Upland Scenarios

What will the future look like?

Introduction

The communities who live, work and depend on the UK's uplands are confronted increasingly by changing climate, evolving resource demands and economic uncertainty. This report is intended to help them, and to provide contrasting visions for policy makers, land managers and society of how the UK's uplands could develop over the next 30-40 years.

The UK's uplands are important for agriculture, forestry and recreation, but past management for goods and services of high market value has degraded some upland ecosystems (UKNEA 2012). Costs linked to water treatment, and risks associated with floods, drought and climate change have increased. Rising human populations in the UK and overseas will further increase pressures to produce, and consequences for upland regions are inevitable.

Here, we present four scenarios for the UK uplands, considering the possible effects of global and local drivers of change. The scenarios form part of a major research project aiming at demonstrating the role of biodiversity in sustaining river ecosystem services - DURESS (Diversity in Upland Rivers for Ecosystem Service Sustainability) - funded by the Biodiversity and Ecosystem Sustainability (BESS) programme of the Natural Environment Research Council.

Upland Scenarios in Brief

From an analysis of drivers of change, and a review of historic changes in the uplands since World War 2, we have considered four possible scenarios to 2050:

Agricultural Intensification

Maximising food and fibre production becomes crucial to meet the challenges of food security and increasing global demand.

Managed Ecosystems

Ecosystem integrity is pro-actively enhanced to safeguard water, carbon and nature through either public funding of agri-environment schemes or because the market value of these services increases.

Business as Usual

Publically funded agri-environment continues to deliver social benefits and ecosystem services.

Abandonment

Land becomes abandoned as a result of market or regulatory failure of the other three scenarios, leading to rapid decline in production and unmanaged development of quasi-natural habitats.

Background

How Were the Scenarios Developed?

Scenarios are structured accounts of plausible futures that anticipate possibilities and prompt response strategies. Ideally, they are logical, clear and robust in their assumptions, but also sufficiently complex to represent the real world and its associated uncertainties.

The DURESS scenarios resulted from:

- **Appraising drivers of change in an expert workshop representing all appropriate sectors (farming, forestry, water, nature, communities...)**
- **Identifying plausible land management responses to each driver of change, called projections.**
- **Analysing possible interplay among these projections to construct the four storylines.**

This broad summary has been reviewed by independent experts and this report card was steered by a panel drawn from academia, industry, NGOs and government.

Associated papers are available at: www.nerc-duress.org

Previous upland scenarios have focused mainly on intensification and extensification. For example, the 'Foresight Land Use Futures' report presented six upland scenarios, with four based on intensification to meet demands for food, energy, wood and carbon sequestration, and two based on extensification or cessation of land use and management. The Rural Economy and Land Use (RELU) programme developed two scenarios based respectively on food needs and on management for wildlife and carbon. The UKNEA project identified six scenarios of which three were environmentally and sustainably focused while three others emphasised national self-sufficiency and provisioning of food and fibre.

What Goods or Services do the Uplands Provide?

Food

The uplands are often designated as Less Favoured Areas within the EU because of they have poor quality farm land and adverse climates. Food production is mostly limited to ruminants and is heavily subsidised.

Biodiversity and Cultural Value

Upland areas are designated under National or European schemes. For example, 28% are designated as SSSI/ASSI. Most common lands are also in the uplands (82% for England). Access provides important recreational facilities.

Fibre

Following WW1, many upland areas were planted with conifers to meet the UK timber needs.

Carbon Sequestration and Water

Uplands help to regulate climate change by acting as carbon sinks. Upland peat soils in the UK store about 300 million tons of Carbon. The uplands also provide 70% of the UK's drinking water.

Past Drivers of Change

Initial emphasis in the uplands was on production of more and cheaper food. The UK Agriculture Act (1947) led to "Deficiency payments" when market prices fell below guaranteed levels, and there were subsidies for improving land and infrastructure for food production.

