feature of our work is that we actively seek involvement in projects and initiatives with wider relevance to practitioners and policy makers, so that the results of our work have tangible impacts on society.

3. Our response to the inquiry is based upon our research findings from recent and ongoing projects and initiatives, including some work in Wales and some with collaborating partners based in Wales, such as Environment Systems, with whom we have shared this opportunity to provide evidence. As a result, we cover just four inter-related questions from the full list provided by the call for evidence. We deal with each question in turn, below.

Q1. How to define the key ecosystems and ecosystem services in a way that makes sense for Wales

4. The CCRI welcomes the chosen approach of the Welsh Government in looking at sustainable management via a focus upon the role of *ecosystems and ecosystem services (ES)*. In thereby taking a territorial approach, rather than a sectoral one, the WG apparently recognises the importance of an integrated approach in which it is the systemic consequences of actions in multiple sectors, by multiple actors, which will determine the long-term sustainability of land management. Two issues are especially important here.

5. One important requirement for defining key ecosystems and ecosystem services is ensuring a full understanding of how the landscape of Wales contributes to ecosystem service delivery and acquiring data and other information that enables this assessment to be made. All land contributes to the delivery of ecosystem services in some way, depending largely on the specific land cover or crop, the soil type underneath, the position of the land in the landscape (for example whether on a steep slope or on a flood plain) and how and by whom the land is managed, for what purposes. A lot of relevant data currently exists, but the understanding of some of the main mechanisms linking natural capital to ecosystems services delivery remains poor. For example whilst the role of broadleaved woodland in locking in atmospheric carbon is well known, the role of peat bogs and other upland vegetation in regulating water flow in the catchment and preventing flooding downstream is less clear.

6. Whilst they are perhaps not as well-developed within ecosystem services thinking as other types of service, our research has shown that it is the social and cultural services provided by land management, as well as the impact of management upon social and cultural assets and the ways in which these assets in turn shape management trends, that is often critical to socio-ecological system resilience (i.e. the ability of sustainable land management systems to evolve and adapt to unanticipated changes). Work by the CCRI under the Valuing Nature Network project (Jones *et al* 2012) highlighted the need for approaches that reveal the connections between society and ecosystems, to find out what people value and why, so that this value can be sustained. Some of these connections are direct and explicit such as commercial land management to produce

food and fibre, but others are more intangible, such as the cultural and even strong emotional relationships that people have with particular landscapes and areas.

7. The cultural dimension of the Ecosystem Services evaluation framework is the least developed of the services, and also the most contested but, we would argue its relevance to many aspects of sustainable land management. Some of CCRI's work (for example around the Severn estuary; on Exmoor; and supporting one of the Pilot areas within Defra's Catchment-based Approach programme) is designed to identify how a 'cultural services' concept can usefully be developed to enable a fuller and more rounded consideration of the roles that culture and personal identity play in determining the value of nature to human society; as well as ways of measuring and working with cultural and social values, without necessarily monetising them - for example, including *social network analysis* to highlight how groups of actors communicate and learn from each other. It is especially important in some areas to recognize *knowledge systems* as a cultural service that can contribute to improved understanding of environmental challenges such as flood alleviation and improving water quality. The significance of *art and creative activities* in developing and enhancing a sense of place is also being explored within CCRI research focused around the cultural service attributes of the lower river Severn landscapes.

8. 'Making sense' of ecosystem services is also important, so that communities and actors on the ground can consider how best to realise their potential. Pilot work under the Payment for Ecosystem Services (PES) framework for Defra, and within Exmoor National Park (Short and Dwyer, 2012) has highlighted that farmers can quite readily understand the concept of ecosystem services, possibly because they work already with dynamic and inter-related concepts such as cropping rotations. Also, because within the framework, provisioning services such as food and fuel production are clearly identified alongside other services, farmers' key role in service provision is clearly acknowledged - something that has not always been the case in respect of other environmental planning approaches. Communities can also see how the services relate to them by considering key roles such as alleviating flooding or providing clean drinking water. Nevertheless, it is important to explicitly provide space within ES planning, in order for such discussions to take place (see also our third question response).

