

<b>List of Posters</b>		
<b>Main author</b>	<b>Organisation</b>	<b>Poster title</b>
Phil Baarda	Scottish Natural Heritage	Targeting and assessing land-use change: a desktop user tool
Kate Baird	SEPA	Tayside mesotrophic lochs – Environmental Improvement Action Plan
Gill Calder	Scottish Wildlife Trust	Biodiversity on SWT reserves
Diana Gilbert	The Macaulay Institute	Where will montane scrub grow?
John Gordon	Scottish Natural Heritage	Developing links Between geodiversity and biodiversity to inform ecosystem management and policy development
Julie Graham	SCRI	Biodiversity in wild raspberry populations.
John Holland	Scottish Agricultural College Hill & Mountain Research Centre	Modelling a hill farm under different management scenarios: impacts on biodiversity
Sally Huband	The Macaulay Institute	Integrating farmer and crofter culture into biodiversity-related land use policies
Elizabeth Humphreys	BTO Scotland	Measuring changes in avian biodiversity within the Scottish rural landscape using the Bird Atlas
Justin Irvine	The Macaulay Institute	Collaborative frameworks in land management: A case study on integrated deer management
Davy McCracken	Scottish Agricultural College	Informing the development of farmland biodiversity prescriptions and policies
Rob Mc Morran	Scottish Wild Land Group	Wild land in Scotland – an opportunity to conserve and enhance biodiversity at landscape scales
Katie Medcalf	Environment Systems	Facilitating biodiversity planning and policy: integrating old and new techniques to deliver region wide habitat mapping.
Claire Morgan-Davies	Scottish Agricultural College	Policy simulations for the Scottish hills: where does biodiversity fit?
Robin Pakeman	Macaulay Institute	Biodiversity: carbon trade offs in crofting systems
John Parrott	Scottish Native Woods	Aspen 2020 Vision – developing Aspen habitat networks
Meg Pollock	Scottish Agricultural College	Reduced sheep grazing: implications for biodiversity indicators
Gerald Schwarz	The Macaulay Institute/ Humboldt University	Exploring the potential for pay-by-results agri-environment schemes
Anna Wilkinson	University of Aberdeen	Genotypic diversity of soil fungi regulates CO <sub>2</sub> efflux and productivity

## **Phil Baarda**

Scottish Natural Heritage, Inverness  
phil.baarda@snh.gov.uk

### **Targeting and assessing land-use change: a desktop user tool**

It is generally acknowledged that habitat fragmentation has a negative effect on biodiversity, and a changing climate is likely to make habitats and species more vulnerable. Better connectivity has been postulated as one of several possible approaches for climate change adaptation and – together with habitat size and quality – is recognised as being a key factor in land-use decision making in the UK.

In Scotland, recent advances in spatial modelling have resulted in the development of a Least Cost Path GIS tool which is catalyzing many initiatives by agency and non-agency bodies. This spatial planning tool has the potential to help deliver a variety of applications, such as:

- best-value agri-environment scheme targeting and assessment;
- forest planning, design and management;
- strategic and development planning in urban systems;
- integrated river basin management plans.

Scottish Natural Heritage is developing a simple and user-friendly mapping tool to allow basic analyses and to inform decision making. The tool is web-based and will require no specialist software or knowledge by the user.

## **Kate Baird**

SEPA, Perth  
Kate.Baird@sepa.org.uk

Other Authors: Louise Bond, Ian Fozzard

### **Tayside mesotrophic lochs – Environmental Improvement Action Plan**

The conservation of mesotrophic lochs is a key responsibility for SEPA, driven by UK, Scottish, and local Biodiversity Action Plan targets, the Water Framework Directive and responsibilities under the Nature Conservation (Scotland) Act 2004. The UK Lakes Habitat Action Plan Group has selected 32 mesotrophic lochs across Scotland which have a recorded presence of biodiversity priority species which are under threat or in decline and in need of conservation. These species include Slender naiad, Shetland pondweed, Pillwort, and some Stonewort species. These 32 priority lochs face various anthropogenic pressures (eutrophication, fish stocking, invasive alien species etc.) which threaten their ecology and water quality.