This policy continued when the UK joined the European Common Agricultural Policy (CAP). During the 1970s and 1980s, mounting evidence of growing environmental effects led to concerns about focussing solely on food production. The European Union introduced Environmentally Sensitive Areas in 1985 followed in 2003 by the Single Farm Payment, together with rural development funding for agri-environment schemes.

Agricultural production is now largely determined by world market condition and, in some parts of the UK, including the uplands is strongly incentivised (underpinned) by current CAP arrangements. The capacity of upland farmers to change their land use and management is constrained by their production-orientated culture, variable weather conditions and market prices. Of English cattle and sheep farms in Less Favoured Areas (LFAs), 25% had farm incomes of less that £10,000 in 2011-12. Since World War II, the input of public funds have had significant influence on how the uplands are managed.

Drivers of Change

Global

Global Climate Change
creates threats, but also opportunities for uplands to contribute to food security, water and carbon storage.

Global Markets - Food & Timber
impacts on the uplands because of their dependence on international markets.

The Ecosystems Approach
how far and fast the approach is adopted will affect future upland use and management for services beyond the traditional provision of food and fibre.

Global Energy Costs
have large influence on costs of inputs such as fertilisers, but future needs for generation and energy security will create opportunities for renewables.

Local (Within UK)

Local Climate Change Responses: Mitigation & Adaptation
win-wins could arise from management linking mitigation and adaptation e.g. woodland to sequester carbon and control floods.

Legislation and Regulation
the de minimis baseline that land users must comply with. **Regulation** is important because land use will be dictated by how legislation is implemented and policed.

Water Resources
the uplands have a major role in water supply and security, and this will grow as water demands increase and climate change effects increase in the 21st century.

Technological Advance and Take-up
advances in biotechnology, engineering and other technologies could have far-reaching consequences for upland use and management.

Biotic / Pollution
animal or plant diseases, and pollution of air, land and water could influence local circumstances.

Social / Cultural
demographic changes, diet preferences to reduce meat consumption and individualistic product demands are among many possible socio-cultural changes.

The expert workshop identified 4 global drivers and 6 local drivers. For each driver, a range of projections was then identified and then rated in terms of probability.

Global Drivers

Global Climate Change

70% probability
The UK invests overseas to increase food security. Rapid expansion of food production in South America, Russia and Eastern Europe, with significantly increased production expected in Africa. The uplands remain important for carbon sequestration and increasingly important for water supply to support lowland intensification.

30% probability
Global climate change and population growth affect food security and change global markets significantly. Government incentivises upland food production to increase security and to meet local and global markets.

Global Markets - Food & Timber

50% probability
Fairly static economy in UK, EU and USA, but continuing global expansion, particularly in BRICS (Brazil, Russia, India, China and South Africa), moderated by competition for natural resources. Upland markets depend heavily on finding overseas customers – which could exist in Europe if NZ switches more exports from Europe to SE Asia.

40% probability
Global economic growth weakens with breakdown of international trade coordination and possible protectionist measures for food and basic commodities. Upland incomes from farm and woodland products become vulnerable as access to European and international markets is reduced by export bans.

10% probability
Strong UK, EU and global economic growth coupled with free trade, restricted mainly by competition for natural resources and lack of finance in the developed world. Potential to develop strong markets, with pressures to intensify production, reduce emphasis on other ecosystem services.

Global Drivers

The Ecosystems Approach

50% probability
The ecosystems approach is adopted where ecosystem services can be most readily valued (e.g. water, carbon). Ecosystem services are emphasised in protected areas and sensitive catchments, but not universally. Landowners/farmers receive income from the public funds via agri-environment schemes or Payments for Ecosystem Services.

30% probability
Weak or limited adoption of an ecosystem approach. Ecosystem services are limited to food and timber as funding for agri-environment schemes declines.

10% probability
Strong adoption and uptake of the ecosystem approach across all sectors extended to reveal full values of all ecosystem services. Market mechanisms apply to nearly all services, with the exceptions (e.g. cultural services) funded by government as a proxy for society.

