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MACAULAY LAND USE RESEARCH INSTITUTE

Newsletter

Don't stop investing in the future

"Current levels of research performance are unlikely to be sustainable unless an increased proportion of our gross domestic product is spent on research and development"

"We must not ignore the fact that we are abysmally ignorant of many aspects of life that affect us now and will continue to affect us during our lifetime."

"If we have a concern about the welfare and quality of life of our children and our children's children we cannot ignore the fact that they will require information and knowledge that we don't currently have. It is our responsibility to make the necessary investment now to ensure that such information and knowledge is available to them in the future."

"We too often forget that high quality research is an investment in the future."

Professor Jeff Maxwell, Director of the Macaulay Land Use Research Institute, makes these comments in his contribution to the Institute's new annual report. He also explored similar themes as part of his delivery of the 24th T B Macaulay Lecture on May 19. In addition, the same points have been close to the surface during recent presentations which he's made to the Scottish Landowners' Federation and the RSE/SNH Millennium Conference.

"The reality of change, past, present and future, is a constant factor of life in 2000," he said. "Actually, it's always been the same throughout my involvement with agricultural and land-use science and I suspect it always will be. The challenge is to be properly equipped to meet today's requirement for change while preparing for the prospect of further changes which may be due tomorrow, or the day after that.

"There's nothing wrong with this process, of course. It's a natural progression which sometimes takes us forward and sometimes doesn't.

"Within this environment, however, I believe passionately that we must have a strong research base to enable us to understand the impact of past changes, to implement the impact of current changes while assisting policy makers to select the best options for change in the future.

"What often makes change difficult, is that society has differing priorities, just like each and every one of us, a factor which leads to competition rather than co-operation. At present, for example, we're in the midst of a shift in land-use emphasis away from food production and towards a wide range of environmental, free access and leisure demands. The public is displaying a willingness to pay for the implementation of this change in land use, at least up to a point. Whether society will be prepared to deploy the £3 billion a year which is currently used to support UK agriculture and the rural economy, in support of these new uses, is questionable.

"What is clear, is that the switching of substantial land use priorities from food to leisure, has become an inevitable process. That is today's change. Our challenge is to manage that change in a way which delivers maximum benefit to society and, above all, ensures that our land resources are maintained at the highest level of environmental and productive quality.

"In completing my 13 years as the first Director of the Macaulay Land Use Research Institute, however, I remain confident that Scotland's scientific community has the talent to assist the policy makers of today and tomorrow to choose the right options and to deliver 'Scotland the Brand', in the true meaning of that slogan, to the Scottish nation.

"That is, provided sufficient funds are invested in research to enable the scientific community to keep doing its job."

Collaboration

The need for close collaboration between Scotland's institutes and universities continues to grow says Professor Jeff Maxwell.

"It's often argued that competition for research funds militates against collaboration between different research organisations," he said. "The true test is whether both potential collaborators, and those who fund them, are able to recognise the potential added value that can flow from good collaboration.

"At the Macaulay we have collaborated extensively within Scotland, the UK and Europe, and many of our recent achievements would not have been possible without such collaboration."

Professor Maxwell also paid tribute to the increasingly valuable influence of the Aberdeen Research Consortium, which encompasses the city's institutes and universities, and the role of CHABOS, the Committee of Heads of Agricultural and Biological Organisations in Scotland.

"To secure economic growth in Scotland and an improved quality of life for its people, it will be important that the distinctive contributions which institutes and universities can make, are integrated in such a way as to make the relationship between basic, strategic, applied and developmental research as seamless as possible," he said.

Key drivers of land use change are:

- Changes in the economic fortunes of agriculture and forestry
- The influence of public opinion on land use, particularly concerning the demand for increased access
- The influence of public opinion on welfare issues, the environment and food standards
- Climate change

Emissions Control - How effective?... How costly?...&... How fast?

There can be no doubting the desire of Pan-European governments to combat the effects of industrial pollution, particularly in relation to 'acid rain'. Emissions control agreements, based on UNECE protocols and linked to the EU's Water Framework Directive, are being used as part of a continuing programme to restore the quality of acidified waters. For many countries the cost of emissions control is considerable due to the imposition of restraints on working procedures, the location of new developments and reduced levels of output. Many questions remain to be answered, however, concerning how much success is being achieved at ground level as a result of such self-control. The original first target date set for restoration was 2010, a date which features prominently in the description of a newly commissioned EU project, which the Macaulay Institute is coordinating.