Working with partners, SEPA is pursuing local biodiversity projects to address these threats, to improve their ecological status, and to safeguard the populations of priority native plant assemblages. Some of the pressures causing deterioration are within SEPA's powers to control, but loch improvement and restoration is the responsibility of several organisations. Working in partnership is beneficial and a holistic catchment management approach can be adopted.

This poster showcases several lochs in Tayside which are part of an Environmental Improvement Action Plan, the objectives of which are to adopt a partnership approach to delivering biodiversity improvements.

## **Gill Calder**

Scottish Wildlife Trust, Edinburgh  
gcalder@swt.org.uk

Other Author: Paul Gallagher

### **Biodiversity on SWT reserves**

The Scottish Wildlife Trust manages 123 reserves covering more than 20,000ha in total. These reserves range from inner city to remote wilderness areas and from the sea to the mountain tops. SWT defines the purpose of its reserve network as "a network of wildlife reserves to safeguard a broad representation of wildlife found throughout Scotland, and to act as examples to others and for the public benefit, including: enjoyment, information and education". The aim therefore is to manage a suite of reserves that are broadly representative of Scottish wildlife habitats. This poster will provide some indication of how closely the Trust is meeting this aim.

Some 29% of the UK Biodiversity Action Plan (BAP) Priority Species present in Scotland and 11% of Scottish Biodiversity List (SBL) species have been recorded on SWT Reserves, whilst the Trust only manages 0.25% of Scotland's area. Of the 41 UK BAP Priority Habitats occurring in Scotland, 28 (68%) have been recorded on 98 SWT Reserves.

## **Diana Gilbert**

Macaulay Institute, Aberdeen  
d.gilbert@macaulay.ac.uk

Other Authors: Alison Hester, Colin Legg, Martin Price

### **Where will montane scrub grow?**

This PhD research will improve understanding of three rare high altitude shrubs, *Betula nana*, *Salix myrsinites* and *Juniperus communis*, as representative of declining treeline ecotone (or montane) scrub habitats.

The poster provides some initial outcomes from a field survey, in 2008, of a sample of the existing populations of each species. The sites surveyed were selected as representative of the range of variation found across all sites for remotely available topographic, land cover and soil data.

In addition, manipulative field experiments are generating data on the effects of winter snow cover, and the combined effects of wind and browsing, on the growth of young plants of each species.

The survey and experiments will provide the basis of guidance for future management of these shrub populations. Investigations into current land management policy will inform, and highlight deficiencies in, implementation strategies in respect of these particular species and habitats.

### **John Gordon**

Scottish Natural Heritage, Edinburgh  
john.gordon@snh.gov.uk

Other Authors: Patricia Bruneau, Vanessa Kirkbride, Alistair Rennie

## **Developing links between geodiversity and biodiversity to inform ecosystem management and policy development**

This poster outlines key links between geodiversity and biodiversity, and highlights the relevance of Earth system science in ecosystem management, particularly in the context of climate change and sea-level rise.

Geodiversity provides the foundation for natural habitats and landscapes. Understanding the functional links between geodiversity and biodiversity is particularly important for conservation management in dynamic environments, where natural processes (e.g. floods, erosion and deposition) maintain habitat diversity and ecological functions. This is explicit in the 'ecosystem approach' and is fundamental at a time when many dynamic systems are expected to respond to climate change and rising sea level.

Changes in geomorphological processes are likely to have significant implications for most ecosystems. A major challenge is to apply understanding of Earth surface processes to mitigate future impacts from climate change and sea-level rise, to help develop appropriate policies and guidance for adaptive management, and to contribute to the restoration of ecosystems already damaged by human activities.

Conservation strategies and policies for managing ecosystem responses to climate change and sea-level rise need to be informed by understanding of the spatial and temporal dynamism of natural processes, and to work in sympathy with them.