10% probability
Government promotes a market-based approach to ecosystem services instead of a publicly-funded approach. Potential triggered by EU withdrawal with resulting re-think on farm funding regimes.

Global Energy Costs

40% probability
Fossil fuels decline, forcing investment in new large clean energy (e.g. tidal) and nuclear energy. Agri-chemicals and fertilisers are expensive.

30% probability
Fossil fuels readily available (including new sources such as shale gas, Arctic oil and gas). Little investment in renewable energy sources. Agri-chemicals and fertilisers are cheap.

30% probability
Fossil fuels decline, forcing investment in distributed energy systems - hydro, wind, solar, biomass. Intermittent generation sources will require energy storage systems – e.g. pumped water storage in uplands.

Local Drivers

Local Climate Change Responses

50% probability
Climate-change adaptation focused on conservation or in designated areas. Mitigation is targeted through renewables and carbon sequestration but limited elsewhere.

30% probability
Rapid response measures – increasing awareness of climate change impacts results in public response. Upland measures including large woodlands as carbon sinks, more water management and biodiversity. Upland farming develops a stronger stewardship approach supported by public funding.

20% probability
Adaptation responses weakly adopted due to conflicts with other land use priorities. Increased costs to society for hard infrastructure.

Legislation and Regulation

50% probability
Increased environmental regulation of land use and management to favour water, climate change responses and habitat management. Existing tax regime (such as inheritence tax or capital gains tax) for owning land.

30% probability
No change: production is favoured with limited support for upland Payment for Ecosystem Services. Existing tax regime for owning land is retained. EU regulatory drive remains similar.

10% probability
Deregulation of environment and land-use controls as emphasis on market mechanisms grow. Existing tax regime for owning land is retained. EU regulatory drive decreases or is removed entirely.

10% probability
Tax benefits of owning land are removed leading to withdrawal of large landowners (corporate and individual) and reduction of land prices.

Local Drivers

Water Resources

50% probability
Local Water – water management becomes a dominant paradigm with the main beneficiaries being downstream communities. Strong focus on water quality and flood regulation with limited energy hydro-schemes.

40% probability
No Change – water is not the dominant driver of land use in the uplands. Regulation is in place to maintain water quality but in competition with other land uses.

10% probability
Water for UK – substantial focus on maintaining supply to other parts of the UK as water demands increase. Increased number of reservoirs, water infrastructure and water transfers. Enhanced benefits to farmers through Payment for Ecosystem Services schemes. Cultural and community resentment locally.

Local Drivers

Technology Advances and Take-up

50% probability
Weak investment into technology and poor uptake in the uplands, whether for mainstream land use or for diversification.

30% probability
Strong investment and take up of mainstream agricultural and forestry technologies by farmers and foresters. Diversification in upland systems are production and market orientated but benefits are realized variably by upland farmers.

20% probability
Strong investment and take up of diverse technologies with a focus on maintaining natural capital and providing renewable energy, biomaterials and other diversification options.

Biotic / Pollution

60% probability
Increased global and local measures to increase biosecurity and prevent pollution increase routine costs for upland farming/forestry. Net effect is beneficial in reducing disease outbreaks and their aftermath e.g. trade bans. Anti-pollution measures have substantial benefits for upland economies in reducing pollution impacts.

30% probability
Biosecurity and anti-pollution measures remain at current levels.

10% probability
Biosecurity and anti-pollution measures are relaxed. Responsibility and liability are placed on land users thus increasing probability of disease outbreaks and increased pollution burdens which restrict productivity.

Local Drivers

Social / Cultural

50% probability
Society remains consumerist and trends for food types remains broadly similar to now. Supply chain remains dominated by international companies and UK supermarket chains. Society becomes more technocratic in its dependence on technology for food production. Upland farmers provide primary products to the bulk market.