Q.2 What incentives can we provide land managers to develop sustainable practices, and in particular, are there any new sources of investment we can attract to support these?

9. The recent research undertaken by CCRI suggests that a range of incentives and other mechanisms can be used to promote changes in farmer behaviour towards more sustainable practices. The role of agri-environment schemes in this respect is of course important and some of our work for the WG shows that they are widely known and have been well-accessed by the farming community in Wales, over the past decade. However, some farmers do not join the schemes; their reasons for not joining are varied but are often linked to their particular farm business and farm family plans, pathways and trajectories (See Ingram et al 2012). Our research suggested that participation in Tir Gofal (TG) on family farms could be traced back to the family's long-term motivations for farm continuity, and depended upon the scheme's consistency with the specific dynamic farm development pathways that farmers evolve in order to ensure their continuity. Thus it is important for incentive schemes to be designed with a good understanding of trends in farm business development, both current and future, to maximise the scope for synergies between what schemes are seeking to achieve and what farmers are likely to be planning.

10. Most agri-environment schemes focus incentives upon prescribed management practices – yet there are acknowledged shortcomings in this approach, if used alone (Dwyer, 2013). The WG has been innovative in using incentives in unconventional ways within Glastir, as shown by CCRI and Commons Vision's evaluation of the CDO officers' role (Brackenbury and Short 2012). This study demonstrated the value of funding advice and support for the farming community as a key element in changing behaviour and adopting new ideas. The development of landscape-scale initiatives, which is gathering increasing credibility in policy circles, requires land managers (and other interests) to work together in a collaborative way. CCRI research for both CCW and WG shows that these initiatives can have a significant impact, but they also have a real need for incentives to support co-ordination activity and advice, as well as land management payments.

11. Recent CCRI work for Natural England has highlighted the central role of facilitation as the most effective means of tackling a wide range of issues in sustainable land

management (Mills, Short and Courtney 2012). And this process is not just about knowledge transfer from environmental scientists to farmers: transfer in the opposite direction is also critical to securing lasting beneficial changes in management. The CCRI is currently evaluating the Hill Farm Training Programme operating in Cumbria and Dartmoor, where farmers act as trainers for conservation professionals, covering a wide range of issues associated with upland farming. About 80 people have attended one of the 3 day-long courses and the feedback from both participants and trainers has been extremely positive. As conservation professionals are made more aware of farmers' business preoccupations and concerns, they are more able to identify aspects of payment schemes which will be most attractive to farmers, and to put together incentive packages which can attract a good level of uptake and continued commitment from farm families. Such innovative approaches to knowledge exchange and dialogue can enable policy makers to broaden the range of incentives on offer (e.g. including capital grants as well as management payments), and increase farmer knowledge of issues around sustainability. There is potential for such an initiative, based around improved dialogue, in Wales and this has been discussed with farmers and officers working on the Forgotten Landscape project in Torfaen.

12. The CCRI research undertaken for CCW and WG on farmer co-operative groups identified likely factors of success for organising and delivering collective agri-environment schemes in Wales. It identified the importance of locally-adaptable engagement strategies, recognizing that motivations for group working will vary according to farm types, sizes, farmers' ages, family situations and so on. Whilst economic motives for collaboration are clearly important, the study found that there were also positive social, cultural and psychological factors that motivated farmers to join such groups. The research also revealed the importance of institutional arrangements that allow groups to develop their own solutions and implementation rules (rather than having these already pre-defined by the scheme); as well as a need for external support, offering the services of a local facilitator and funding for both planning and management stages, for any group farm scheme. The research was able to identify the extent to which both business and social confidence can grow within such groups, thus opening up further development opportunities into the future. In this way, funding for group agri-environment schemes in Wales has the potential to act

as a catalyst for further development opportunities, including farm diversification activity, collective input purchasing and novel product marketing strategies.