Called RECOVER:2010, the project is a 1.6 million Euro (£1m) investigation which is designed to assess the impact of current and future pressures on sensitive European freshwater ecosystems. The project will also provide key end users with an assessment of the success to-date of emission control measures plus providing predictive models to show what can be achieved in the future at both international and regional levels.

"We need to know if the strategies and policies which are currently in place across Europe to achieve emissions control are going to deliver the recovery benefits for which they were designed," said Dr Bob Ferrier, the project leader at the Macaulay. "It's also necessary to establish the cost-effectiveness of current control measures as judged against the benefits which will be achieved by 2010 and to be able to say what it might cost to secure further restoration of acidified waters.

"In addition, Recover:2010, will also seek to identify what Pan-European governments consider to be acceptable levels for the recovery of acidified waters."

A meeting for 'end users', drawn from government agencies and authorities across Europe, will be held before the end of May to identify what each country would view as targets for the restoration of acidified waters. Options range, of course, from the recreation of conditions in which a few fish may be able to survive in a large number of areas to the provision of a quality environment for large numbers of fish, but only in selected and specific locations.

"We need to know, as a starting point, what the potential end users of the project's predictive models are actually aiming to achieve," said Dr Ferrier. "A clear focus on this issue will enable our development of predictive models to be much more effective than would otherwise be possible and tailored to delivering on the key policy options.

Based on data already held by the Macaulay covering changes in water quality in Galloway since 1979, the research team has already a predictive restoration model which they know is accurate when predictions are compared with actuality over the past 20 years. Such a model, produced as part of the EU DYNAMO project (which was also led by the Macaulay), will be the foundation for the building of an European network.

"We will be concentrating on a number of selected regional targets as part of Recover 2010," said Dr Ferrier. "The UK targets will be Galloway again, the Pennines and North Wales. Other targets have been chosen in Germany, Norway, etc. Clearly, we want to know what, if any, regional recovery differences exist. Ultimately, our aim is to produce models which will be tailored to meet regional characteristics."

Dr Ferrier and Dr Rachel Helliwell, head an eight-member international team of research partners (see below) in their management of Recover 2010. The project is scheduled to run for three years.

Recover research partners:
Macaulay Land Use Research Institute, UK
Institute of Hydrology, UK
University of Bayreuth, Germany
Norwegian Institute for Water Research
Czech Geological Survey
International Institute for Applied Systems Analysis, Austria

£2 million project to help EU keep pace with changing livestock policies

A £2 million project, designed to create an 'off the shelf' method for assessing the impact of changes in livestock-related polices, has been awarded by the European Commission to the Macaulay Institute as the lead centre of a five-country research team.

Due to take three years to complete, the project will be co-ordinated by the Macaulay Institute under the direction of Dr Iain Wright. Research partners are based in Germany, Denmark, Greece and the Netherlands.

The aim is to produce a management tool which will provide information for policy makers concerning the economic, environmental and social impacts of proposed livestock policy changes.

"Once the tool is built, it will be able to answer questions such as how changes in milk quota arrangements will affect different regions of the European Union, or how a shift to area-based payments will affect the condition of sensitive grassland habitats," said Dr Wright.

Traditionally, if policy makers wanted information concerning this type of change, they would commission a study, often starting from scratch in terms of gathering and collating relevant data. Once the new tool is produced the need to start from scratch will be reduced significantly.

One of the key potential benefits of the tool is that every time it is used to answer a policy question, all new data which is generated by such a process, will automatically become part of the system's data base. This will create a more advanced starting point for future analysis than exists at present.

"Studies have shown that policy makers are aware of the continual need for livestock systems to adapt to changing situations," said Dr Wright. "Our task is to provide a product which will help them to understand the impact of planned changes in policy, enabling them to respond accordingly."

The tool will be designed to assess the impact of policy changes at all levels from European and national status down to a regional and local basis.

Western Isles economy - growing but vulnerable

A 20% increase in tourist activity within Scotland's Western Isles would generate an extra £6.7 million in output value while producing an additional 416 jobs for the local community.