30% probability
Society demands are more individualistic for food and other products and services. Food is mainly vegetarian for health benefits. Emphasis is on local community food growing, local sustainability and traceability of food chain. Reduction of meat consumption particularly beef and lamb has impacts on upland markets.

20% probability
Society becomes poorer as proportion of aged to employed populations increases. Society becomes more fragmented in its needs and in community make-up. Aged population favours convenience foods. Demands for ecosystem services are mainly for passive cultural services – not active recreation. Upland farmers have to rely on income from their products with retrenchment from agri-environment support.

From Drivers to Scenarios

What Are the Trends?

Historical and current upland land use fluctuates between a Production Focus and an Agri-environment focus, depending on the balance between market incomes and public/government support. Thus individual land holdings have a bias either to 'Intensification' or what we term a 'Transition' period characterised by agri-environment support schemes, which are a mid-point to a full ecosystem service approach.

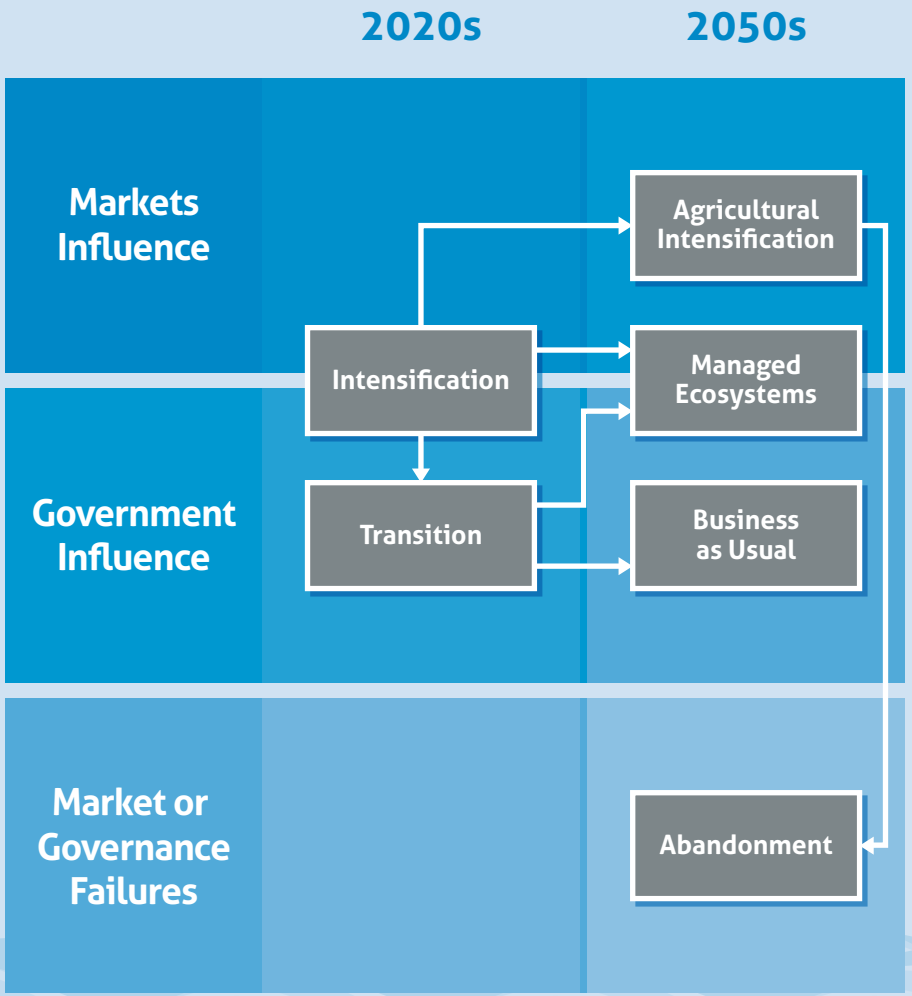
What Could Happen?

