The Lie of the Land

Future Challenges for Rural Land Use Policy in Scotland and Possible Responses

Vicki Swales
Land Use Consultant

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Contents

Executive Summary

Recognising growing political interest in land use issues across the UK and the need to enhance dialogue and knowledge exchange between the scientific and policy communities, the Rural Economy and Land Use (Relu) Programme appointed two independent Rural Land Use Analysts to work part-time from October 2007 – December 2008. The Analysts were given a brief of identifying challenges and lessons for policy emerging from a selected suite of 20 on-going Relu research projects and of facilitating discussion of these with researchers and the policy community (including policy makers and key rural land use stakeholders).

Changing demographics, new consumer demands and climate change, to highlight just a few factors influencing land use, mean that the lie of the land is constantly evolving. How we achieve sustainable rural land management is a challenge for all of us – scientists, policy makers, rural communities and society at large. This paper is a contribution to the on-going debate about the future of Scotland's rural land resources – the challenges we need to respond to and the possible responses we might make. It accompanies a paper which considers rural land use from a wider, UK perspective. The focus on Scotland recognises the differences between Scotland and the rest of the UK in relation to factors such as land use capabilities and patterns, land tenure and legislative arrangements, governance and institutions, communities and culture. It is also particularly relevant in the context of the recently launched, Scottish Government's Rural Land Use Study which will inform how Scotland can best use its rural land resource to achieve a range of objectives.

Rural land in Scotland has particular characteristics and attributes that distinguish it from elsewhere in the UK. The majority of Scotland's territory is classed as rural, much of it remote. Agriculture is the dominant land use and much of this land is of high nature and landscape value. Scotland's soils account for 69% of total UK carbon storage. National, European and international policy sets the framework within which land use takes place and provides some key drivers for land use decisions. The Scottish policy initiatives, strategies and statements reviewed in this paper highlight the multiple objectives being established for land use and some of the ambitious targets – relating to, for example, water quality, biodiversity and climate change - which land use must play its part in meeting now and into the future.

Based on discussions with Principal Investigators and research staff of selected Relu projects, with Scottish Government and rural land use stakeholders and drawing on evidence submitted to the Relu Land Use Policy Analysts during the course of the past year, a number of strategic land use policy challenges have been identified. Our research suggests we need to:

1. Promote multifunctional land use and the management practices that deliver multiple benefits
2. Develop policy that is locally responsive, flexible and adaptable

3. Develop more integrated and collaborative governance arrangements and structures and engage stakeholders and local communities in policy development and delivery
4. Provide the right mix of policy tools, encourage the private and voluntary sectors and test new, more innovative approaches to achieve multifunctional land use

Relu research projects offer numerous insights into different aspects of these four key challenges and how they might be addressed. From developing methods and models to understand the impacts and trade-offs of different land uses, to how to engage local communities and others in understanding land use problems and developing solutions. In many cases, the research is still in progress and any results are provisional. The inclusion of these projects here hopefully encourages policy makers and stakeholders to keep a watching brief on them and encourages researchers to frame their results in the context of the land use challenges identified. The Relu programme is also highlighting the value of interdisciplinary research; policy development and design needs to be interdisciplinary too. There also appears to be a need for better integration and communication between the research and policy communities if we are to really address the problems and dilemmas we face. New research needs are emerging all the time and a number of issues that might warrant further investigation have been identified.

The way the land lies – how we view it and what we expect of it - is constantly evolving. The debate about the future use and management of Scotland's rural land resources is alive and kicking. This paper represents a contribution to that debate and will hopefully provide some food for thought and reflection as the Scottish Government's Land Use Study proceeds throughout the coming year.

The Lie of the Land

Future Challenges for Rural Land Use Policy in Scotland and Possible Responses

1. Introduction

We live in a small country, of finite land resources. The demands we make of this land are multifarious and increasingly complex. As population grows and living standards rise, so too does our need for land on which to build the infrastructure necessary for modern-day living – houses, offices, shops, roads and airports, for example. The settlements in which we live and work and the inter-connecting routes by which we travel are extensive and expanding. But surrounding this built environment lies open land – fields, forests, moorland, lochs and rivers – which comprise the rural landscape. It too is a workplace, producing vital goods and services on which we all rely.

Some of the goods and services produced from our rural land resources are obvious to see - food, fibre and timber. But other goods and services are less evident and, perhaps, more easily taken for granted. Rural land is habitat for a diversity of wildlife and the source of our drinking water supply, it cycles vital nutrients and plays a fundamental role in the carbon cycle. We value the rural landscape for aesthetic, spiritual and cultural reasons and use rural areas for recreation and play. Ensuring the continued provision of these goods and services into the future, without degrading or depleting the natural resources and ecological systems which make them possible, is perhaps the greatest challenge we face and of fundamental importance to our future health and well-being.

The debate about the future use and management of Scotland's rural land resources is not a new one, nor is it one that can ever be concluded. The lie of the land is constantly evolving. Changing demographics, new consumer demands and climate change, to highlight just a few factors with implications for land use, mean that we must continually adapt and respond to changing circumstances. How we achieve sustainable rural land management is a challenge for all of us – scientists, policy makers, rural communities and society at large. This paper is a contribution to the on-going debate about the future of Scotland's rural land resources – the challenges we need to respond to and the possible responses we might make. It is particularly relevant in the context of the recently launched, Scottish Government's Rural Land Use Study which will inform how Scotland can best use its rural land resource to achieve a range of objectives.

2. A contribution to the debate: the background to this paper

2.1 The Rural Economy and Land Use Programme

The Rural Economy and Land Use Programme (Relu) is an interdisciplinary research programme which aims to advance understanding of the challenges

facing rural areas in the UK, today and in the future. The programme, with a budget of £24 million funding research between 2004 and 2011, seeks to inform policy and practice regarding choices on how to manage the countryside and rural economies.

Recognising growing political interest in land use issues across the UK and the need to enhance dialogue and knowledge exchange between the scientific and policy communities, Relu contracted two independent Rural Land Use Analysts to work part-time from October 2007 – December 2008. These posts were funded collaboratively by the Research Councils, Defra, Scottish Government and the Commission for Rural Communities. The Analysts were given a brief of identifying challenges and lessons for policy emerging from a selected suite of 20 on-going Relu research projects (see Annex 1 for a list of projects) and of facilitating discussion of these with researchers and the policy community (including policy makers and key rural land use stakeholders).

2.2 Work Programme

This paper is the culmination of a series of activities undertaken by the Relu Land Use Policy Analysts over the past fourteen months, including:

- Preparation of a discussion paper 'Drawing Strategic Lessons from Relu Projects' which identified twelve policy themes or goals for land use policy, drawn from policy statements and strategic documents and discussions with Defra, Welsh Assembly Government and Scottish Government, and eighteen cross-cutting issues relevant to the delivery of land use policy.
- Meetings with Principal Investigators (and associated research staff) of selected Relu projects to discuss the above mentioned paper and identify policy challenges and lessons emerging from research.
- Meetings with an Advisory Group established to support the work of the Analysts and attendance at Relu's People and the Rural Environment Forum events to present and discuss on-going findings.
- Contributing to The Great Land Use Debate – an open web-based debate co-ordinated by Relu to stimulate discussion and contributions on rural land use issues.
- Preparation of a second discussion paper 'Rising to the Land Use Challenge: Issues for Policy-Makers' with input from the Relu team and research projects prior to circulation and meetings to discuss the paper with selected individuals and organisations representing the policy community. Written submissions commenting on the paper were also received from a number of stakeholders.
- Establishing links to the UK Foresight Land Use Futures project (led by Government Office for Science) and the Rural Land Use Study (led by Scottish Government).

2.3 Purpose of this Paper

This paper is intended as a contribution to the current rural land use policy debate in Scotland (see Section 3); it accompanies a paper which considers rural land use from a wider, UK perspective. The focus on Scotland recognises the differences between Scotland and the rest of the UK in relation to factors such as land use capabilities and patterns, land tenure and legislative arrangements, governance and institutions, communities and culture. This paper attempts to draw together all the information, views and ideas expressed during the course of this work that are relevant to the Scottish land use debate. It takes the Relu projects as its starting point, drawing on other work and wider analytical frameworks where appropriate. It is not, in any way, intended to be a thorough academic review of all literature and research relevant to rural land use policy, nor does it set out to make any specific recommendations. This paper is an independent report to Relu and does not represent any Relu position on rural land policy issues.

The paper is aimed at a number of different audiences. By discussing land use policy challenges, highlighting where and how current research projects might inform policy responses to these challenges and identifying potential subjects requiring further or new interdisciplinary research, it is hoped the paper will be of relevance to both the policy and research communities and to research funders. Above all, it is hoped the paper, and the process that contributed to it, will encourage dialogue and knowledge exchange on the subject of rural land use policy in Scotland.

3. Rural Land Use in Scotland: key facts and figures

Rural land in Scotland has particular characteristics and attributes that distinguish it from elsewhere in the UK. Key characteristics which have implications for land use policy are:

Much of Scotland is rural. Only 5% of its territory is classed as Predominantly Urban with 54.4% classed as Predominantly Rural and the remainder as Intermediate regions[1]. Much of this rural area has the further distinction of being remote, located more than a 30 minute drive to the nearest settlement with a population of 10,000 or more[2]. Population is heavily concentrated in several major urban areas such as Glasgow, Edinburgh, Dundee and Aberdeen. Both remote and accessible rural areas have seen increases in population in recent years (a 4.3% increase in accessible areas between 2001 and 2004).