13. Approaches in which farmers and advisers work closely together to review and modify farm management in novel ways are regularly referred to as examples of the 'co-production of knowledge'. A potentially successful approach was developed in Exmoor (Short and Dwyer 2012). Here the farmers and land managers were not incentivised to work together by management payments, but by being invited to be part of the solution to a challenging water catchment issue. This response is consistent with the findings of earlier farmer behaviour work by the CCRI (Dwyer et al 2007) that outlined the importance of trust between various interest groups as a motivator for positive behavioural change, something that develops with increased communication, over time. Another interesting prospect within the Exmoor study was the capacity to attract funding from South-West water to assist in achieving certain agricultural management changes, on the basis that this should lead to water quality improvements in their supply to Taunton. Whilst CCRI's work on the model ceased following production of a scoping and feasibility study, we understand that the National Park has been working with farmers and stakeholders in the same area, brokering ideas about some kind of agreement with the water company, among the farming community. We suggest that WG should recognise and explore the potential for similar private-sector (utility)-funded initiatives in those situations where the links between land management and specific, vital ES are particularly clear (water, energy, carbon storage).

14. Finally, WG should not ignore the potential for incentives for changed behaviour to come from private food-sector drivers and initiatives. Work by CCRI for LEAF (Linking Environment and Farming – the main promoter of integrated farming methods in the UK) highlighted the significant cost-savings made by several businesses as a result of changing management in ways which should promote ES; as well as the strong perception among farmers that membership of LEAF gave them renewed social standing among the wider community. Food retailer and industry-led producer protocols also include a range of requirements that act as incentives for more sustainable land management practices, as do similar initiatives in the forestry sector (e.g. the FSC certification scheme, now quite widely recognised by major retailers and

some consumers). To date, most of these initiatives have developed independently of policy and public funding. However, there could be scope for increased cost-effectiveness in policy arising from new public-private partnerships associated with the development or promotion of protocols, brands and labels designed (at least in part) to help farmers to improve the sustainability of their land management. Partnership has already been demonstrated to some extent in respect of organic farming, with government incentives supporting action plans in which a variety of private bodies fulfil different roles. CCRI's early work with ADAS on supermarket protocols for fresh produce (funded by the Environment Agency but never fully published due to commercial confidentiality issues) in 2004 indicated that this area of action is likely to remain a key influence upon farmers' management decisions and practices, into the future, and similar points apply to the forestry sector, also, in respect of timber and woodfuel markets.

Q.3 The most appropriate geographical scale(s) at which we should be delivering sustainable land management policies and practices in Wales?

15. The CCRI has been involved in a range of action based research that covers both sustainable land management and improved quality water catchments, working in the upper Thames catchment and elsewhere in south-west England. From this experience, we believe that the most promising approach is to integrate both land and water goals and to let those working at the local level determine the precise mechanisms for achieving these suggested outcomes. This bottom-up approach can be a powerful tool for innovation: within the Upper Thames Pilot Catchment the wide range of stakeholders involved has led to the development of a PES (payment for ES) pilot and another integrated engagement project that is seeking to bring farmer/land owners and communities together, to resolve issues around Water Framework Directive delivery and water flow, biodiversity and flooding.

16. CCRI's report into collective environmental approaches, for CCW, suggested different landscape-scale target areas in Wales for delivering sustainable land management policies, including common land, water catchments, targeting for species and habitat recovery. It was suggested that the geographical scale at which sustainable land management policies are delivered should be dependent on the environmental issues that are being addressed; the desirable spatial configuration of

uptake; and the thresholds of management required to achieve specific objectives. Good scientific evidence and knowledge need to underpin the selection of target areas and the desirable spatial configuration of threshold levels. Local community input can also be important in helping to identify local priorities and ensure that schemes reflect local conditions. In fact, there is evidence that some spatial targeting of payments for agri-environment activities, allowing for local tailoring of management prescriptions, could enhance the economic efficiency of such payment schemes.