Post 2020, when the next CAP for 2014-2020 ends, Intensification could lead to a free market scenario in food and fibre: the **Agricultural Intensification** scenario. This would be driven if there is a reduction of public funded from EU CAP or UK withdrawal from the EU.

The Transition period could continue with public funded support, representing a **Business As Usual** scenario.

With a reduction in public funded support, the Transition period could lead to a free market scenario for ecosystem services – a logical extension of valuing ecosystem services. The **Managed Ecosystems** scenario could also however stem from increased government support.

A market or governance collapse in the products and services of uplands could lead to an **Abandonment** scenario, characterised by de-stocking and land abandonment.



Agricultural Intensification Scenario

Global food security forces policy to focus on production: Hill farming is now expected to be an important contributor to the national livestock industry by providing breeding and finishing stock to lowland farming systems and fatstock for the market. Environmental protection activity is limited to compliance with regulations.

Business as Usual Scenario

The farming management paradigm is initially dominant but policy aims to balance the aims of agricultural productivity and environmental protection. Farming does not address UK food security which is managed for export markets. Environmental protection is based on a limited amount to small areas of land such as protected areas, areas with high tourism value, or areas requiring specific protection to meet regulations.

Managed Ecosystems Scenario

Carbon and biodiversity management becomes the dominant management paradigm in upland systems. Policy is focused on restoring peatlands, and expanding wetlands and woodland to increase biomass and regulate soil carbon exports. Reliance on overseas areas for provisioning services (fuel, fibre and food) may increase.

Abandonment Scenario

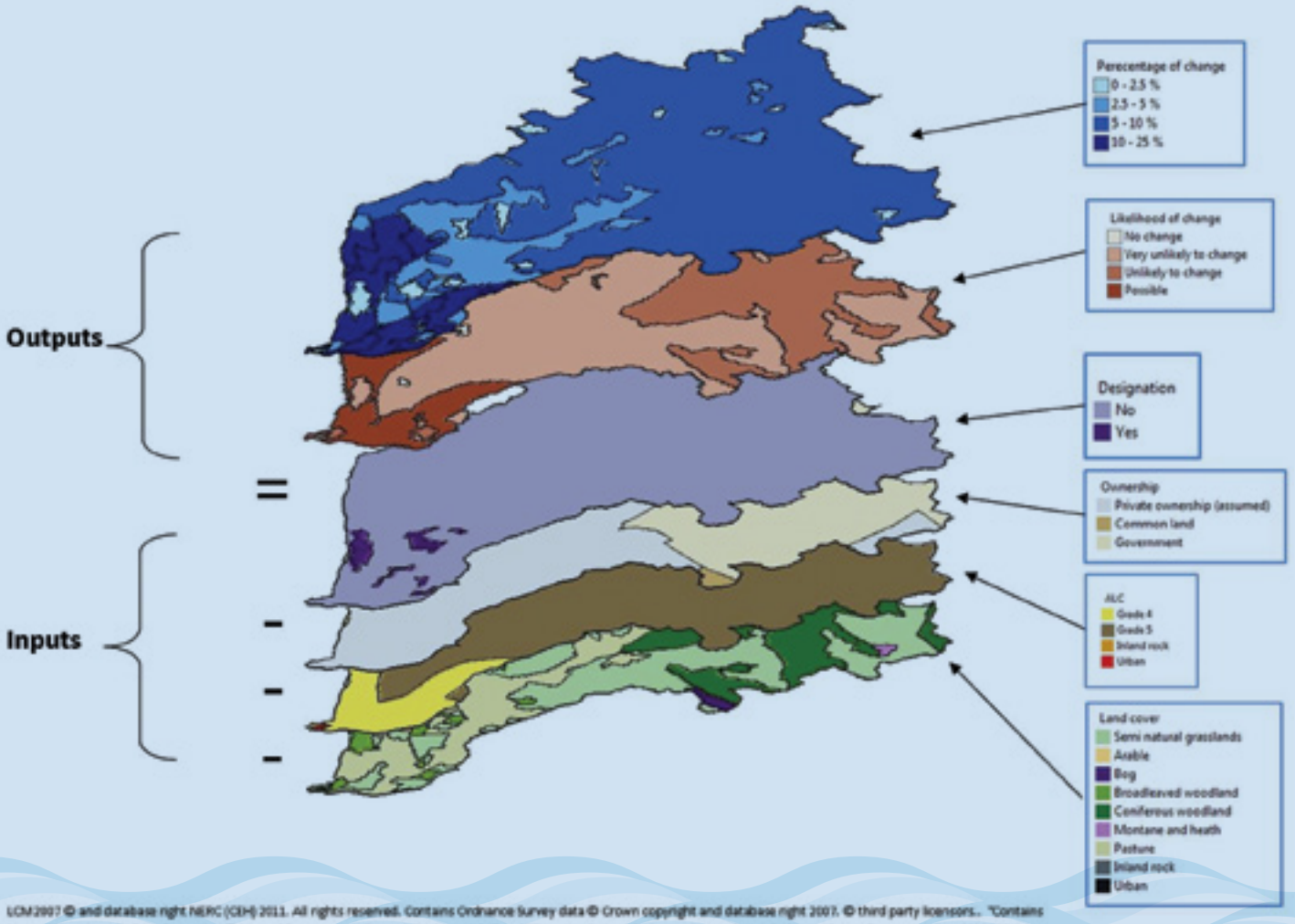
Existing upland policies become too costly to implement because of competition for public funds for other priorities, and lack of viable markets for products and services. Sustainability of farming enterprises becomes compromised through loss of farm succession and poor uptake of new technology and practices. Decline in farming activity and upland livelihood opportunities leads to eventual abandonment. Upland communities become more dependent on external jobs, with takeover for retirement and tourism.