Agriculture occupies 85% (6.12 million ha) of total land area. Most of this land is semi-natural habitat comprising rough grazing and 85% is classed as Less Favoured Area reflecting mountainous terrain, poor soils and harsh climatic conditions. Only 10% is used for crops, fallow and set-aside.

[1] Applying an OECD classification for Predominantly Rural regions based on more than 50% of the population living in municipalities with fewer than 150 inhabitants per square kilometre.

[2] Based on Scottish Government urban-rural classification referenced in 'Scotland Rural Development Programme 2007-2013', Scottish Government.

Production is dominated by livestock, mainly beef cattle and sheep with significant dairying in the south-west. Average farm size is 101 ha, large by UK standards but this masks significant variation; there are many large estates but 39% of holdings having less than 5 ha of utilised agricultural area. A large proportion of these small holdings are found in the north and west where crofting, a type of land tenure not found elsewhere in the UK, is important. The number of farm businesses fell by 10% from 1998 to 19,500 in 2004.

Woodland occupies 17% (1.33 million ha) of total land area. A further 1.3 m ha is classed as suitable for woodland and 2.2 m ha as potentially suitable. Woodland cover has increased in recent years, mainly through farm woodland planting. Some 35% of forests and woodlands are under State ownership and managed by the Forestry Commission. Scotland's forests comprise a relatively large proportion of exotic conifers for commercial production compared to the rest of the UK. Scotland's forests currently sequester 10 M t/CO_2/yr and targets have been set to increase forestry sequestration by 1M t/CO_2/yr by 2020.

43% of water bodies in the Scotland River Basin District do not meet Water Framework Objectives. But these water bodies face fewer environmental problems than most others in the UK. The main problems arise from diffuse and point source pollution, physical alterations to water bodies, abstraction and flow regulation pressures. Many problems arise from large population centres and more intensively farmed areas although water bodies in more remote rural areas are at risk from acid deposition and hydrological schemes. Some 90% of Scotland's water supplies are from surface waters and 10% from groundwater. Some 8% of the total mainland area is prime agricultural land that lies on a floodplain. Climate change is predicted to increase the incidence of flooding and result in sea level rise around Scotland's coasts but also result in long dry spells during summer months.

Scottish soils are estimated to store around 3,000 million tonnes of carbon (c. 69% of the UK total carbon storage). Most of this carbon storage is in blanket peat which is vulnerable to agricultural practices such as drainage, ploughing and overgrazing. Data on soils is poor but soil compaction, poaching and erosion is problematic in some, generally more intensively managed, areas.

Much of Scotland's rural land is of high nature and landscape value. Natural heritage designations, designed to protect the most valuable areas, include: 2 National Parks; 40 National Scenic Areas; 51 National Nature Reserves; 51 Ramsar sites; 239 Special Areas of Conservation; 141 Special Protection Areas; and, 1,455 Sites of Special Scientific Interest covering 1.04 million ha (13% of total area). Protected areas occur in most parts of Scotland but are most significant in the north and west and the central mountain areas. Much of this area is defined as High Nature Value farmland[3], the maintenance

[3] HNV farmland is a European concept that recognises the inter-relationship between farming and the environment. Providing support for HNV farmland is now a recognised challenge for public policy, particularly within the framework of the Common Agricultural Policy. Work to identify HNV farmland

of which requires the continuation of extensive farming systems. Scotland holds the largest share of HNV farmland in the UK.

4. Rural Land Use Policy in Scotland: some recent developments and emerging challenges

4.1 Recent policy developments

The use and management of Scotland's rural land takes place within the context of national and regional strategic policy frameworks and is influenced by key pieces of EU and national legislation. Land use also operates within, and is influenced by, a much wider and increasingly global context with, for example, trends in the global economy, energy and food prices having a direct bearing on land use policy and practice. It is not the intention here to provide a comprehensive overview of all relevant existing policy and legislation that affects rural land use in Scotland but to highlight some key drivers, starting from a national perspective and broadening out to consider the wider context.

The ***Government Economic Strategy*** sets out the Scottish Government's purpose, stated as: '*To focus Government and public services on creating a more successful country, with opportunities for all of Scotland to flourish, through increasing sustainable economic growth*.' Strategic objectives are for Scotland to be: wealthier and fairer; smarter; healthier; safer and stronger; and, greener. The ***National Performance Framework*** establishes national indicators and targets, many of which are of direct relevance to rural land use including:

- Grow exports at a faster average rate than GDP
- Increase the rate of new house building
- Reduce overall ecological footprint
- Increase to 95% the proportion of protected nature sites in favourable condition
- Increase the abundance of terrestrial breeding birds
- Increase the proportion of adults making one or more visits to the outdoors per week
- 50% of electricity generated in Scotland to come from renewable sources by 2020 (interim target of 31% by 2011)
- Reduce to 1.32 million tonnes of waste sent to landfill by 2010

In 2007, national and local government signed a concordat which committed both to moving towards ***Single Outcome Agreements*** (SOAs) for all 32 of Scotland's Councils. These agreements are intended to give greater freedom to local authorities to deliver the services needed in their area whilst ensuring that the outcomes of the National Performance Framework are met. SOAs will include details of how local authorities will work in partnership with Community

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and farming systems is on-going. See 'IEEP (2007) Final Report for the Study on HNV Indicators for Evaluation. Report for DG Agriculture. IEEP, London' for further elaboration of the HNV concept.

Planning Partners in the prioritisation and delivery of both national and local outcomes. SOAs should ensure the delivery of quality services with distinctive attention paid to the needs of remote rural as well as deprived urban areas.

Choosing Our Future: Scotland's Sustainable Development Strategy, published in 2005 sets out five key principles, all highly relevant to rural land use policy: living within environmental limits; ensuring a strong, healthy and just society; achieving a sustainable economy; promoting good governance; and, using sound science. ***Sustainable Development in Scotland: A review of progress by the Scottish Executive*** produced by the Sustainable Development Commission in 2007 highlighted a number of areas where improvements could be made, including:

- Greater effort to make sustainable development the key driving principle behind government policy and action;
- Greater focus on delivery of outcomes and measurable changes to the sustainability of Scotland;
- Greater integration of economic development within the wider objectives of sustainable development
- Building on initial work to establish a joined-up approach to crime, regeneration, planning, greenspace provision and community participation and enhancing community planning which has the potential to deliver integration
- Enhanced environmental performance including reducing greenhouse gas emissions, giving greater focus to energy efficiency and demand reduction, more sustainable transport and waste reduction.

Responding to climate change is a key priority for the Scottish Government. Scotland's ***Climate Change Adaptation Framework*** will identify roles and responsibilities in adapting to climate change for key decision makers throughout Scotland. A first public consultation – ***Adapting Our Ways: Managing Scotland's Climate Risk*** – on the initial outline of the Framework was conducted in 2008 and a second consultation, building on responses to the first, will be launched in 2009. This will be informed by the Scottish Government ***Climate Change (Scotland) Bill*** that is currently progressing through Parliament. The Bill is intended to create a framework to ensure a reduction in Scottish emissions by 80% by 2050. Scotland's emissions, and the potential to reduce emissions, are different from the rest of the UK, with considerable potential for renewable energy, particularly marine and wind energy. The contribution that land based sectors can make to climate change mitigation and adaptation, and the action needed, is set out in a number of reports including the report of the Agriculture and Climate Change Stakeholder Group, ***Climate Change and Scottish Agriculture.***

Scotland's economy is dominated by the service sector which accounted for 72% of GDP in 2006, followed by production (19%). Agriculture, forestry and fishing contribute the least economically, accounting for only 1.8% of GDP. Output from activities which depend on the natural environment is estimated at £17.2 billion per year (11% of total Scottish output) and supports 242,000 jobs (14% of all full time jobs in Scotland). Tourism contributes approximately

3% of GDP and in 2007 tourists spent £4,179 million with over two thirds of that coming from the domestic market. ***Scottish Tourism: the next decade***, 2006 identifies scenery and the natural environment as two of the most important factors in Scotland being a choice as a leisure destination. Opportunities for 'adventure' including activities such as mountain biking, climbing and watersports are key reasons for people to visit Scotland and play to Scotland's strengths. Its wildlife and cultural heritage are other key reasons for people to visit and many of the assets and attributes that visitors to Scotland value are located in rural areas. The strategic goal is to grow tourism by 50% by 2015 but to do so in a sustainable manner. Tourism itself, and other activities such as agriculture and forestry, can have both positive and negative impacts on the natural assets on which tourism relies.