### **Julie Graham**

SCRI, Invergowrie  
julie.graham@scri.ac.uk

Other Authors: Mary Woodhead, Kay Smith, Bruce Marshall, Gavin Ramsay, Joanne Russell, Geoff Squire

## **Biodiversity in wild raspberry populations**

The red raspberry (*Rubus idaeus* ssp. *idaeus*) is cultivated on a large scale and has many sympatric wild populations in Tayside. The high potential for gene flow between these populations has encouraged the study of the interactions among wild and cultivated forms of a species. These studies have revealed that the wild red raspberry exists as a series of local populations, which are differentiated genetically and physiologically, and that the physiological differences are maintained in common environments. The wild plants are also genetically distinct from cultivated raspberries. Ten years after initial studies had been carried out, a decline in population size was observed, generally resulting mainly from habitat degradation. In the light of current concern over the impact of climate change on small fruit crops e.g., lack of winter chill, coupled with the demonstration that populations exhibit significant variation in key physiological traits, information on changes in the wild red raspberry populations over time has important practical relevance for the conservation of these populations and for the utilisation of wild germplasm in plant breeding programmes.

### **John Holland**

Scottish Agricultural College Hill & Mountain Research Centre, Crianlarich  
John.holland@sac.ac.uk

Other Authors: Tony Waterhouse, Claire Morgan-Davies

### **Modelling a hill farm under different management scenarios: impacts on biodiversity**

This poster shows the results of some simple modelling work that has been carried out at SAC's Hill and Mountain Research Centre looking at the impacts of different management scenarios on biodiversity. A number of management scenarios for a hill farm in west Perthshire were modelled. A stakeholder workshop was held at the Hill and Mountain Research Centre where four management scenarios were developed, based on what the participants thought were the most appropriate and practical SRDP Rural Priority Options (agri-environment and forestry options) that could be implemented on the hill farm. The impact of abandonment was also modelled. Using information on bird densities from the farm and local woodlands together with information on the extent and distribution of the different plant communities, higher plant species and butterfly species on the farm, an attempt was made to model the impact of the new management scenarios on the biodiversity of the farm. In addition to this biodiversity modelling, models for greenhouse gas exchange and farm economics are being developed and run for the different management scenarios.

### **Sally Huband**

The Macaulay Institute, Aberdeen  
s.huband@macaulay.ac.uk

Other Authors: Gerald Schwarz (Humboldt University, Berlin)

### **Integrating farmer and crofter culture into biodiversity-related land use policies**

This research investigates the meanings that farmers and crofters attach to the livelihoods of farming and crofting and to specific land and livestock management practices. This is contrasted with the meanings attached to land management activities directed towards biodiversity conservation. Previous work has hypothesised that farmers can accrue cultural capital from conventional productivist farming activities – or, more simply put, social standing amongst their peers and a sense of pride and self-esteem.

Activities directed at biodiversity conservation do not generate cultural capital because they are at odds with the meanings attached to conventional farming practices, e.g., if tidy farms represent good farming, then planting land with relatively unkempt looking wild bird cover will not be an attractive option. This research tests these conclusions by interviewing farmers and crofters that work high nature value (HNV) farm and croft land. Farmers and crofters with different levels and lengths of engagement in biodiversity conservation will be surveyed using semi-structured interviews. Based on the findings of these interviews, a review of existing biodiversity-related land use policies will be carried out, and opportunities and constraints for better integration of cultural aspects of farming and crofting with biodiversity goals will be assessed.

**Elizabeth Humphreys**

BTO Scotland, School of Biological and Environment Sciences, Stirling University  
liz.humphreys@bto.org

Other Authors: Simon Gillings, Dawn Balmer and Bob Swann

**Measuring changes in avian biodiversity within the Scottish rural landscape using the Bird Atlas**

The British Trust for Ornithology (BTO) runs a number of large-scale bird monitoring schemes covering a wide range of habitats across Scotland. These schemes are underpinned by the efforts of large numbers of skilled volunteers and often involve working in partnership with other organisations. The Bird Atlas 2007-11, being run in partnership with the Scottish Ornithologists' Club and BirdWatch Ireland, will provide the most comprehensive information on bird populations within Scotland's landscape to date. Using information from earlier atlases, important changes in the distribution and relative abundance of all regularly occurring breeding and wintering bird species will be identified, providing valuable insights into the underlying causal processes, such as changes in land management practices and climate change. In addition, data from the new Bird Atlas will be invaluable in terms of identifying key areas for species of conservation interest, carrying out site assessment, and facilitating the targeting of conservation initiatives. Bird Atlas information will thus represent a rigorous evidence base and key tool for Government, on which to base policy decisions concerning birds and the environment.