How Do the Scenarios Translate on the Ground?

Predicting the futures of upland landscapes under a range of scenarios is a key step towards making management decisions that are likely to promote river biodiversity and the services river ecosystems can sustain.

For each scenario, the probabilities of land use change are predicted using rules based on land ownership, nature designation, land agricultural quality (ALC) and current land cover data. For each of these combinations, maps are created to show where land cover change would occur, the magnitude of this change, and it's likelihood.

The process applied to a Welsh catchment (see figure) illustrates how these different layers of spatial character are combined to create a map of land use change (in blue) as well as the likelihood that this change will occur (in red).



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Scope for Change

Upland farming and forestry operate in difficult physical conditions leading to fragile business economics. The culture of production of food and fibre is embedded in the upland agricultural community, despite poor prices from highly competitive markets.

Financial viability is very heavily dependent on funding support from EU and Government sources.

Historically, this has been an important driver of change to align upland use and management with Government priorities. Substantial change in the uplands can also occur from investment from external sources – for example for grouse shooting. Part-time farming with external income from farm diversification or other jobs can also increase farm income and support farming activities.

Managing Uplands for Ecosystem Services?

While there are clear opportunities to manage uplands to deliver a wider range of ecosystem services such as water resources, flood management, carbon sequestration, renewable energy and biodiversity, the challenges are far ranging. Though currently supported to some extent by Government, funding may decline with the continuing financial squeeze in meeting the needs of an ageing population and a declining productive population. Markets in ecosystem services could develop as an alternative source of funding, but the full mechanisms for implementation are yet to emerge. The pressure for additional clean water resources provides perhaps the best opportunity for developing a viable market.

Faced with these challenges, market failure for traditional upland goods (food, fibre) or for wider ecosystem services could well lead to abandonment of uplands. The outcomes depends on the future trends in diversifying farm-household income.

Further Reading

Background papers on scenario building and management of the uplands can be found in the following reports.

Haines-Young, R. et al. (2011) The UK NEA Scenarios: Development of Storylines and Analysis of Outcomes. In: The UK National Ecosystem Assessment Technical Report. UK National Ecosystem Assessment, UNEP-WC-MC, Cambridge.

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