Agriculture, the primary land use, is the subject of a number of key strategies and policy reviews. ***A Forward Strategy for Scottish Agriculture, 2001*** established a vision for a prosperous farming industry focused on: producing food and products that customers want; playing a major role in sustainable rural development and the prosperity of rural communities; being a lead player in the protection and enhancement of the environment; and, embracing change and new opportunities. The spur for this Strategy was the establishment of a devolved Government and the Foot and Mouth crisis. The Strategy established an Agriculture and Environment Working Group in 2001 to examine the environmental issues that would impact on farming and food processing businesses over the next 5-10 years and advise on how best to tackle them. The resulting ***Custodians of Change*** report identified: diffuse pollution to water; biodiversity and habitat protection; and, landscape change as the priority environmental issues for agriculture. Key recommendations included: the need for a Government strategy unit to develop more effective, integrated agricultural/environmental policies; widening the range of options supported by the Rural Development Regulation; and, promoting and funding co-operative planning and action through the Scottish Rural Development Plan (SRDP) appropriate to regional environmental priorities. The Forward Strategy was revised and updated by ***A Forward Strategy for Scottish Agriculture: Next Steps*** in 2006. This document highlighted a number of new challenges and cross-cutting issues that had become more prominent since the publication of the first strategy. These included: CAP reform and international trading arrangement; health and well-being (for both animals and humans); climate change; and, sustainable development. ***The Scottish Rural Development Programme 2007-2013*** addresses five key outcomes: improved business viability; enhanced biodiversity and landscape; improved water quality; tackling climate change; and, thriving rural communities. Sustainability and correcting market failure are two key principles underpinning the priorities of the programme. A key feature of the SRDP is to deliver outcomes that reflect regional and local circumstances (while meeting national and international objectives and obligations). This is to be achieved by administering the SRDP through a network of regional project assessment committees.

More recently, a number of independent studies and reports have highlighted concerns about the future of farming in the hills, uplands and islands. The

Committee of Inquiry into the Future of Scotland's Hills and Islands, 2008 undertaken by the Royal Society of Edinburgh highlights concerns about the decline in livestock farming and the potential negative consequences for the economy, rural communities and the environmental goods and services such farming provides. The report makes a number of recommendations including the need for on-going and improved support (through the CAP and other measures) and a substantial shift in decision making and delivery of public resources from centrally based agencies to regionally based structures and community driven approaches. Evidence of the declining numbers of livestock on Scottish hills is provided in ***Farming's Retreat from the Hills*** produced by the Scottish Agriculture College. The report emphasises the importance of the Single Farm Payment (SFP) and payments under the Less Favoured Area Scheme, Scotland (LFASS) in providing support to farm businesses. The Scottish Government is currently consulting on the future of LFASS.

Scotland is also in the process of developing a ***National Food and Drink Policy***. Following a national food discussion, a Food and Drink Leadership Forum, chaired by Cabinet Secretary Richard Lochead, has now been established to take work forward and is due to report back with initial findings and recommendations in early 2009. Other working groups will focus on: healthier eating and sensible drinking; sustainability; labelling; skills and innovation.

The way land is owned and managed has been addressed in recent years in Scotland building on the ***Recommendations for Action from the Land Reform Policy Group*** published in 1999. The reasoning for land reform is that more diverse patterns of land ownership and use and greater community involvement in decision-making should contribute positively to sustainable rural development. Legislation and other measures have been introduced to facilitate changes in land ownership and management including the Land Reform (Scotland) Act 2003, which established a community right to buy for both crofting and non-crofting communities and changes to the law on public access. The impacts of land reform cannot yet be fully evaluated as many will only emerge over extended timescales; a recent scoping study and impact assessment highlights the need for long-term monitoring and evaluation. The ***Committee of Inquiry on Crofting,*** 2008 examined the future of crofting and crofting communities including issues of control, responsibility and ownership. Together with broader land reforms, it is suggested that crofting has the potential to offer a model for people and communities in rural areas elsewhere.

The ***Scottish Forestry Strategy,*** 2006 sets out a vision, principles, outcomes and objectives for forestry in Scotland. Key outcomes include: improved health and wellbeing of people and their communities; competitive and innovative businesses contributing to the growth of the Scottish economy; and, high quality, robust and adaptable environment. The strategy includes an aspiration to increase woodlands from the current 17.1% of total land area to 25% without setting a specific target date. Forest and woodland management

is also seen as critical in relation to climate change mitigation and adaptation and to achieving targets for favourable condition of protected nature sites.

'Wild Deer in Scotland: A long term vision' published in 2000 sets out a 15-20 year vision to guide deer management and was followed in 2001 by 'The Long Term Strategy'. The Strategy suggests that a collaborative and integrated approach to land management is needed and that there are few places in Scotland where this will not involve deer. The challenge is seen as twofold: first, to integrate deer management into the wider policy context; secondly, to develop arrangements for local deer management that are sustainable and effective in delivering policy objectives.

Scotland's Biodiversity: It's In Your Hands, 2004 establishes a 2030 vision for biodiversity and an overall aim: '*To conserve biodiversity for the health, enjoyment and wellbeing of the people of Scotland, now and in the future'*. The Strategy's five key objectives are:

- To halt the loss of biodiversity and continue to reverse previous losses through targeted actions for species and habitats
- To increase awareness, enjoyment and understanding of biodiversity and engage many more people in conservation and enhancement
- To restore and enhance biodiversity in all our urban, rural and marine environments through better planning, design and practice
- To develop an effective management framework that ensures biodiversity is taken into account in all decision making
- To ensure that the best new and existing knowledge on biodiversity is available to all policy makers and practitioners

Achieving these objectives has considerable implications for the use and management of rural land. Alongside the Strategy, the ***Nature Conservation (Scotland) Act 2004*** placed a duty on all public bodies and office holders to further the conservation of biodiversity and changed the procedures for designating, reviewing and managing SSSIs.

Implementation of the EU ***Water Framework Directive*** is well underway in Scotland. Scotland's water bodies face fewer environmental problems than those in the rest of the UK but 43% of water bodies in the Scottish River Basin District do not currently meet WFD objectives of good ecological status. Agriculture (and to a lesser extent, forestry) is a key sector responsible for diffuse pollution of rivers, lochs, transitional and coastal waters, requiring changes in land management practices.

Many of these strategic documents and policies for Scotland refer to the wider economic, social and environmental context in which they operate and to relevant UK, EU and international legislation and commitments. From a global perspective, the current 'credit crunch' and recent spikes in food and energy prices will have far reaching consequences, demanding both government and individual responses, and with implications for how land is managed in Scotland. Meanwhile, international commitments on climate change and biodiversity, for example, will remain key drivers of rural land use policy into

the future. Closer to home, developments in the European Union will have implications for rural land use policy and practice. The EU Budget Review is of particular note since it will determine the size of the budget (€126.5 billion in 2007) and how it is to be spent from 2014. The CAP budget which currently accounts for the largest share of the total budget (44% in 2007) is expected to be cut, perhaps substantially, in order to fund other EU priorities such as economic growth and employment. Total CAP expenditure in Scotland in 2007 amounted to £550 million, of which direct payments accounted for 72%. Many farmers, particularly those in upland areas, are heavily dependent on public subsidy. Reductions in the EU CAP budget, of which Scotland already receives a low share, are likely to have severe implications for the sustainability of farming, especially in more marginal areas where HNV farming is predominant. New European environmental legislation such as the proposed Soil Directive could also have implications for land use and management.

4.2 Emerging challenges for land use policy

Taken as a whole, many of the key policy drivers and commitments cited here appear to demand 'more and better' of everything - more economic growth, more jobs, more vibrant rural communities and social cohesion, a better environment. Reconciling these myriad wants and needs and meeting society's expectations, whilst protecting the natural resources on which we rely, is a major policy challenge. Managing and adapting rural land use to meet a range of economic, social and environmental objectives raises some specific challenges. Identifying these challenges, understanding them and developing responses to them are all areas to which Relu research can make a contribution.

Based on discussions with Principal Investigators and research staff of selected Relu projects, with Scottish Government and rural land use stakeholders and drawing on evidence submitted to the Relu Land Use Policy Analysts during the course of the past year, a number of strategic land use policy challenges have been identified. Our research suggests we need to:

1. Promote multifunctional land use and the management practices that deliver multiple benefits
2. Develop policy that is locally responsive, flexible and adaptable
3. Develop more integrated and collaborative governance arrangements and structures and engage stakeholders and local communities in policy development and delivery
4. Provide the right mix of policy tools, encourage the private and voluntary sectors and test new, more innovative approaches to achieve multifunctional land use

5. Responding to Land Use Policy Challenges

Many of the land use challenges identified above are already being faced up to by policy makers in Scotland, as witnessed by the wide range of strategies, policy initiatives and legislative changes highlighted at Section 4.1 of this

paper. But questions of how to address these challenges remain. The 20 Relu research projects reviewed as part of this work should, in time, contribute to the evidence base needed to help answer these questions. This potential contribution and the early findings emerging from Relu research projects, are reviewed below. All of these projects are still in progress and any results are provisional. The aim here is to highlight where projects connect with certain issues and may provide definitive evidence in due course.