17. A key consideration for policy-makers when trying to achieve a particular threshold of change within a target area is to be clear about the priorities and the scale of intervention, and ensure that sufficient funds are available to meet these aims. If resources are limited, it may be best to focus these on a limited number of target areas to successfully achieve threshold levels in these areas, rather than spread resources thinly across several areas and achieve little. However, governance is also a key area and this was explored in the CCRI evaluation of the Integrated Biodiversity Delivery Areas (Short et al 2012). This area focuses on studying the interactions, patterns and trends associated with environmental changes and the ways in which we can moderate or ameliorate the problems that such changes may cause. Our research suggests that a 'one size fits all' approach to delivery should be avoided. Whilst targeted landscape-scale of delivery is preferred to fragmented small-scale delivery, there should be flexibility in the delivery approach so that this can reflect specific conditions. A model of landscape-scale delivery that might work for a lowland arable area, where buffering or connectivity for resource protection is the main priority, would require a different approach to an area such as upland commons, with strong multi-objective priorities including recreation, biodiversity and water protection.

Q.4 How 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.

18. As social scientists, we recognize that this question will elicit fuller responses from other scientists for whom environmental data management is their main concern. However we would like to make the following comments.

A) In our experience, the involvement of the public in data collection, often referred to as 'citizen science', merits further exploration by the WG. Given the acknowledged

lack of 'official' resources available to collect baseline data for Wales, serious consideration needs to be given to exploring opportunities for gathering 'crowd-sourced' data from land managers themselves as well as members of the public. These data could be valuable in validating and ground-truthing official data (particularly from remotely-sensed sources), as well as filling gaps in data coverage, of which there will be many. Relatively simple mobile technology solutions could be particularly useful in this regard. Mobile 'apps' such as Plant Tracker (EA/CEH/Bristol Uni) and Leaf Watch are showing that high quality spatial datasets can be produced by the public for use in environmental/land management. The FP7 funded project COBWEB, in which the Welsh Government is a key partner, seeks to empower citizens to collect and contribute data for use in policy formation and governance. The project aims to increase the value and interoperability of crowdsourcing technology to policy makers by enabling the fusion of citizen-sourced data with reference data from a range of sources including data published by public authorities.

B) Dissemination of data. Despite a lot of talk about establishing a spatial data infrastructure for Wales, there is little reported progress. In our view, it is vital that the various agencies that collect and manage the bulk of environmental spatial data in Wales (largely NRW and Welsh Water) should coordinate their spatial data collection, management and dissemination within a common framework. A single, public-facing online geoportal could act as a central repository for environmental spatial data for Wales, and as a platform for viewing and downloading all available data. The CCRI would be interested to know how far advanced the WG and NRW are with their thinking on this, to consider the potential role of organisations such as ourselves, in helping to develop and test such a framework.

C) With increasing development of earth observation (EO) techniques, the creation of an absolute baseline date for monitoring becomes less relevant, as a baseline can be set at any time for which satellite imagery or other suitable data is available, and can be done retrospectively, as techniques develop to bring more understanding from EO data that has been collected over many years. This is especially important for those ecosystems where timeliness of assessment is key (such as intertidal areas, or when mapping the maximum extent of flooding). The use of state-of-the-art unmanned aerial systems (UAS) can provide a rapid response to the requirement for timely data

collection, alongside crowd-sourcing and other citizen-science models. Farmer and forester involvement in data collection should also not be overlooked: where it is feasible, such an approach can help to embed a positive engagement with the environmental goals among the beneficiary community; notwithstanding the need to ensure that reporting is reliable and can be triangulated with other more coarse-grained or arm's length sources of information.

Concluding remarks

19. We thank the Committee for the opportunity to compile and submit this evidence and we hope that it will be useful to the inquiry.

Janet Dwyer, Chris Short, Jane Mills, Matt Reed and Rob Berry,
Countryside and Community Research Institute
University of Gloucestershire, Oxstalls Lane
Longlevens, GLOUCESTER
GL2 9HW
Tel: +44 (0)1242 714122

References

Brackenbury S and Short C (2013) *Doing Things Differently: Glastir Common Land Element and the Local Action Groups. An evaluation of the Commons Development Offer role using the LEADER methodology*. Report to the LAG groups. Commons Vision: Swansea.