At the same time, a 25% increase in sea transport costs would lift the price of outputs from the islands by at least 4.8%.

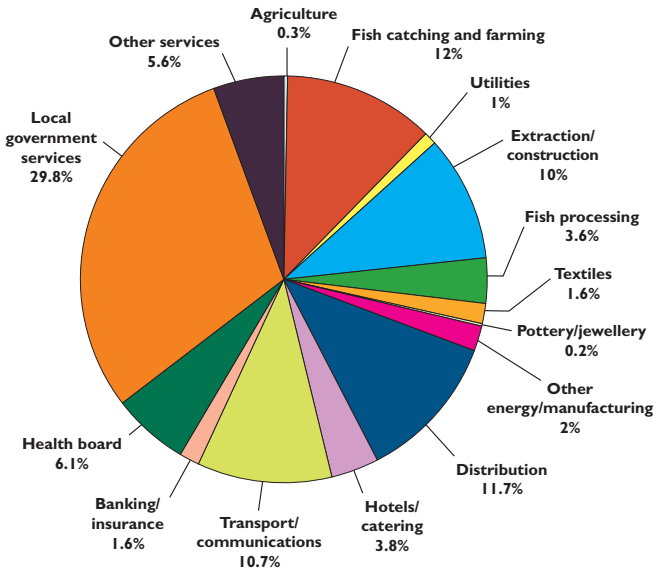
These contrasting impact scenarios are contained in a recently completed study of the Western Isles by the Macaulay Institute and the University of Aberdeen.

Combined with other study results, they show that while the islands economy has grown strongly in recent years, and has clear potential for growth in the future, the Western Isles still lags behind many other parts of the Highlands and Islands and has become increasingly vulnerable to change over the past decade.

Based on regional accounts relating to the islands' performance in 1997, the study revealed a Gross Regional Domestic Product (GRDP) of £7,827 per capita, equivalent to just 65% of the UK average and significantly lower than current estimates for Shetland, Orkney and many other parts of the Highlands and Islands.

There has been growth since the last study was carried out in 1988/89, particularly in tourism, which has advanced from 4% to 14% in terms of its contribution to the islands' GRPD. Taken along with the fact that the area has a £98m trade deficit, however, the study concludes that the Western Isles is now 'more vulnerable to change in the macroeconomy' than was previously the case.

Another change which shows continuing momentum concerns the reliance of the local economy on a few specialist sectors. Fish farming, for example, has become the Western Isles' largest net export sector while sea fishing, fish processing, education, transport and telecommunications have also become disproportionately important. The five most significant sectors, in fact, now contribute 74% of the islands' total added-value income in comparison to 61% in 1988/89.



Western Isles - Contribution to GRDP

Completed for Comhairie nan Eilean Siar (Western Isles Council) and Western Isles Enterprise, the study will be used to help shape future development policies for the islands with the aim of maximising output potential while lessening the islands vulnerability to future macroeconomic changes.

Farm Woodlands show double benefits

On a per hectare basis, farm woodlands and new native woodlands in Scotland show greater output and employment effects than commercial coniferous woodlands according to a survey carried out by the Macaulay for the Forestry Commission.

While it has generally been assumed that farm woodlands and native woodlands are primarily of environmental and recreational value, the survey showed that they both make a significant contribution to the Scottish economy. Taking into account the linkages the sector has with other sectors in the economy, the total removal of the whole sector, if that was possible, would result in a reduction of £811 million a year in Scottish output value and would cause the loss of 12,130 jobs.

"In addition to the overall conclusion, which may have surprised some people, the survey showed that a relatively high percentage of expenditures associated with forestry "leak" from the rural economy to urban areas of Scotland", said Deb Roberts, economist at the Macaulay Institute.

"For example, around 40% of the value of all input expenditures accrues to urban-based businesses whilst 17% of the money associated with timber harvesting leaks from Scotland to the rest of the UK".

Drinking Water

Drinking water quality

An evaluation of drinking water drawn from private water supplies in Aberdeenshire found that 91% of samples failed to meet statutory quality requirements.

Working with a random selection of 86 category 1F (single dwelling) private supplies, samples were taken on three separate occasions during a one-year period. Microbial analysis revealed an 89% rate of failure on at least one occasion for each of the selected supply sources. It was also found that 30% of supplies had nitrate levels in excess of the drinking waters guidelines, resulting in a combined failure rate of 91%.