5.1 Promote multifunctional land use and the management practices that deliver multiple benefits

5.1.1 Understanding impacts and trade-offs

Our demands on land are many and varied. Striking a balance between the sometimes conflicting demands on rural land, especially in an era of climate change and rising global demand for food and energy, is a key challenge. Being able to identify the value of different goods and services provided by land and water resources and the potential conflicts, and possible trade-offs required, between them is critical to developing more effective decision-making processes and tools. The *Floodplains* project is exploring land management options that can join up multiple objectives including managing flood risk, water resource management, enhanced biodiversity, enjoyment of the countryside and rural livelihoods. Climate change and the need for renewable energy sources has driven a massive global expansion in biomass production on agricultural land in the last few years but rising food prices and concerns about the environmental impacts of biomass crops have combined to make this a contentious, and increasingly questioned, land use. Only by fully understanding the economic, social and environmental consequences of shifting land use towards biomass production and away from food production can conflicts and trade-offs be understood and informed land use decisions be made. The *Energy Crops* project is making a significant contribution in this regard by developing a framework for Sustainability Appraisal for two perennial biomass crops – short rotation coppice and *Miscanthus*. These appraisal methods may have wider application e.g. assessing the impacts of new woodland planting compared to alternative land uses.

Understanding the distribution of social, economic and environmental goods and services and the extent to which there may be inequalities is critical to the development of sustainable rural development policy. Research suggests that environmental deterioration and restricted access to environmental goods and services can have negative impacts on human welfare and quality of life. There is also evidence that communities that are disproportionately exposed to environmental risks may be least equipped to take action to reduce their vulnerability. The *Inequalities* project is seeking to: improve measurement of inequality; understand the distribution of social and environmental deprivation and how residents experience and perceive this; and identify if there are areas in England where environmental and social inequality demands a policy response. The methodology employed may have wider application to understanding issues facing rural communities in Scotland.

The *Water Framework Directive* project is assessing the costs and benefits of changing farming practices in order to produce a healthy river environment, with good amenity value. The methodology being developed has also been applied to the question of increasing woodlands on agricultural land, assessing the relative costs and benefits of afforestation. A key outcome of the project will be the development of a practical tool for making land use allocation decisions over large areas of land. But the methodology highlights difficulties in terms of valuing environmental attributes e.g. the value of carbon, and work is ongoing in this area. The Foresight Land Use Project is looking at different paradigms around valuation – social well-being, economic and environmental – and how these might affect our approach to land use.

5.1.2 Informing multi-functional land use decision making

Understanding the interactions between land use and the environment, the nature and magnitude of impacts under different land use scenarios, and the likely effects of possible land use policies is complex. A number of Relu projects are employing different modelling techniques to help inform our understanding of these issues and predict the possible consequences of different policy decisions. The *Hill Farming* project is using models to explore farmers' responses to policy and subsidy changes and the impacts on biodiversity and landscapes. Similarly, the *Biodiverse Farming* project is using computer models to understand farmer behaviour and impacts on biodiversity. The value of any model is highly dependent on the data and assumptions on which they are based. A number of projects recognise the importance of drawing on local knowledge and expertise in order to strengthen confidence in the outputs of models. The *Deer* project is using local knowledge to feed into ecological models and build on scientific knowledge of deer behaviour in terms of habitat use and grazing preferences. The *Catchment Management* project is using stakeholder workshops to inform land use and hydrological models and assess what 'best management practices' could be employed to achieve agreed water quality targets for surface water bodies. Several projects (*Water Framework Directive*, *Floodplains*, *Sustainable Uplands*) are taking account of carbon in their modelling work and exploring the extent to which different land management practices and scenarios might affect carbon emissions or improve carbon capture and storage. This work is highly relevant given the ambitious targets being established in Scotland for reducing greenhouse gas emissions. But discussions with stakeholders suggest differing views on how land should be used to address the carbon challenge ranging from 'choices of how we use land should start, not finish, with the issue of climate change' to 'reducing greenhouse gas emissions should not dominate policy to the exclusion of other issues'.

These differing views on how we should use land and the difficulties of valuing different environmental goods and services highlight the need for ongoing debate and research. Ultimately, how we use land will reflect political and societal choices and it is critical that these choices are informed by the best possible science and an understanding of the possible consequences and impacts of different choices.

5.2 Develop policy that is locally responsive, flexible and adaptable

5.2.1 Regional or local targeting

There is an increasing need to develop policy that is responsive to local situations and to move away from 'one size fits all' policies. This implies greater targeting of policy to regional or local level, recognising the substantial variation within and between land management enterprises and land managers in any one catchment, landscape or identifiable bio-physical zone. Several Relu projects, including *Hill Farming*, *Community Catchment Management* and *Livestock Waste*, are providing insights into these variations and may help to identify the kind of targeted policy interventions that are required to achieve specific outcomes.

5.2.2 Flexibility, risk and uncertainty

Future policy development needs to factor in risk and uncertainty and retain flexibility to adapt to changing circumstances and protect future land use options. A number of Relu projects - including *Floodplains*, *Sustainable Uplands* and *Energy Crops* are using scenario development as a means of exploring the likely impacts of different policy options. Scenarios can be particularly helpful in engaging stakeholders in discussions about land management options and related uncertainties and risks. This approach is being applied by the *Floodplains* project which has developed 6 land use scenarios e.g. 'Maximise agricultural production' and 'Maximise flood storage' to identify the objectives that could be achieved under each scenario at 8 case study sites. Risk and uncertainty in relation to floodplain management are explored through the scenarios.

Understanding and communicating the risks arising from certain kinds of land use is a key issue for the scientific and policy communities. The *Livestock Waste* project is exploring the risk that livestock agriculture has for human exposure to pathogenic organisms from watercourse (including bathing waters or consumption of contaminated shellfish). The project is promoting participatory approaches to understanding and managing risk in this area and is developing a farm-scale risk assessment tool that can be used by farmers to help understand how changes in management practices can reduce pollution risks. The *E coli* project is seeking to understand how this serious threat to human health spreads in rural environments and how the risk of people becoming infected can be reduced. As people spend more leisure time outdoors, and are encouraged to do so e.g. through recreational initiatives and health campaigns, the risk of exposure to ticks and debilitating tick-borne diseases increases. The *Animal Disease Risks* project is looking at how such risks can be reduced and what needs to be communicated to the public to keep themselves safe without scaring them off outdoor activity.

5.2.3 Longer term policy visions

Whilst policy needs to be flexible and adaptable, and responsive to risks and uncertainties, there appears to be growing demand for greater clarity

regarding the long term objectives for rural land use. The *Hill Farming* and *Sustainable Uplands* projects suggest that many farmers are uncertain whether food security, climate change or other environmental issues are now the dominant policy drivers. The *Floodplains* project suggests that '*In the farmers' view, policy has tended to switch from one extreme (maximum food production) to the other (environmental stewardship) and back again, leaving farmers in confusion about which strategy (maximising output or relying on environmental payments) is the best to guarantee their livelihoods in future*.' Their research suggests that current land use policy is often fragmented, inadequately targeted and dominated by short-term thinking. These findings highlight that unless policy makers give land managers a clearer sense of what is required from rural land at a strategic level, it will be very difficult for land managers to respond effectively. The Scottish Rural Property and Business Association (SRPBA) has suggested[4] that the global challenges we face cannot be dealt with over the term of a Rural Development Plan but require long term (30-40 years) commitment in order to provide greater clarity and security to both society and those managing land resources. The Rural Land Use Study, launched by the Scottish Government in September 2008, is a key opportunity to provide an integrated evidence base to help inform a longer term, strategic view of rural land use in Scotland and consider how different land use expectations and demands can be met.

5.3 Develop integrated and collaborative governance arrangements and structures and engage stakeholders and local communities in policy development and delivery

5.3.1 Devolving power and resources

Developing more locally responsive policy demands new ways of working and raises questions as to the appropriateness of current governance arrangements and structures. It may be necessary to move away from 'top-down' policy decision making and delivery systems towards ones that are more integrated, collaborative and 'bottom-up'. Two Relu projects suggest there may be benefit in devolving greater powers and resources (not just responsibilities) to local authorities, and the local offices of national agencies, to work with local communities to prioritise the delivery of public goods and services and develop local solutions to problems. The *Deer* project highlights the difficulties at local level of implementing multiple policies promoted by Government agencies and NGOs. The project suggests that engaging local deer managers with local agency staff at the outset of policy implementation could lead to a more sustainable relationship between national policy objectives and community objectives. The *Catchment Management* project, drawing on experience in other countries, also makes a case for a different approach to governance. The value of devolving responsibility to the local level – to elected and locally accountable bodies – is highlighted in a number of case studies. In Germany and Denmark, for example, local government is taking the lead in land and water management whilst in the US progress is

[4] SRPBA (September 2008) Policy Briefing 'Food for Thought'

being made towards integrated governmental partnerships in relation to catchment management. The move to Single Outcome Agreements with local authorities in Scotland and the development of partnerships with Community Planning Partners may represent a positive move in this direction.