Dwyer, J. (2010). UK Land use futures: policy influence and challenges up to 2060. Land Use Policy. http://dx.doi.org/10.1016/j.landusepol.2010.12.002

Dwyer, J. and Short, C. (2011) An ecosystem services pilot in the South West; building a framework for delivery, Report to Exmoor National Park Authority and Natural England. CCRI: Cheltenham.

Dwyer, J. (2013) Policy integration for sustainable agricultural landscapes: taking stock of UK policy and practice. *Landscape Research.* DOI:10.1080/01426397.2013.784245

Fera, CCRI, ADAS (2013) Evidence requirements to support the design of new agri-environment schemes BD5011, Report to Defra Fera: York.

Julie Ingram, Jane Mills, Ana Frelih-Larsen, McKenna Davis, Paolo Merante, Sian Ringrose, Andras Molnar, Berta Sánchez, Bhim Bahadur Ghaley, Zbigniew Karaczun (2014 Forthcoming) Managing Soil Organic Carbon: a Farm Perspective. Article in *EuroChoices.*

Ingram, J., Gaskell, P., Mills, J. and Short, C. (2013) Incorporating agri-environment schemes into farm development pathways: a temporal analysis of farmer motivations. *Land use Policy*. 31, 267- 279

Jones L *et al* (2012) Scale dependence of stocks and flows in the valuation of ecosystem services, Report to the Valuing Nature Network, NERC.

Mills, J., Gaskell, P., Reed, M., Short, C., Ingram, J., Boatman, N., Jones, N., Conyers, S., Carey, P., Winter, M., and Lobley, M (2013) *Farmer attitudes and evaluation of outcomes to on-farm environmental management.* Report to Department for Environment, Food and Rural Affairs (Defra). CCRI: Gloucester

Mills J, Gibbon D, Ingram J, Reed M, Short C and Dwyer J (2011) Organising Collective Action for Effective Environmental Management and Social Learning in Wales*, The Journal of Agricultural Education and Extension*, 17: 1, 69- 83

Short C, Fisher R, Mills J, Jones O, Kambites C, Manley W, Cairns, A and Gaskell P (2012*) Integrated Biodiversity Delivery Area Programme: Selection and Development Phase* Evaluation Report to Natural England. CCRI: Gloucester.

Short, C. and Dwyer, J. (2012) Reconciling pastoral agriculture and nature conservation: developing a co-management approach in the English uplands. *Pastoralism: Research, Policy and Practice*, 2:13. Available at: http://www.pastoralismjournal.com/content/2/1/13/abstract

Short, C., Griffiths, R. and Phelps, J. (2010) *Inspiring and Enabling Local Communities: an integrated delivery model for Localism and the Environment*. Report to Farming and Wildlife Advisory Group and Natural England. CCRI: Cheltenham.

Sutherland, L., Mills, J., Ingram, J., Burton, R.J.F., Dwyer, J. and Blackstock, K. (2013) Considering the source: Commercialisation and trust in agri-environmental information and advisory services in England. Journal of Environmental Management 118 (2013) 96-105.

Environment and Sustainability Committee

Meeting Venue:	Committee Room 3 – Senedd
Meeting date:	Thursday, 6 February 2014
Meeting time:	09:30 – 13:55

This meeting can be viewed on Senedd TV at:
http://www.senedd.tv/archiveplayer.jsf?v=en_400001_06_02_2014&t=0&l=en

Cynulliad Cenedlaethol Cymru
National Assembly for Wales

Concise Minutes:

Assembly Members:	Mick Antoniw Russell George Julie James Julie Morgan William Powell Antoinette Sandbach Joyce Watson
Witnesses:	Iwan Ball, WWF Cymru Gill Bell, Marine Conservation Society Gareth Cunningham, RSPB Cymru Keith Davies, Natural Resources Wales Sarah Dawson, Welsh Government Jim Evans, Welsh Fisherman's Association Neil Hemmington, Welsh Government Sarah Horsfall, Seafish Dr Kirsty Lindenbaum, Natural Resources Wales Dion Thomas, Welsh Government Rosemary Thomas, Welsh Government James Wilson, Bangor Mussel Producers