Additional research, based on archival data held by Aberdeenshire Council, was then carried out in relation to water samples taken between 1992 and 1998. This revealed that out of 1585 samples, 38% failed to meet the statutory limits for total coliform count. In many cases, in fact, samples were found to contain faecal coliform. The same archival study also included an assessment of nitrate concentrations. Working with the result from 901 samples, it was found that 19% had more than the statutory limit of 50mg per litre of NO_3.

Carried out on a joint-project basis by the Macaulay and the School of Applied Sciences, Robert Gordon University, the evaluation reached the following conclusions:

- There is a clear public health risk to a significant proportion of Britain's rural population. In Scotland alone it's estimated that more than 60,000 people are dependent on private water supplies and that 50% of these draw water from category 1F sources.
- There is a need for routine statutory monitoring of all private water supplies. There is currently no statutory requirement for local authorities to monitor category 1F supplies.
- Adequate protection of private water supply sources is essential if the risk of contamination is to be reduced.

This work has been followed by two other joint projects:

- Undertaken for the Scottish Environment Protection Agency and the Scottish Executive, one project established a monitoring network to assess the status of Scottish groundwaters to satisfy the requirements of EC directives.
- The other examined the potential for developing a microbiological risk assessment based on the physical protection of the source and on the potential for pollution in the surrounding area.

Mountain hares versus native birch - a conservation conflict

Recent research by Shaila Rao and Dr Glenn Iason has confirmed that high densities of mountain hares can have a substantial impact on planted native birch saplings by causing a suppression of growth. Browsing by hares is profound in the period immediately after planting, and during subsequent winters. Trees planted in shorter heather were more accessible to hares and suffered most damage. Land managers are advised where possible not to plant in areas of high hare density and short heather. This strategy may diminish the conservation conflict between mountain hares, which are a vulnerable species, and increasing native birch woodland, also a conservation objective. The work has been carried out as part of a NERC CASE studentship, jointly with SAC and the University of Aberdeen.

Sociable sheep may eat less

Studies have shown that some sheep are more sociable than others. There are also indications that in some grazing situations the more sociable types may eat less than sheep which display greater independence.

A recent study, based on 56 female Scottish Blackface sheep, divided into eight groups of seven, found that those sheep which initially moved faster towards their companions when first released into a test area, stayed longer with their companions before moving away to graze. The same sheep also stayed closer to the dividing fence while they grazed.

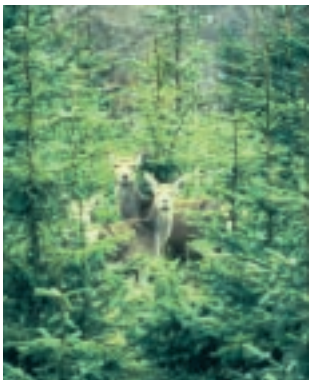
One conclusion drawn from the study, is that when vegetation is patchy, requiring sheep to spread out in order to select the best diet, the more sociable individuals may be at a disadvantage.

Deer-resistant Sitka spruce

It may be possible to grow Sitka spruce trees which are resistant to deer, so reducing browsing damage which is currently a source of significant commercial loss.

Chemicals known as mono-terpenes, which are found in conifer trees, have been shown to act as a natural repellent to tame red deer in trials carried out by the Institute and the Institute of Terrestrial Ecology, Banchory. By making use of high level mono-terpene clones, therefore, it is potentially possible to grow Sitka spruce which deer will browse less readily than would be the case with low mono-terpene trees.

The Macaulay/ITE project involved taking cuttings from 15 mature Sitka trees. Three high mono-terpene clones were then selected along with three low mono-terpene clones. Four trees from each clone, making 24 in total, were then offered simultaneously to eight red deer daily for 10 days.



Browsing records, kept for all 24 trees, revealed that the high mono-terpene trees suffered less damage than low mono-terpene trees.

The research team's conclusion is that it is possible to incorporate terpene concentrations as a selection trait in Sitka breeding programmes, so reducing browsing damage and associated economic losses.