5.3.2 New boundaries, new bodies?

Devolving responsibilities for decision making and service delivery to local authorities may have merit but questions remain as to how issues and problems that cut across administrative boundaries should be dealt with. For example, water catchments, valued landscapes or priority biodiversity areas will have very different delineation to local authority boundaries. An approach to land use planning and resource allocation based on ecologically relevant and socially meaningful areas either requires significant partnership working by relevant authorities and stakeholders across boundaries or entirely new governance structures. Few stakeholders consulted appear to be arguing for – or consider feasible – a radical overhaul of current land use governance structures. However, some suggest there may be a need for new co-ordinating bodies to facilitate the delivery of multiple goods and services and promote partnership working in defined areas, for example, at a landscape or catchment scale. A key role of such bodies might be the production of agreed management plans that different delivery partners sign up to. The Scottish Environment Protection Agency has already recognised the need to co-ordinate river basin planning and land use planning and proposed a Planning Working Group to inform co-ordination between RBMPs and Development Plans. Pilot projects to develop management strategies for National Scenic Areas in Wester Ross and Dumfries and Galloway have also been undertaken.

Other opportunities exist to promote partnership working. Partnership working can be facilitated by funding streams such as Leader which support Local Action Groups. The LAGs bring together multiple partners in an area to work together to achieve agreed outcomes. For example, the current Cairngorm LAG brings together the Chamber of Commerce, Association of Cairngorm Communities, Scottish Natural Heritage, Aberdeenshire Council, the National Park Authority and the Crofters Commission, among others, to help revitalise communities and develop a progressive rural economy. Identifying coherent land use zones and establishing co-ordinating bodies which, in partnership, develop a vision, agree priorities and prepare and oversee implementation of a management plan, may be one approach to achieving a more strategic and co-ordinated approach to land use planning and management and delivering multiple goods and services. Learning lessons from governance arrangements and structures applied elsewhere and potentially trying out new models of governance may be necessary in future.

5.3.3 Engaging stakeholders and local communities in policy development and delivery

Stakeholder involvement in environmental decision-making is increasingly regarded as a democratic right and is being embedded in public policy. There

are many methods of engaging ‘stakeholders’ (commonly defined as ‘anyone who is affected by or can affect the outcome of a decision’). The degree of engagement relates to its purpose: from passive dissemination of information (‘communication’), through gathering information (‘consultation’) to two-way engagement where information is exchanged through dialogue or negotiation (‘participation’). This hierarchy places ‘participation’ on the higher rungs of the ‘ladder’ of engagement. Greater emphasis on ‘participation’ is increasingly seen as desirable in moving towards more democratic and accountable decision making.

We need to understand better the potential benefits and difficulties of stakeholder engagement. Participatory processes can build consensus and can also help stakeholders learn to live with differences. Such processes should lead to better-quality and more sustainable decisions. But participatory processes have also been subject to some criticism for creating consultation fatigue, and cynicism, and disproportionately empowering minorities, but there is growing consensus over best practice participation.

In particular, Relu projects suggest that much can be gained by involving ‘non-experts’ in policy-making. Obtaining a better understanding of issues and sensitivities from the perspective of those affected by them should help policy-makers to align policy more effectively with real experience and aspirations. However, embedding participation in public policy is not without its difficulties: while stakeholders are numerous, the resources available for stakeholder engagement are constrained.

Relu research is providing insights into the following key questions:

Whom should we engage in new conversations and how?
Numerous tools can be used to explore the complex inter-relationships between stakeholders and their interests. Techniques such as Social Network Analysis and Stakeholder Analysis are being used by a number of Relu projects *(e.g. Deer, Sustainable Uplands* and *Floodplains*) to illuminate complex inter-relationships between stakeholders and could be more widely applied. The *Livestock Wastes* project has emphasised the importance of selecting approaches to engagement. ‘Speaking the right language’ and using familiar tools is very important. For example, interviews conducted around an aerial photograph or map of the farm have proved more effective than following a questionnaire, or using a laptop (putting a barrier between the farmer and interviewer). The *Angling* project highlights that some groups are difficult to engage. ‘Anglers’ are not one discrete group but diverse individuals with different motivations and perspectives on river quality, design and management. Many are interested in only one stretch of water, so it is difficult to involve them in policy discussions at river-basin scale. Many are not affiliated to any particular body - and none can claim to represent all anglers. Consulting them necessarily involves complex negotiations through many different routes. Non-traditional ‘lifestyle’ farmers may be another group that policy-makers need to engage with, given their increasing number, but which do not have a representative voice and are not easily consulted.

The question as to whether some groups (particularly large, well-funded organisations) exert undue influence on policy has arisen during the course of this work. Relu research suggests that the use of participatory processes that engage local communities, individual land managers and the wider public may provide new and varied opinions that act to balance organisational perspectives on land use issues. Some Relu projects are testing different approaches to wider public and community engagement. The *Sustainable Uplands* project has encouraged stakeholder-led visits to moorlands in the Peak District to discuss different values, options and threats for these landscapes. This has facilitated two-way learning and developed inputs for scenario modelling. The *Water Framework Directive* project has used large sample surveys, across both rural and urban populations, to address perceptions and preferences on land use issues. The *Deer* project has also examined public perceptions in relation to woodland management and deer culling. The *Energy Crops* project has surveyed attitudes among town-dwellers living near to energy crop sites: it found that local people are more concerned about associated power plant infrastructure and the potential for increased noise and road traffic than the crops themselves. A citizens' jury has been used by the *Livestock Waste* project to tap local perspectives on whether contemporary livestock farming puts watercourses at risk of microbial pollution. Members of the public were asked to consider evidence from different perspectives and then come to a collective judgement or verdict.

How do we learn from local stakeholders and help them to learn?
The *Knowledge Controversies*, *Sustainable Uplands*, *Floodplains, Livestock Waste, Community Catchment Management* and *Catchment Management* projects suggest that drawing on local knowledge and insights will greatly benefit policy. For example, local communities have sometimes rejected official 'science-based solutions' to flood-risk challenges. If modellers instead engage with local knowledge and draw on detailed, and often long-term, records and observations (e.g. about what direction the water takes and which areas flood first), they can develop better models, explore different scenarios with local people, engage them in discussion about costs and trade-offs, and deliver solutions which are widely owned. The *Deer* project is using 'participatory GIS' to integrate stakeholder and scientific knowledge to inform negotiations among neighbouring land managers about managing deer. This work is also relevant to other 'common-pool' resources.

How do we build confidence and capacity in stakeholder engagement?
Consultation fatigue, cynicism about token consultations, and pessimism about the extent to which responses will be taken into account, are real risks for policy-makers. The *Knowledge Controversies* project suggests that using intermediaries with no vested interest to lead engagement work builds confidence and delivers better outcomes. People can be more willing to engage with an independent party than with officials. This approach may be particularly valuable for controversial issues. By acting as a facilitator, catalyst, mediator and broker, the intermediary can gain feedback which would not otherwise have been possible. Although participation is increasingly becoming embedded in policy, the requirements of participatory processes do not always fit well with the organisational structures charged with

implementing these policies. Administrative costs and time may also frustrate engagement. Policy-makers may also fear a loss of control: will involving local people in designing local solutions lead to costly proposals that do not fit within national frameworks? Decision-makers may feel uncomfortable committing themselves to implement and resource the as-yet unknown outcome of a participatory process. In many cases, to do so would represent a radical shift in the organisational culture of government agencies and other institutions. There may be ways around these concerns - such as clearly setting out the environmental limits and cost constraints. Policy-makers should weigh against these challenges the clear benefits of tapping wider sources of expertise and knowledge and in so doing promoting wider ownership. Other challenges that might need to be addressed include stakeholder fatigue and the costs to citizens of giving non-paid time to participate.

5.3.4 Understanding and engaging with land managers

Given the dominance of agricultural and forestry land use in Scotland, engaging more effectively with private land managers (farmers, foresters and estate owners) will be critical to enhancing the delivery of public goods. A number of stakeholders have commented on the need to build social capital and work with the grain of land managers motivations rather than against them. There is a growing body of research which is helping us to understand the attitudes, motivations and interests of those directly managing the land and a number of Relu projects will further contribute to this evidence base. Understanding decision making frameworks can help policy makers when designing incentive schemes and developing legislation and in identifying advice and training needs to support new or different land management requirements.

Policy makers particularly need to understand why farmers might adopt alternative land uses. The *Organic* project is examining why farmers convert to organic methods and the socio-economic and environmental scale effects. Reasons why farmers see organic farming as an attractive option include: suitability of land and existing farming systems; proximity of markets; neighbourhood effects; crisis episodes forcing change; and, a desire to maintain a family farm employing household labour. The project will also assess the likely impacts of new scenarios (e.g. ‘a 20% increase in organic farming’). The *Energy Crops* project is surveying growers to understand why they grow short rotation coppice and *Miscanthus*. Responses include: the prospect of long-term contracts and, until relatively recently, low farm commodity prices; a desire to develop energy crops within a diversified business; the ease of managing these crops; and ‘testing the water’ for alternative enterprises. As with organic farming, there appears to be a ‘neighbourhood effect’ as the farmer who starts to grow the crops sets off a local chain reaction. Proximity of markets and infrastructure also influence the switch to energy crops.

During the course of our work, a number of stakeholders have suggested that the farming community in particular feel ‘under pressure’, ‘hostile’ and

'defensive' and cared for by neither government nor the public. It has also been suggested that there is widespread disillusion with rural policy makers and the apparatus of rural delivery among those who live and work in rural areas. If this is the case, the methods of engagement and participatory processes advocated and applied by many Relu research projects could provide important insights as to how to improve relationships and build trust and understanding between stakeholders and policy makers.