Committee Staff:	Alun Davidson (Clerk) Catherine Hunt (Deputy Clerk) Graham Winter (Researcher) Nia Seaton (Researcher)

1 Motion under Standing Order 17.22 to elect temporary Chair

1.1 Mick Antoniw was elected temporary Chair in the absence of Dafydd Elis-Thomas.

2 Introductions, apologies and substitutions

2.1 Apologies were received from Dafydd Elis-Thomas and Llyr Gruffydd. There were no substitutions.

3 Motion under Standing Order 17.42 to resolve to exclude the public from the meeting for item 4

3.1 The Committee agreed the Motion.

4 Draft Planning (Wales) Bill - Factual briefing from Welsh Government officials

4.1 The officials gave a presentation and responded to questions from members of the Committee.

4.2 The officials agreed to attend a further session with the Committee to continue the briefing.

5 Marine policy in Wales - Follow up : Evidence from Wales Environment Link

5.1 The witnesses responded to questions from members of the Committee.

5.2 The witnesses agreed to provide further data on the damage caused to the marine environment as a result of the recent severe storms.

6 Marine policy in Wales - follow up : Evidence from the fishing industry

6.1 The witnesses responded to questions from members of the Committee.

7 Marine policy in Wales - follow up : Evidence from Natural Resources Wales

7.1 The witnesses responded to questions from members of the Committee.

7.2 Keith Davies agreed to provide further information on the number of NRW staff involved in the development of the national marine planning process and to clarify the reference to ‘non recent population’ in NRW’s Article 17 report.

8 Papers to note

8.1 The Committee noted the minutes.

Letter from the Communities, Equality and Local Government Committee : Committees' consideration of Welsh Language

8.2 The Committee noted the letter.

Edwina Hart MBE CStJ AC / AM
Gweinidog yr Economi, Gwyddoniaeth a Thrafnidiaeth
Minister for Economy, Science and Transport

Llywodraeth Cymru
Welsh Government

Eich cyf/Your ref
Ein cyf/Our ref SF/EH/04310/14

Dafydd Elis-Thomas AM
Chair Environment and Sustainability Committee

dafydd.elis-thomas@wales.gov.uk

13th February 2014

Dear Dafydd

Thank you for your letter of 16 January seeking clarification on a reference contained in my response to the Committee of 20 December.

On 6 November the Committee received evidence from several organisations and representatives, including Professor Stuart Cole. I replied to a number of issues raised by the Committee in my letter of 20 December. One quote within this response was attributed to Professor Peter Jones and Doctor Scott Le Vine.

I attach a clarified response to your Query 8 at Annex A, in which now includes the omitted quote from the Paper "On the Move" by Professor Jones and Doctor Le Vine, and also correctly attributes the second quote to the Department for Transport's command paper, Action for Roads.

Bae Caerdydd • Cardiff Bay
Caerdydd • Cardiff
CF99 1NA

English Enquiry Line 0845 010 3300
Llinell Ymholiadau Cymraeg 0845 010 4400
Correspondence.edwina.Hart@Wales.gsi.gov.uk

Wedi'i argraffu ar bapur wedi'i ailgylchu (100%)
recycled paper

Printed on 100%

Annex A

Welsh Government Response to Query 8 Raised by the Environment and Sustainability Committee 13 November 2013

Q8) A number of witnesses raised concerns about the data used for the forecasting of traffic growth. They highlighted that traffic has plateaued in recent years, yet the forecast is showing an increase in demand. Could you provide further detail on how these figures have been calculated?

The M4 Corridor around Newport Consultation Document[1] shows observed and forecast traffic levels on the existing M4. This shows substantial growth occurring in the late 1990s, followed by a generally flat profile prior to the economic downturn in 2007/2008, which was further affected by the major road works on the M4 in 2009 and 2010. Following the completion of these road works, traffic volumes have risen back to around the 2005 pre global recession level. 'TEMPRO' (Trip End Model Presentation Program) forecasts show growth from 2011 onwards.

