

Creating sustainable solutions for our land and people

Edited by Sue Bird

Uncertainty, the Precautionary Principle and Evidence-Based Policies

In dealing with the management of land for primary food production or forestry, it is inevitable, within the concept of sustainability that we are also dealing with the management of the environment. Land cannot be used for production without there being implications for the soil, vegetation, habitats for wildlife, the landscape, and the quality of water entering our streams, rivers and estuaries. However, we know also, and only too well, that while productive use of natural resources can lead to profit it can also lead to loss. This depends on markets, government support and the constraints that may be self-imposed or legally implemented to avoid over exploitation, to control the impact of pollution and to ensure food safety and animal welfare. The use and management of the land for either agriculture or forestry has become an increasingly complicated business. Agricultural and forestry managers aim to manage their resources to achieve a profit while at the same time they are obliged to meet environmental objectives and the demands and preferences of society. Thus, both industries are increasingly subject to policies of a variety of kinds. Some of these are implemented as a result of applying the precautionary principle while others are the result of soundly based evidence that suggests there is a need for strict control and regulation.

Policies that are implemented by applying the precautionary principle carry the implication that there is sufficient uncertainty about the outcome of some practices that a constraint or control is imposed until such time that more certain evidence is available. Further research aims to lead to more strongly evidence-based policies being implemented, as a consequence of which, the constraint or control may be lifted or be more strongly applied.

Much of the research at the Macaulay addresses issues within this context. It aims to reduce the uncertainties: it aims to enable systems of production to be developed within a strongly evidence-based context. It aims to produce the evidence whereby any constraints can be clearly justified or relaxed, or alternative approaches in land management can avoid the problem. Moreover, our research aims to investigate the social costs and benefits of a particular approach. This type of research has become increasingly important for producers, not least because the public at large is taking a more direct interest in what takes place in the countryside and, as taxpayers, what it costs. The research we do is crucial to the long-term viability of our countryside as a 'living' and prosperous place for people to be.

We are pleased to feature in this newsletter some examples of our research that are relevant to policy. During this autumn we have had the pleasure of hosting visits of our local MSPs to the Institute and we have enjoyed discussing some of these projects with them and gaining new insights into the type of research that the Scottish Parliament may require to support the sustainable development of rural Scotland.

Jeff Maxwell
Director

Professor Margaret Gill is appointed Director Designate of the Institute

Professor Margaret Gill has been appointed Director Designate of the Institute. Professor Gill, who is currently Chief Executive of NR International Ltd, will take up her post as Director next summer, when Professor Maxwell retires.

Professor Gill was born and brought up in Scotland and studied agricultural science at the University of Edinburgh. During the first stages of her career she worked as a research scientist in the field of ruminant nutrition at the Grassland Research Institute in Berkshire, before joining the Natural Resources Institute of the Overseas Development Administration in 1989. In 1996 she was seconded to establish NR International and was appointed to the post of Chief Executive later in that year



Commenting on her appointment Professor Gill said "My interest in agriculture was kindled on a hill farm in Scotland. Since then, and my time at the University of Edinburgh, it has been my ultimate aim to return to Scotland to contribute to the research that will impact on the continued development of its rural areas. As Director of the Macaulay I will be in a unique position to do so. It will also allow me to reinforce my commitment to high quality systems research for which the Institute has an established reputation, and to extend its portfolio of research internationally".

Interactions between Land Use and Water Quality in the Ythan Catchment

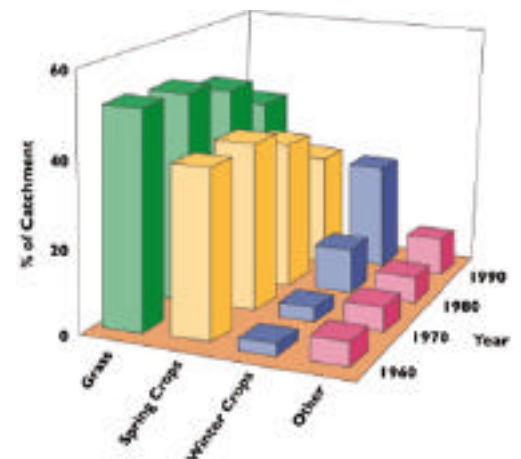
The Ythan catchment covers an area of 68000 ha in the north east of Scotland, to the north of Aberdeen. Approximately 1000 farms, covering an area of 55000 ha, are within the catchment.