5.4 Provide the right mix of policy tools, encourage the private and voluntary sectors and test new, more innovative approaches to achieve multifunctional land use

5.4.1 Policy tools and instruments

Many of the goods and services provided by rural land can be defined as public goods i.e. they provide net benefits to communities as a whole but are unlikely to be fully provided by the market. For example, a farmer may manage their land in such as way that helps to store water and prevent downstream flooding in urban areas but cannot charge a price for this and recoup the costs of their effort. Securing the adequate provision of these goods and services requires public intervention to correct for market failure. Farming and other activities can also give rise to negative externalities such as the pollution of water supplies by nitrates and phosphates or the over-abstraction of water leading to shortages. Addressing these issues also demands government intervention. Interventions available to government include: information, advice, voluntary agreements, economic instruments (including taxes, levies and incentives) and regulation. Finding the best mix of interventions to promote public goods and prevent negative externalities is a continuing challenge for policy makers involving considerations of both efficiency and equity.

A number of Relu projects will provide insights into policy instruments and their potential to deliver public goods and services. For some years now, agri-environment schemes, designed to incentivise the adoption of environmentally beneficial farming practices, have been seen as key policy tools for securing the provision of public goods from agriculture. But such schemes have also been criticised for failing to achieve their objectives and value for the public money invested in them. The *Biodiverse Farming* project is exploring the impacts of farming practices on biodiversity, the motivations and drivers of farmers and hopes to identify ways in which biodiversity targets can be better achieved from agricultural land in future. Determining which new farming methods and agri-environment schemes are likely to adopted by farmers will be one output of the research.

Discussions with stakeholders have highlighted a number of issues in relation to agri-environment schemes. Payments under such schemes are required by EU legislation to be based on 'additional costs and income foregone resulting from the commitment made'. A number of commentators have suggested that

‘payments by results’ i.e. based on the value of the environmental outcomes delivered, rather than loss of agricultural income, may be more effective in incentivising behaviour. The Land Use Policy Group of the UK nature conservation agencies is looking at this issue as well as the benefits of existing agri-environment schemes. Concerns expressed about a payment by results approach relate to difficulties in valuing environmental outcomes and the costs of the monitoring required to implement such an approach. The short term nature of agri-environment agreements has also been raised as a matter of concern. Given the economic uncertainties facing many farmers, especially those in more marginal areas, it has been suggested that longer term agreements giving guaranteed income might not only be more attractive to farmers but would be in the public interest, securing the on-going provision of important public goods and services. This issue may be particularly relevant for Scotland with its high proportion of HNV farmland which depends on the continuation of traditional farming and crofting systems, many of which are under economic pressure and are not well placed to survive in a more market orientated environment.

As well as financial incentives, land managers need better information, advice and training to help them manage resources in increasingly complex and multifunctional ways. The *Agri-environment* project is exploring the different approaches adopted by farmers to agri-environment scheme management, the impacts this has on wildlife and assessing how training for farmers might influence results. The project is also highlighting that agri-environment prescriptions do not always necessarily lead to the desired outcomes as farmers are often not sufficiently engaged with the aims of the policy in the first place. This finding supports calls from some stakeholders for more proactive engagement with farmers to improve their knowledge and skills and greater emphasis on enabling more positive and radical behaviour change. This appears to be an area where both the public and private sectors have a role to play: many of the major food retailers are actively engaged with their suppliers, providing advice and extension support to achieve more sustainable production.

5.4.2 Alternative instruments

Incentive based agri-environment measures look set to remain a central component of EU rural development policy for the foreseeable future, but there may be some merit in exploring alternative mechanisms for achieving land and water management objectives. This may be particularly pertinent if the forthcoming EU Budget Review substantially reduces the Common Agricultural Policy budget and lessens the leverage of current policy mechanisms on farming. In the US, for example, conservation easements are widely used to buy out certain property rights, usually in perpetuity, from landowners. Open space covenants are used in New Zealand. Land swaps or land buy-outs may also have a role to play in future in securing the provision of public goods where they are most needed. The extent to which recent land reforms in Scotland create opportunities in these areas may warrant further consideration. Providing greater public support for community groups and building partnerships between government and the third sector (voluntary

bodies and charities) in rural areas, may also be beneficial in securing the provision of public goods.

5.4.3 Encouraging collaboration

Greater collaboration between land managers, especially where there is a need for landscape-scale or catchment scale management, is desirable. Choice experiments undertaken by the *Deer* project suggest that deer managers are averse to enforced collaboration and may not respond to incentives to encourage it. Other approaches may be more beneficial and the work will consider the role of Deer Management Groups in reaching agreement among landowners and managers. The *Catchment Management* project suggests that bringing land managers together using participatory approaches may make it harder for individuals or any one group to resist or veto the majority view. In other words, the process of dialogue and negotiation may be as important as providing other support such as incentives and advice. An earlier piece of Relu research[5] examined the role of environmental co-operatives in the Netherlands where farmers come together to enter collective agri-environment agreements. The original initiative was farmer-led, founded on a genuine desire by a group of farmers to work together, but government has facilitated this approach by providing funding for more co-operatives to start up, working with co-operatives to design appropriate agri-environment schemes and allowing co-operative agreements. Such an approach may warrant consideration in Scotland.

5.4.4 The role of the market

A number of stakeholders have questioned whether the market could do more to deliver the goods and services we require from land. Carbon emissions trading and carbon off-setting schemes are already established but there is potential for growth. The *Sustainable Uplands* project is looking at ideas for local carbon off-setting schemes; local businesses would off-set carbon emissions and the money raised would be used to fund peatland restoration projects designed to enhance carbon capture. The *Anaerobic Digestion* project is examining the potential for the development of anaerobic digestion on farms for bioenergy production. The market does not yet work in favour of energy production from such sources. For example, energy policy interventions give Liquified Petroleum Gas from fossil fuel a strong price advantage over Biogas from renewable sources. Regulations relating to the disposal of residual digestate are also a barrier at this stage. The project highlights the need for better integration of policy in relation to land use, waste and energy policy to enable the market to develop.

There has been growing interest in recent years in developing certification or labelling schemes for food and timber products produced sustainably. Such products tend to cost more than conventionally produced products since they internalise the externalties of production into the product price. The market

[5] Franks, J and Mc Gloin, A (2006) Co-operative Management of the Agricultural Environment. Relu 0009.

price is therefore a true reflection of production costs. Organic food is perhaps the best example of how production costs can be internalised but currently much depends on the willingness of consumers to pay higher prices for food with certain attributes. Two Relu projects (*Local Food* and *Nutrition*) are exploring key issues around 'healthier' food and 'local' food and assessing consumers' willingness to pay for certain food attributes. Their results will be vital to understanding public attitudes to food and purchasing choices and may help us to assess realistically how far food markets can drive the delivery of ecosystem services. An initiative in Fife – the Fife Diet – is already making headway in this area, encouraging citizens to only use produce from within the region in order to reduce carbon emissions from food transportation. The Carnegie Trust is investing funding over the next five years to create One Planet Food, a system designed to narrow the gap between producer and consumer. It is hoped Fife will be a prototype for a number of 'food hubs' in Scotland. However, food issues are complex and policy development in this field needs to consider a wide range of different impacts and potential trade-offs that might arise from different policy decisions. For example, climate campaigners argue against air freighting of fresh produce from Africa whilst poverty campaigners actively promote such trade links in the interests of economic development overseas. The *Local Food* project has found that 'freshness' is by far the main reason why consumers value local food. A fresher, air freighted product may be better than the same produce grown at home under glass (with high energy requirements) or produce transported by road from southern Europe. Equally, the *Nutrition* project suggests that policies to promote a healthier diet with less red meat could impact severely on the beef and sheep sectors, particulaly in remote areas, with impacts on the economy (loss of output and jobs) and the environment (undergrazing of habitats).

5.4.5 Learning lessons and new approaches

As some of the examples cited above demonstrate, there may be great potential to learn lessons for land use policy and practice from experiences elsewhere. However, differences between countries, for example, in relation to legislation, institutional arrangements and social norms and cultures, need to be recognised and the transferability of approaches considered carefully. The *Catchment Management* project will develop a management template providing guidance on process, scientific and data requirements and governance arrangements, drawing on international experience in the USA, Australia, Germany, Denmark and the Netherlands.

Several stakeholders have championed the need for new, more creative and innovative approaches to land management and made a case for pilot schemes and initiatives to trial different approaches to achieving multiple benefits from land. In some respects, there is past evidence of this with the development of agri-environment schemes over time demonstrating a process of policy evolution, with new ideas having been tried and tested and then adopted more widely. The analysis above suggests there is considerable scope to try new public policy tools and approaches, to learn from experiences in other countries and for the market to deliver more.