The Three Gorges project in China

The Macaulay is currently involved in a research project in China where the creation of a 600km long reservoir, in the upper reaches of the Yangtze river, is giving rise to a number of critical land use questions.

The reservoir is being created in the Three Gorges Area by damming the Yangtze at its eastern extremity. The project is expected to result in improvements in flood control in the lower reaches of the Yangtze plus the generation of hydro-electric power.

One 'cost' of the development, however, is that the area's most productive agricultural land will be flooded. That will force local farmers to move their production processes further up the very steep sides of the gorges, a development which it is believed can only increase the risk of soil erosion.

While the immediate loss of production through loss of soil by erosion is serious enough, there's also a fear that the steady accumulation of eroded soil in the already sediment-loaded Yangtze could threaten the long-term future of the dam itself.

We are working with the Institute of Soil Science, Nanjing and the Huazhong Agricultural University, Wuhan, in seeking to address these concerns.

Using GIS techniques, Institute scientists have already reached the conclusion that the farming land which remains once the dam is complete, will be unable to support the food needs of the local population. That's a view which stands even after allowing for a reasonable amount of technical innovation in terms of future improvements in crop production potential.

The Institute is also contributing to the development of agroforestry solutions for use on the upper slopes of the Three Gorges Area. This involves the planting of trees and shrubs for fruit and fuel production, intercropped with conventional agricultural produce.

The aim of this work is to achieve maximum food and fuel output from the available area, and to do so in such a way that soil erosion is kept to a minimum.

The work is being funded by the Royal Society and the Macaulay Development Trust.

Macaulay Photo Album

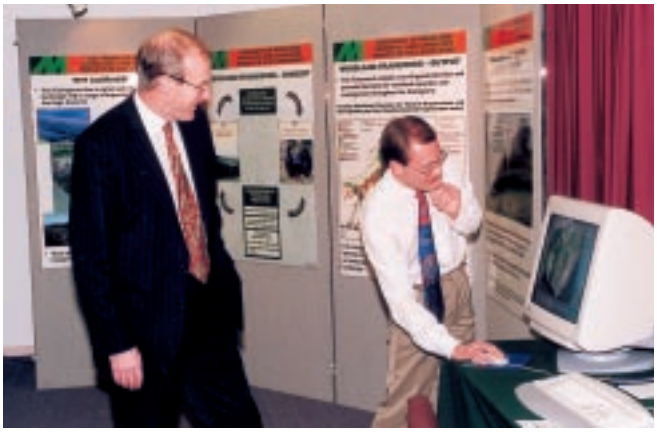
A SELECTION OF SOME OF OUR EVENTS TO DATE IN 2000

Glensaugh Research Station, February

We were delighted to welcome a range of guests including local Councillors, MSPs, SNFU members, members of our Board of Governors and neighbours to our Research Station in the eastern end of the Grampian mountains. A tour of the facilities was followed by a lively debate on current land use issues.

David Nelson, Officer in charge of Farm Resources talks about beef cattle

John Milne, Institute Deputy Director and Head of Research Stations, talks about research on fine fibre production from cashmere goats



Visit of John Home Robertson MP MSP, Deputy Minister for Rural Affairs, February. The Minister is pictured with Dr David Miller viewing some of his work on the visualisation of landscape change.

'Talk Environment' seminar, March

This was one in a series of seminars organised by Robson Mclean and KPMG. Usually held in Edinburgh, and aiming to stimulate discussion of environmental issues within the business community, a wide range of guests enjoyed David Miller's 3D visualisation as part of his presentation on 'Access to environmental data in Scotland - now and in the future'.

Edinburgh Science Festival, April

'Dr Miller's toolkit for countryside change'

We have developed an interactive computer programme which uses animated sequences and embedded video clips to introduce children and the general public to the techniques and models we have used to investigate the options and impacts of countryside change. The planting (or regeneration) of native woodlands, and the building of windfarms have been used as two case studies in the programme. The programme also includes a computer game, which challenges the user to match types of land to potential for growing trees or building windfarms. The programme had its inaugural showing at the Edinburgh Science Festival and proved popular with ages 5 to 75! We are now developing a workshop to take out to local schools based on the programme.

The photo shows some of the young visitors to the exhibition hall at the Royal Botanic Gardens, Edinburgh, during the Science Festival.

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