The problem

- The Ythan catchment has been designated a Nitrate Vulnerable Zone, because in some streams the concentrations of nitrate exceeds 50 mg/litre (EC limit) and in the river there has been a rising trend of nitrate over a considerable period.
- On average about 1800 tonnes of nitrogen per year enters the estuary from the river. Only 2% is derived from public sewage discharge, the rest from soil and is affected by land use practices in the catchment.
- Following designation, an Action Programme will have to be drawn up to reduce nitrate emissions from terrestrial sources.

Land use in the catchment

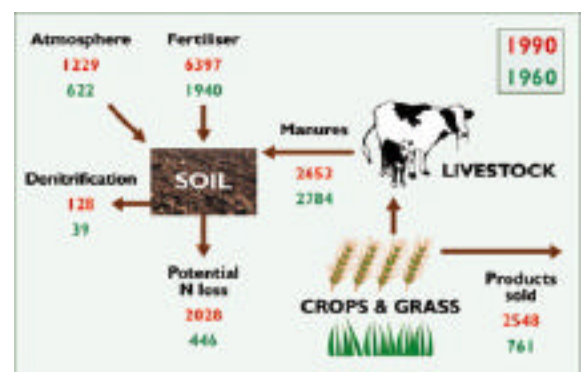
- In the cropping year 1994, 90% of the area was used for agriculture (38% as grassland, 17% autumn sown crops, 28% spring crops and 3% root crops). Only 9% of farms had no livestock and a significant proportion of the national pig herd was within the catchment.
- Changes in land use since 1960 have included a reduction in the area of grassland, a switch from spring oats to spring barley and an increase in autumn sown crops (which is similar to the national trend).
- At the whole catchment level the Ythan differs from many other catchments in Scotland by having a much larger proportion used for agriculture.



Change in areas (1960 - 1990) of main crop types for the Ythan catchment

Nitrogen budget for the catchment

- Fertiliser practices used for most crops are similar to current recommendations given by SAC, although:
 - (1) a significant proportion of autumn-sown crops still receive N at planting, and
 - (2) there is on some farms a lack of compensation for manure applied by a reduction in inorganic fertiliser use
- A nitrogen budget based on data from 1994 showed a surplus of some 5500 tonnes of nitrogen in the catchment (inputs-outputs) that year (compared with 1500 tonnes lost to the estuary). Therefore some 3000 tonnes of surplus nitrogen accumulated in the soil in that year.



Calculated fluxes of nitrogen (tonnes) for the whole catchment: 1960 and 1990

Scenarios for reducing nitrate losses

- Because of the surplus nitrogen accumulating in soil, it is impossible to predict how long any abatement measurements would take to effect a reduction in nitrate leaching but over an unspecified period we have modelled some likely outcomes.
- **Modelling different scenarios suggest that:**
 - (1) Adoption of the Prevention of Environmental Pollution from Agricultural Activities Code would reduce potential nitrate leaching by 4% over the whole catchment. Mainly pig and dairy farms would be affected (needing extra investment for slurry storage) with impacts of pig farms being greatest, reducing potential nitrate leaching by 19% and farm incomes by 9%.
 - (2) Introduction of unfertilised grassland (on 50% of the grassland in the catchment) would reduce potential nitrate leaching by 14% and farm incomes by an average of 8%.
 - (3) An increased use of set-aside (by a compulsory 50% associated with cereals, linseeds, oilseeds and protein crops) would reduce potential nitrate leaching by 12% and farm incomes by 14%.

It is important to note that our assumptions are based on the 1994 cropping year. Changes in land use and management have taken place since then. To provide a more up-to-date assessment, more recent data needs to be collected and analysed.

A report on the economic impacts of the designation of the Ythan River as a NVZ, 'Modelling Policy Impacts on Nitrate Leaching and Farm Incomes in the Ythan Catchment' is available on our website at http://www.mluri.sari.ac.uk/~apt606/eseg/publications/policy_series/policy5.pdf

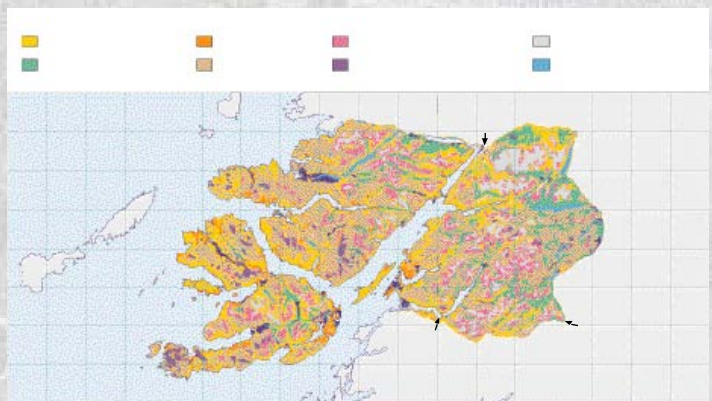
Predicting the potential distribution of native woodlands in Scotland

The native woodlands of Scotland are of national and European conservation importance because of the multiple and diverse benefits which they provide. These can include diverse wildlife habitats and as a source of timber or for recreation.