6. The need for interdisciplinarity

The Relu research programme promotes interdisciplinary research and the coming together of the social, environmental and biological sciences to consider land use issues. If greater emphasis is to be given in future to achieving multifunctional land use, and to understanding the economic, social and environmental impacts of policy, such an interdisciplinary approach to research must become more widespread. The same interdisciplinarity needs to be applied to land use policy development with decision making informed from a range of different disciplines and perspectives. For example, agriculture policy decisions need to be taken based not just on the economic effects of policy (e.g. on farm incomes, sector output, global trade etc) but also on the basis of social and environmental impacts. There is also a need for better integration and communication between the research and policy communities to ensure that research is cognisant of, and relevant to, emerging policy agendas and dilemmas and that policy is based on sound science and relevant evidence as it emerges. Perhaps new mechanisms need to be found to facilitate communication and knowledge exchange between the science and policy communities on land use issues? One suggestion made during the course of this work was for Government to organise an annual conference or event that brings policy makers, scientists and stakeholders together to discuss emerging land use policy challenges and present relevant research.

7. Future research issues

A number of areas that might profit from further research have been identified during the course of this work. The following list is by no means comprehensive but may warrant further consideration by the research community and research funders:

- ***Payments for environmental services***: paying for public goods and services, where there is recognised market failure, is a key challenge for the future. Current payment mechanisms, such as agri-environment payments, are largely based on agricultural income foregone plus costs incurred. There are concerns that this does not adequately recognise the value of public goods delivered or provide a stable source of income for farmers who enter agreements. Is there an alternative basis for payments? Research into alternative instruments and approaches to securing the provision of public goods, such as conservation easements or tendering, also warrant further analysis.
- ***Land use and climate change mitigation***: given ambitious targets for reducing emissions in Scotland and recognition of the role of land use in climate change mitigation, what would a rural landscape managed primarily to capture and store carbon and reduce emissions look like? What would the impacts on other goods and services be and what would be the implications for land management systems and practices?
- ***The role of the market***: whilst public intervention is required to correct for market failure and ensure the provision of public goods and services, is there more that could be achieved through the market?

Research might review the extent to which the market is currently delivering environmental and other goods and services (drawing on examples in the UK and abroad) and the potential for it to deliver more in future.

- ***New governance models for more co-ordinated, integrated and bottom-up approaches to land use planning and management***: achieving a more joined-up and integrated approach to land use planning and management appears to be critical given the many demands we make of land. How might this be achieved? What existing models can we draw on (including drawing on experience elsewhere)? What might new governance arrangements and structures look like and how might they operate in Scotland?

8. Conclusions

As a society, we make many demands on our rural land resources. Perhaps now, more than ever, in the face of climate change, how we use and manage those resources will determine our future health and wellbeing. Scotland has some distinctive characteristics that present both difficulties and opportunities in relation to land use. The rurality of Scotland, with much of its land area also being remote, has wide implications for the people who live there, for those who work the land and for policy. Agriculture dominates land use but much of this land is of limited agricultural capability and provides poor economic returns for those who farm it. However, the low intensity of many farming systems, especially in the more remote areas, means that Scotland has the largest share of the UK's High Nature Value farmland, important for a wide range of species and habitats. This land resource also plays a fundamental role in the provision of Scotland's water supply and stores 69% of the UK total carbon storage. Woodland and forestry is a significant land use, producing timber and other fibre but also sequestering carbon. Large areas of agricultural land are suitable or potentially suitable for woodland expansion but such expansion could, in some situations, compromise the delivery of other goods and services from land. Our choices about how to use land and how we manage it have serious implications, particularly in the face of climate change.

National, European and international policy sets the framework within which land use takes place and provides some key drivers for land use decisions. The Scottish policy initiatives, strategies and statements reviewed in this paper highlight the multiple objectives being established for land use and some of the ambitious targets – relating to, for example, water quality, biodiversity and climate change - which land use must play its part in meeting now and into the future.

The discussions undertaken throughout the course of our work have highlighted numerous land use policy challenges that we need to face over the coming years. First, we need to shift away from the sectoral, single-purpose policies of the past that zoned land primarily on its suitability for development, food and timber production or for wildlife, landscape and recreation. This approach undervalues the much wider range of public goods

and services that land and water resources can provide. In future, we need to recognise that land can, and should wherever possible, deliver multiple goods and services. Adopting such an approach requires:

- the need for agreement as to what those good and services are and their value to society in order to establish priorities and objectives (including governance structures and processes by which to achieve this)
- the need to understand the trade-offs between different goods and services and the areas of complementarity and conflicts
- the need to better understand the kind of land management systems and practices that can deliver multiple goods and services

Secondly, there is an increasing desire to ensure that policy is responsive to local situations and circumstances and to move away from the 'one size fits all' approaches of the past. There is also recognition that policy needs to be flexible and adaptable to changing circumstances. Climate change, for example, is likely to create risks (increased flooding, drought, new diseases) that will impact on land use and uncertainties (about the frequency, timing and location of events) that land use policy must respond to. At the same time, those responsible for policy delivery and those affected by it e.g. land managers, increasingly demand a strategic vision and clear sense of purpose for rural land use.

Thirdly, in line with developing more locally responsive policy, there is a recognised need to move away from 'top-down' governance arrangements and structures towards ones that are more integrated, collaborative and 'bottom-up'. This requires those responsible for policy development and delivery to work in partnership, at a spatial level which is ecologically relevant (e.g. water catchments or other bio-physical zones) and socially meaningful (i.e. recognisable to local communities). A shift to more 'bottom-up' and collaborative governance arrangements and structures demands better engagement with stakeholders and local communities to: identify problems; define objectives for land use; and, identify and deliver solutions. There is a particular need to recognise the critical role of land owners and managers in this process and their importance in terms of delivering public goods and services. Understanding private property rights and the attitudes and behaviours of landowners and managers are key issues here.

Fourthly, ensuring the delivery of public goods and services from land is likely to require public intervention and the application of a mix of policy tools including regulation, incentives and advice. Defining the 'right' mix to achieve multiple benefits is a key challenge. It may also be possible to create the conditions in which markets can help deliver desired outcomes and to help the voluntary sector deliver more. Trying and testing new approaches through pilot schemes and other initiatives and learning lessons from these may also be valuable; the most effective approaches could be rolled out more widely. Lessons can also be drawn from international experiences.

Relu research projects offer numerous insights into different aspects of these four key challenges and how they might be addressed. From developing methods and models to understand the impacts and trade-offs of different land uses, to how to engage local communities and others in understanding land use problems and developing solutions. In many cases, the research is in its early phase and it will be some time before results are available. The inclusion of these projects here hopefully encourages policy makers and stakeholders to keep a watching brief on them and encourages researchers to frame their results in the context of the land use challenges identified. The Relu programme is also highlighting the value of interdisciplinary research; policy development and design needs to be interdisciplinary too. There also appears to be a need for better integration and communication between the research and policy communities if we are to really address the problems and dilemmas we face. New research needs are emerging all the time and a number of issues that might warrant further investigation have been identified.

The way the land lies – how we view it and what we expect of it - is constantly evolving. The debate about the future use and management of Scotland's rural land resources is alive and kicking. This paper represents a contribution to that debate and will hopefully provide some food for thought and reflection as the Scottish Government's Land Use Study proceeds throughout the coming year.

ANNEX 1: RELU PROJECTS REVIEWED

Details of the 20 projects are provided below in order of expected completion date, with their short title (used solely for reference purposes in this paper), long title, and the planned completion date.

1 Local Food (Merits of Consuming Vegetables Produced Locally and Overseas) (2008)
Is importing food always a bad thing? This project is researching the advantages and disadvantages of consuming locally produced fruit and vegetables as opposed to fruit and vegetables produced overseas. Social and natural scientists are considering a range of relevant factors: greenhouse gas emissions, local employment, consumer perception of relevant attributes, nutritional quality of produce and community characteristics relating to local food cultures.
Contact Professor Gareth Edwards-Jones, University of Wales, Bangor **Email:** g.ejones@bangor.ac.uk

2 Nutrition (Implications of a Nutrition Driven Food Policy for the Countryside) (2008)
Healthy eating is the mantra of the moment but are there ways in which we could enhance the nutritional qualities of the food we eat, and what would the effect of that be for the countryside? This project is investigating whether the type of pasture cattle graze on affects the fats in their meat, whether growing soft fruit and salad crops under new ultra-violet transparent film enhances the levels of antioxidants that can reduce cancer and what the consumer demand might be for such products.
Contact Professor Bruce Traill, University of Reading **Email:** w.b.traill@reading.ac.uk

3 Floodplains (Integrated Management of Floodplains) (2008)
Recent flood events in Britain have heightened interest in exploring solutions that can join up multiple objectives such as managing flood risk, water resource management, enhanced biodiversity, enjoyment of the countryside, and support to rural livelihoods. The project is addressing these issues and re-examining a selection of agricultural flood defence schemes, previously studied by the research team in the 1980s, to identify and explain changes in land and water management that have occurred over the last 40 years.
Contact Professor Joseph Morris, Cranfield University **Email:** j.morris@cranfield.ac.uk

4 Energy Crops (Impacts of Increasing Land Use Under Energy Crops) (2008)
Future policies are likely to encourage more land use under energy crops: principally willow, grown as short rotation coppice, and *Miscanthus*, a tall, exotic grass. These crops will contribute to the UK's commitment to reduce CO2 emissions. However, it is not clear how decisions about appropriate areas for growing the crops, based on climate, soil and water, should be balanced against impacts on the landscape, social acceptance, biodiversity and the rural economy. This project integrates social, economic, hydrological and biodiversity studies in an interdisciplinary approach to develop a scientific framework for sustainability appraisal of the medium and long term conversion of land to energy crops.
Contact Dr Angela Karp, Rothamsted Research **Email:** angela.karp@bbsrc.ac.uk