Forecasts are made in accordance with the Welsh Government WelTAG and Department for Transport WebTAG guidance (see www.dft.gov.uk/webtag). Calculation methodology is explained as follows.

Traffic surveys were carried out between March and May 2012 to enable comparison with forecast traffic flows and update the M4 traffic model. Attached at Annex B is a copy of "Figure 7.2: 2012 Traffic Flows and Urban Motorway Operating Conditions" from the M4 Corridor around Newport WelTAG Appraisal Report Stage 1 (Strategy Level). This shows that in 2012 the M4 at Newport was experiencing traffic flows associated with operational problems, resulting in frequent traffic congestion, which could increase the risk of incidents and accidents occurring.

The M4 traffic model was validated using the 2012 information. Further information on the traffic model can be found in the 'M4 Corridor, Newport, Local Model Validation Report (LMVR), Draft 1', November 2012[2]. Traffic forecasts were prepared for the then anticipated opening year of the proposed M4 Corridor around Newport Options in 2020 and the design year of 2035 as required by the Design Manual for Roads and Bridges. Car trips were factored using the Department for Transport's National Trip End Model (NTEM), as set out in the TEMPRO version 6.2 program. The growth in goods vehicle trips, both light and heavy vehicles, was based on the forecasts contained in the National Transport Model produced by the Department for Transport. Variable demand modelling has been deployed using DIADEM (Dynamic Integrated Assignment and Demand Modelling) to produce the model forecasts, in accordance with WebTAG unit 3.10 advice. It should be noted that traffic forecasts at this strategic stage of option assessment are based on a number of assumptions. More details of such assumptions are documented in the 'New M4 Project, Magor to Castleton, Traffic Forecasting Report', Arup, November 2012, which is available at www.m4cem.com.

With regard to recent and future traffic forecasts your attention is drawn to recent research[5] led by Professor Peter Jones at University College London, who was referred to in Professor Cole's evidence to the Committee.

This research is reported in the Paper "On the Move[3]" which contains the following quote which is relevant to strategic roads like the M4:

"Commentators have used the national car traffic figures to explore the hypothesis that mileage per capita has 'peaked'. But the grand total hides quite different experiences from one part of the country to another, ranging from the South West region, where car traffic

[1] Figures 4 and 5, draft Plan Consultation Document, available at www.m4newport.com.
[2] LMVR available on www.m4cem.com.
[3] On the Move, December 2012, written for the RAC Foundation, the Office of Rail Regulation, Independent Transport Commission and Transport Scotland by a research team led by Professor Peter Jones at University College London.

growth continued systematically until the onset of the recession in 2008, to London, where car traffic levels have been falling since 1998. Crucially, the report concludes that if company car mileage is discounted, then there has been a pattern of continuing strong growth in private car use for those aged 30 and over, outside London, up to the start of the economic downturn. This group represents approximately 70% of the population of driving age in Great Britain.

Therefore the notion that car traffic peaked in the mid-2000s is at best an oversimplification.

Many of the changes noted in the report relate to the rate of car and rail use per person. Yet on top of this transport planners need to account for marked population growth. Over the next 20 years or so the number of people inhabiting the British Isles is predicted to swell, again with large regional variations. Any fall in the rate of travel per head by a particular type of person may be offset by a growing number of people of that type."

Furthermore, in July 2013, the Department for Transport published its command paper entitled Action for Roads: a network for the 21st century[4]". The following are quotes from that paper:

"*Even under our lowest growth forecasts we would expect traffic growth to cause major increases in congestion, greater delays and more unpredictable journeys. Without action, growing demand will place unsustainable pressure on our roads, constraining the economy, limiting our personal mobility and forcing us to spend more time stuck in traffic. This will mean more pollution and more frustration for motorists..."*

"…by 2040 traffic on strategic roads will have grown by 46%, based upon central estimates of population growth, economic growth and the decline in the cost of motoring. In situations where the economy grows faster than expected, where the costs of motoring fall and population grows more quickly, this could mean traffic could grow by as much as 72%. If economic forecasts were downgraded, if population growth stagnated and if motoring technology did not develop as fast as predicted, the increase would be smaller. However, the minimum forecast increase, 24%, is still a substantial rise on current levels."