These woodlands have been reduced to less than 5% of their original area and this issue has been recognised within the UK Biodiversity Action Plan - our commitment to Agenda 21 - which contains native woodland Habitat Action Plans with explicit expansion targets for native pine woodlands and upland oakwoods.

As a tool to help guide native woodland expansion, we have developed the Native Woodland Model with support largely from Scottish Natural Heritage (SNH) but also from the Forestry Commission and the Cairngorms Partnership. The basis of the model is a series of decision rules which link site characteristics (geology, slope and rockiness, soil type and existing vegetation cover) to the requirements of National Vegetation Classification (NVC) woodland types. The site characteristics are derived from the integration of the 1:250 000 scale soil map and the 1:25 000 scale land cover map within a Geographical Information System. Although there is considerable knowledge about the relationships between most NVC woodland types and site conditions, this knowledge requires careful translation when applied to the integrated dataset. Additional research from the literature was necessary to allow us to make predictions of woodland potential over large areas of wet moorland and in the montane scrub zone.

The model has been used in a number of specific applications, notably as the zoning mechanism in the Cairngorms Forest and Woodland Framework. This Framework identifies opportunities for the development of different types of woodlands, within the constraints imposed by other land use interests, in the internationally important Cairngorms area. It forms a strategic frame of reference within which the Forestry Commission can target particular grant aid packages and helps woodland managers design schemes which empathise with the Framework objectives and provides focus for their woodland grant applications.



Potential distribution of woodland and scrub communities in part of Western Scotland.

Contact: Willie Towers, Alison Hester and Ann Malcolm

The Environmental Change Network

The Environmental Change Network (ECN) is the UK's long-term integrated monitoring network designed to aid in the detection, interpretation and forecasting of environmental changes. It is a multi-agency initiative that consists currently of 54 terrestrial and freshwater sites.

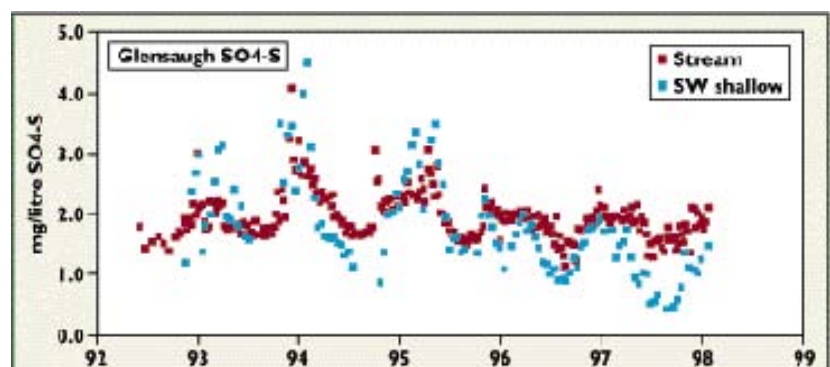
The Institute's Research Stations at Glensaugh and Sourhope were the two original Scottish terrestrial sites and have been joined recently by the Cairngorm terrestrial site which is sponsored by the Centre for Ecology and Hydrology (CEH), Scottish Natural Heritage (SNH), Scottish Environmental Protection Agency (SEPA) and the Institute.

ECN sites have historical environmental data and are making regular measurements using standardised protocols on the main drivers of change and ecosystem responses. These include air quality, water chemistry, surface water discharge and a range of vertebrate and invertebrate surveys. These long-term data are relevant to issues such as the impacts of climate change, biodiversity loss, atmospheric pollution, soil degradation and water quality.

An example of the application of ECN Data can be found in a report on indicators of climate change in the UK recently produced by the Department of the Environment, Transport and Regions (DETR). This states that ECN site and regional data will be used to supplement the national data summaries and can be used as an aid to interpreting trends in the indicators. In the future, ECN data will provide a rich source of potential new indicators that could be included in the DETR list.

Information on ECN objectives, organisation, sites and measurements, along with access to summary data are available on its web site at <http://www.nmw.ac.uk/ecn>

Contact: John Miller



ECN Glensaugh sulphate - S concentrations in soil water and streams.

Less Favoured Area compensatory payments: taking account of land quality

The new EC Rural Affairs Directive changes the way in which support is provided to the Less Favoured Areas. Instead of Hill Livestock Compensatory Allowances being paid on a headage basis to cattle and sheep, the payments will be based on area. However, the regulation states that account must be taken of land quality.