5 Livestock Waste (Sustainable and Safe Recycling of Livestock Waste) (2008)
Dairy and beef farmers provide consumers with reliable sources of milk and meat but can we be sure that the animal waste is disposed of safely and without environmental and social risks? This project is investigating current perceptions of farmers, retailers, consumers and local downstream industries, such as tourism and shell fisheries, about pathogen transfers to the food chain. Changes in management practices could help to address the problem, and a farm-scale risk assessment tool is being developed to assess this. The project is determining the impacts of such changes on farm costs, and the potential costs to other stakeholder groups and the region as a whole.
Contact Dr David Chadwick, Institute of Grassland and Environmental Research **Email:** david.chadwick@bbsrc.ac.uk

6 Hill Farming (The Sustainability of Hill Farming) (2009)

Moorland ecosystems are particularly fragile. This project is investigating how we can manage them in a way that delivers sustainable hill farming communities while also protecting the environment. Taking the Peak District as a case study, the researchers are examining how farmers respond to policy changes and how they can design business plans to cope with such changes most effectively. The team is developing new modelling tools for examining the dynamics of moorland change across whole landscapes, how the actions of one farmer affect those of neighbours and how upland bird species rely on a diversity of habitats across the landscape.
Contact Dr Paul Armsworth, University of Sheffield **Email:** p.armsworth@sheffield.ac.uk

7 Biodiverse Farming (Management Options for Biodiverse Farming) (2009)
In this project, natural and social scientists are looking at the social, economic and political factors underlying farming practice, and the implications for biodiversity when farmers decide to change what they do or how they do it. They are using ecological models to predict how key biodiversity indicators such as weeds and birds will respond to the way the land is managed.
Contact Professor Bill Sutherland, Cambridge University **Email:** w.sutherland@zoo.cam.ac.uk

8 Inequalities (Social and Environmental Inequalities in Rural Areas) (2009)
This project is examining patterns of inequality in the distribution of social, economic and environmental goods and services in rural areas. They are considering how methods for measuring inequality differ within the natural and social sciences and exploring ways to resolve these differences and find a common approach. Having identified inequalities the team will be focusing on their implications, considering whether they can be regarded as unfair, and consulting with local residents about their perceptions of local inequality and injustice.
Contact Dr Meg Huby, University of York **Email:** meh1@york.ac.uk

9 Sustainable Uplands (Sustainable Uplands: Learning to Manage Future Change) (2009)
This project combines knowledge from local stakeholders, policymakers and social and natural scientists to anticipate, monitor and sustainably manage rural change in UK uplands. The result will be a choice of options to address future challenges that could never have been developed by any group alone. Factors driving future change are modelled with computers to develop detailed pictures of possible future social, economic and environmental conditions. Stakeholders and researchers then identify strategies that could help protect and enhance future livelihoods and the environment and evaluate them through computer models, site visits and other participatory methods.
Contact Dr Klaus Hubacek, Dr Mark Reed, University of Leeds **Email:** hubacek@env.leeds.ac.uk, m.s.reed@leeds.ac.uk

10 Angling (Angling in the Rural Environment) (2009)
This project focuses on the role that angling, as a leisure activity, plays in the economy and the UK countryside. Angling is seen as important for rural employment, but rivers are under pressure from a whole range of human activities so their ability to sustain flora and fauna may be at risk. This project analyses the complex natural and socio-economic inter-linkages between river, fishing, biodiversity and institutions of governance and practice. The results will be used to inform policy on integrated development of the rural river environment.
Contact Dr Liz Oughton, University of Newcastle **Email:** e.a.oughton@ncl.ac.uk

11 Deer (Collaborative Deer Management) (2009)
There are many associated costs and benefits in the management of deer. Deer management creates jobs for stalkers on forestry and sporting estates and people in the meat industry, and deer create particular landscapes that attract tourists. However in some areas, high deer numbers cause damage to sensitive habitats, to crops and gardens and cause road traffic accidents. Therefore there are many different attitudes to deer and conflicts on how best to manage them. This project is investigating how well people involved in deer management work together and how this can be improved so that the benefits are maximised whilst the costs are minimised.

Contact Dr Justin Irvine, Macaulay Institute **Email:** j.irvine@macaulay.ac.uk

12. Organic (The Effects of Scale in Organic Agriculture) (2009)
A move to organic farming can have significant effects on wildlife, soil and water quality, as well as changing the ways in which food is supplied, the economics of farm business and indeed the attitudes of farmers themselves. This project addresses two key questions: firstly, what causes organic farms to be arranged in clusters at local, regional and national scales, rather than be spread more evenly throughout the landscape, and secondly, how the ecological, hydrological, socio-economic and cultural impacts of organic farming may vary due to neighbourhood effects at a variety of scales.
Contact Dr Sigrid Stagl, University of Sussex **Email:** s.stagl@sussex.ac.uk

13. Water Framework Directive (Modelling the Impacts of the Water Framework Directive) (2010)
This project brings together hydrology, economics and other disciplines to examine both the physical impacts of the EU Water Framework Directive upon rivers and how the changes in land use needed to achieve a reduction in pollutants in water are likely to impact upon already fragile farming communities. The project also applies a variety of innovative techniques to attempt to value the likely benefits of improving outdoor water quality.
Contact Professor Ian Bateman, University of East Anglia **Email:** i.bateman@uea.ac.uk

14. Knowledge Controversies (Understanding Environmental Knowledge Controversies) (2010)
Scientists, and those who use their work, are having to think again about how science should inform democratic decision-making and the role of public engagement in this process. Taking the example of flood risk management, this project examines how and why the scientific practice of hydrological modelling becomes subject to scientific dispute and public controversy, and with what consequences for public policy. With hydrological models now capable of connecting local flood events to land management practices at catchment scale, the project is developing 'competency groups' as a new method for bringing the knowledge of local people with experience of flooding to bear on the modelling of flood risk.
Contact Professor Sarah Whatmore, Oxford University **Email:** sarah.whatmore@ouce.ox.ac.uk

15. Community Catchment Management (Testing a Community Approach to Catchment Management) (2010)
This project investigates a specific catchment - Loweswater in the Lake District - and looks at how scientists, institutional stakeholders, farmers and residents can share expertise and work together positively for the benefit of their environment. They are considering questions such as whether the current "carrot and stick" initiatives are the best option to ensure that landowners look after the environment, and whether involving local people more in decision making and using their local knowledge and expertise would be a viable approach.
Contact Dr Claire Waterton, Lancaster University **Email:** c.waterton@lancaster.ac.uk

16. Catchment Management (Catchment Management for Protection of Water Resources) (2010)
Reductions in water pollution have so far mainly been achieved through regulation and investment in waste water treatment, but the underlying water quality problem in much of the UK remains diffuse pollution derived from current and past land use plus atmospheric deposition. Best management practices and buffers that protect water courses and recharge zones can achieve much, but ultimately changes in land use may be needed in the worst affected areas. This project looks at the means, the governance needs, and the costs and benefits of alternative approaches, drawing on an analysis of international experience and investigation of two UK case study catchments.
Contact Laurence Smith, University of London (SOAS) **Email:** l.smith@soas.ac.uk

17. Anaerobic Digestion (Energy Production on Farms Through Anaerobic Digestion) (2010)
This project is examining the potential for the development of anaerobic digestion on farms, and the contribution that this could make to diversification of agricultural practice by enhanced

land use planning for bioenergy production. The research addresses the policy issues, both within the broader European Community and the UK, to identify the drivers and obstacles that could stimulate or inhibit the development of on-farm digestion as part of a wider strategy for rural development.
Contact Professor Charles Banks, University of Southampton **Email:** c.j.banks@soton.ac.uk

18. E coli (Reducing E coli Risk in Rural Communities) (2010)
E coli is a very serious threat to human health. It can be devastating and sometimes fatal, and children and elderly people are at particular risk, but we still know little about how it is spread in rural environments. Researchers from a wide range of natural and social science disciplines are working on the project and investigating how we can reduce the risk of people becoming infected.
Contact Professor Ken Killham, University of Aberdeen **Email:** k.killham@abdn.ac.uk

19. Animal Disease Risks (Assessing and Communicating Animal Disease Risks for Countryside Users) (2010)
Many people enjoy spending leisure time outdoors, but with changes in environmental conditions and use of the countryside, some risks, such as tick-borne diseases, could become more acute. This project is examining the risks, what can be done to reduce them and the kinds of information that people need to keep themselves safe, without being inappropriately alarmed.
Contact Dr Chris Quine, Forest Research, Roslin **Email:** Chris.Quine@forestry.gsi.gov.uk

20. Agri-environment (Improving the Success of Agri-environment Schemes) (2011)
Agri-environment schemes are intended to improve natural habitats but the results are mixed. is a five year study of how well wildlife habitats are created under such schemes, and whether training for farmers improves the outcomes.
Contact Professor James Bullock, CEH Wallingford **Email:** jmbul@ceh.ac.uk