[4] Action for Roads: A network for the 21st Century, Department for Transport, July 2013 (Cm 8679).

Annex B

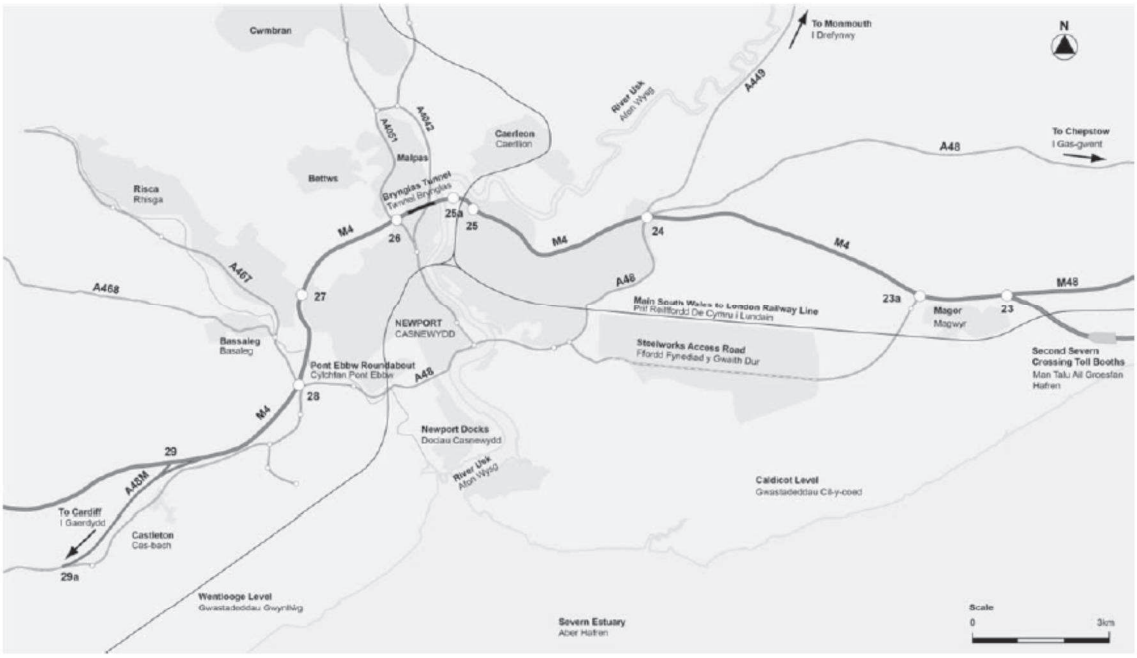
Figure of Traffic Flows and Urban Motorway Operating Conditions

(extract from m4 Corridor around Newport WelTAG AppraisalReport Stage 1 (Strategy Level))

Figure 7.2: 2012 Traffic Flows and Urban Motorway Operating Conditions

Location	2012 AADT	DMRB Urban Motorway Capacity[19] Veh/hr	Sept 2012 ~ Highest Peak % Flow to Capacity	
			Average Weekday Peak	Maximum Weekday Peak
J23a to J24	79,300	5600	70.2%	78.3%
J24 to J25	93,400	5600	80.2%	87.2%
Brynglas Tunnels	70,100	4000	85.7%	95.6%
J26 to J27	104,400	5600	86.2%	94.2%
J27 to J28	103,400	5600	96.6%	103.3%
J28 to J29	104,200	5600	92.1%	100.2%

Flow to Capacity	Operational Conditions
< 80%	Operating within capacity
80% to 100%	Operational problems occurring
> 100%	Severe operational problems



[19] Design Manual for Roads and Bridges Volume 5, Section 1, Part 3, TA 79/99 Amendment No.1, Traffic Capacity of Urban Roads, Table 2, May 1999