We looked at a comparison of current headage payments with area-based payments, with and without an assessment of land quality.

Figure 1 shows the current HLCA payments to a sample of 215 farms in the Scottish Executive Rural Affairs Department Farm Accounts Scheme and compares them with what farms would receive if payments were based solely on area i.e. a flat rate per hectare. Clearly there would be a massive redistribution of payments, with many farms receiving considerably more or less than they currently receive.

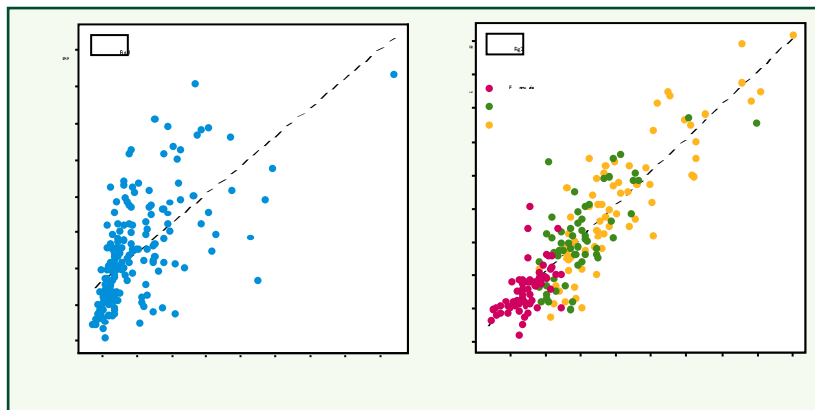


Figure 2 shows what happens to this analysis if some assessment of the quality of the land (and in particular the rough grazings) is included in the calculation. It is apparent that this method enables area-based payments to be modified to minimise the re-distribution of payments. An important finding was that there is no bias according to farm size.

The quality of the rough grazings was assessed by using the Institute's Land Cover of Scotland data set. The exact location of the sample of farms used in the study was not released by SERAD, but their location to the nearest 10km square was given. It was therefore assumed that the quality of the rough grazing on the farm was the same as that in the 10km square in which it was situated, and this will have contributed to some of the remaining variation in the results.

This method shows that it is possible to take account of the quality of land in weighting LFA compensatory payments and it has considerable merits in terms of its rationality and transparency. We hope to have the opportunity to repeat the analysis using a sample of 300 farms of known location and boundary. This method also has the potential to define area payments based on other criteria for land management (eg biodiversity) and weight payments in relation to those objectives accordingly.

Contact: **Iain Wright**

Job title

Programme Manager: Integrated Catchment Management

Research interests?

Catchment management and water quality. I believe the future is catchment management because you can't manage land and water in isolation. They are part of a continuum.

Other interests?

I have always had an interest in things aquatic - keeping fish, fishing, eating fish! They are fascinating creatures. For years I enjoyed diving which gave me a great opportunity to explore the coastline of Scotland and beyond. There is something quite spiritual about being on a boat on a peaceful summer's evening. I also like to ski, sail and play golf (when I can) and have a passion for music of all kinds. I have played in bands for years, the last one being a ten-piece soul band called 'Spoil the Dog'.

Early influences?

I spent a lot of my childhood in the countryside, fishing with my father around Oban, watching Red-Throated Divers and enjoying the natural history of Argyllshire. My school was very good at taking us on field trips and we learned a lot about Scottish landscapes/environment and our dynamic Scottish culture, which has developed into my specific interest: the impact of environment change on terrestrial and aquatic ecosystems.

Favourite country?

I love Canada. I love the rivers. It's a wonderful country with a great quality of life where the people have a wonderful attitude.

Most exhilarating moment?

My most exhilarating moment was also my scariest. I was diving on the scuttled German Grand Fleet in Scapa Flow when I got entangled on a piece of wreckage and was quickly plunged into total darkness. I managed to get myself free but it was pretty scary.

Most interesting place visited in connection with work?

I was invited to visit Biosphere in the middle of the Arizona desert which was amazing. The two-year project to house people and grow food independently from the 'outside world' failed because the concrete started to give out CO₂, the atmosphere went out of balance and the people went 'stir-crazy'. Fascinating.

Greatest fear?

To lose my sense of humour.

Next challenge?

Managing a three-year EU 5th Framework Project called RECOVER: 2010, where we will be using models to predict the recovery of acidified systems in Europe.

'IN THE CHAIR'

with Dr Bob Ferrier



'Finally, some peace to write that proposal!'