

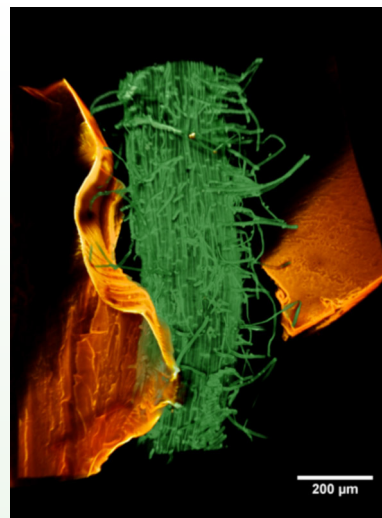
Strategic Programme

Land Use



Visualisation representing trees in an urban environment with audience participation.

Photograph: © The James Hutton Institute



Lettuce root (green) observed growing in newly developed transparent soil

Photograph: © The James Hutton Institute

Introduction

The research in this theme is focussed on sustainable management and resilience to local and global change, it is intended to improve understanding of how synergies can be achieved in relation to land use issues such as biodiversity, reduced greenhouse gas (GHG) emissions, soil and land management. This work will aid in the identification of opportunities for delivering multiple benefits from land use, combining studies of the biophysical potential of the land, and social and economic factors motivations and behaviours.

The outputs from this research will provide evidence to inform, guide or directly contribute to a range of public policies relating to environmental change. These policies cover climate change, agriculture and rural development, environmental and food security, biodiversity and nature conservation, planning, renewable energy, and communities.

Intended benefits from the Theme's research

The research is focussed on providing evidence to inform the planning, management and use of land, taking account of the interactions between social and environmental processes at different spatial and temporal scales. For example, findings from research into frameworks for risk assessment, and the estimation of benefits and effects of bulky organic fertiliser application for production and soil function support more effective use of resources by land managers in lowland agriculture. With regard to risk in managing arable land, modelling the potential capability of land for agriculture in Scotland by 2050 allows a better understanding of the range of impacts of climate change in Scotland, including a potential expansion in the area of available prime agricultural land by between 20% and 40%. Such work supports arguments for devising new ways of managing land through better irrigation and soil drainage, and also relates decisions to information associated with GHGs of grazing livestock. Research also demonstrates that dealing effectively with endemic production-limiting disease can help reduce the carbon footprint of livestock farming, while also benefiting efficient production in this important component of the food chain.

The research in the uplands includes a 'common garden' experiment in which known-provenance native Scots pine trees have been planted under contrasting climatic regimes. The findings will provide information on relationships between tree genotype and environmental factors as determinants of associated biodiversity, which will be of value to estate and woodland managers for long-term security of Scotland's natural heritage, habitats and cultural landscapes.

Irrespective of land-use sector, socio-economic factors are an important part of the definition of land use. To improve our understanding of issues associated with current and future uses, institutional arrangements, such as machinery rings, are being studied to understand their importance as key sources of information transfer within rural communities. Such findings give insight to potentially effective means of disseminating new knowledge on contemporary issues, such as renewable energy.

Key policy areas supported

Specific Scottish Government policies of relevance to this theme are the Land Use Strategy (LUSS), Renewables Routemap to 2020, Food and Drink Strategy and the Scotland Rural Development Programme (SRDP). Other actions to which this work is contributing include mitigation and adaptation under the Climate Change (Scotland) Act, Scottish Soil Framework and Soil Monitoring Action Plan, National Planning Framework 2, Scottish Planning Policy, draft Agri-renewables Strategy, and the work of the Woodland Expansion Advisory Group. At a European level, the principal policy contexts for the Land Use theme research are the Biodiversity Strategy to 2020, European Environment Strategy towards 2020, Common Agricultural Policy, and Territorial Strategy, which contextualise the equivalent Scottish Government policies, and the Climate and Energy Package – containing the “20-20-20” targets.

Outcomes and Outputs of the Research

Outputs from this research target the public, private and third sectors, comprising science, policy, industry, NGO and public audiences. The types of outputs cover scientific knowledge, conceptual, spatial and quantitative models, publicly-available data, monitoring frameworks and associated documentation.

Examples developed to date include:

- A documented National Soils Inventory of Scotland
- A DNA-based bioindicator using soil nematode community profiling for assessing soil quality and use in environmental impact assessments
- A farm-based carbon calculator of emissions to help producers reduce their carbon footprint and increase efficiency
- Cross-scale Geographic Information Systems (GIS) scenario tools which use spatial modelling to link scenarios of future socio-economic or biophysical contexts to regional and local implications for land use.

A key aspect of the research is the close engagement with stakeholders in the programme of knowledge exchange (KE), aligned with the KE strategy of the strategic research portfolio. The KE mechanisms cover electronic and printed media, and face-to-face events ranging from individual discussions to public exhibitions. Examples of events include those for industry, such as the Livestock Technology Showcase (August 2011) at the Scottish Agricultural College's Beef Research Centre in conjunction with the BioSciences Knowledge Transfer Network, and a seminar on the Common Agricultural Policy (CAP) and climate change for CAP Directors. An important purpose of the research is to enhance the links between research, education and training. Demonstration materials are being produced for use in teaching in the Curriculum for Excellence in primary, and secondary education (e.g. biosphere), and post-graduate courses (e.g. remote sensing and GIS).

The research plans are designed to deliver in a phased manner over the five-year period from 2011 to 2016. Shorter-term activities include literature reviews and the development of new approaches, such as requirements of an ecosystem approach, updated modelling of Land Capability for Agriculture, and analysis of outputs from the SG programme 2006 to 2011, such as documentation of the National Soil Inventory for Scotland.

The full term of the research is required for the design, setting up, and operational testing of new initiatives. Examples of platform experiments are:

- Monitoring CO₂ fluxes of grassland systems (Bush Estate, Midlothian)
- Long-term arable sustainability research at the Balruddery Centre for Sustainable Cropping (Perthshire)
- Long-term study of lamb live-weight gain under different anthelmintic treatments for use in the modelling GHG emissions
- Forest-to-bog chronosequence sites in GHG Responses to Land Use Change and Biodiversity and Land Use Change, at Forsinard, Caithness.

Related Research Activity

The theme research provides leverage funding from public and private sectors sources, at European and national levels. These are in three broad categories:

- European Union – evaluation of the rural development programme (e.g. ENVIEVAL, 2103 to 2016, FarmPath, 2011 to 2014, AMIGA, 2011 to 2015)
- private enterprise - liver fluke diagnostic test, microplate-based system for microbial respiration (MicroResp public service – criminal and environmental forensic investigations. Involvement in such projects contributes to the financial sustainability
- of the partner institutes, provides for a for them to demonstrate Scotland's scientific leadership and engagement at international and UK levels, and deliver opportunities for dissemination of findings from the SRP amongst peers, policy teams and stakeholders from the UK and overseas.

Key email contact

Theme leader: Prof David Miller (David.Miller@hutton.ac.uk)