**Justin Irvine**

Macaulay Institute, Aberdeen  
j.irvine@macaulay.ac.uk

Other Authors: Stefano Fiorini

**Collaborative frameworks in land management: A case study on Integrated Deer Management**

Managing natural resources and understanding the conflicts that arise due to multiple land-use and ownership objectives requires participation of practitioners as well as policy makers, and an adaptive approach to developing research. Wild deer provide a useful lens to investigate this because grazing is a key driver of habitat condition, and deer management is vital to rural communities because of the income and employment it supports. Deer range freely across ownership boundaries and, increasingly, management objectives for the density of deer can vary between adjacent land-holdings, leading to conflicts. We developed novel natural and social science methodologies to integrate scientific and local expert knowledge to inform conflicts and develop consensus which could lead to more sustainable management solutions.

## **Davy McCracken**

Land Economy and Environment Research Group, Scottish Agricultural College,  
Auchincruive, Ayr  
davy.mccracken@sac.ac.uk

### **Informing the development of farmland biodiversity prescriptions and policies**

Farmland is the dominant land cover in Scotland, and many of the habitats and species on which we place high nature conservation value are dependent upon the continuation of specific farming systems and practices. The intensification of farming systems over the last 40 years has had a negative impact on farmland biodiversity, especially that associated with cropping and grazing systems in lowland Scotland. Recent declines in livestock numbers on the Scottish hills and uplands have raised concerns that abandonment of farming practices will have further negative impacts on habitats and species intimately associated with upland livestock grazing systems. All of SAC's farmland biodiversity research has the aim not only of improving understanding of farm management and biodiversity interactions but also of using the findings to develop and improve farmland biodiversity prescriptions and policies. This poster uses three examples to provide an indication of the range of research that we are engaged in.

## **Rob Mc Morran**

Scottish Wild Land Group  
enquiries@swlg.org.uk

Other Author: Jayne Glass

### **Wild land in Scotland – an opportunity to conserve and enhance biodiversity at landscape scales**

The Scottish Biodiversity Strategy calls for further landscape level approaches to the conservation and enhancement of biodiversity in Scotland. Focusing efforts on the protection and restoration of Scotland's wild land offers opportunities for biodiversity initiatives at landscape scales. Despite various policies on wildness and some attempts to map this resource in Scotland, 'wild land' remains undefined spatially. Furthermore, due to wild land in Scotland often being characterised in terms of remoteness and numbers of inhabitants, the biodiversity related values of these areas are not always fully recognised. Recent attempts to define wildness in the Cairngorms National Park include the development of a GIS wildness mapping tool. To ensure adequate recognition of the biodiversity values of wild areas, it is critical that future applications of this tool include attempts to recognise areas of high biodiversity value as well as those most suitable for habitat restoration.

Despite their value, wild landscapes remain a threatened resource, with one well recognised issue being the recent growth in proposals for energy related developments in wild areas. To ensure that Scotland's 'wild biodiversity' is adequately protected, further mapping of wildness throughout Scotland is key, as is the development of alliances and partnerships between interested and relevant stakeholders.

## **Katie Medcalf**

Environment Systems, Aberystwyth  
katie.medcalf@envsys.co.uk

Other Author: Andy Tharme (Scottish Borders Council)

### **Facilitating biodiversity planning and policy: integrating old and new techniques to deliver region wide habitat mapping.**

Scottish Borders Council and the Tweed Forum needed a Phase 1 Habitat map, including Priority Habitats, of the Tweed catchment to facilitate work at a landscape scale and for site-specific projects in terms of catchment management, planning and biodiversity policy. One feature of particular interest was the connectivity of the landscape and spatial dynamics of the semi-natural Priority Habitat communities within the area.

Environment Systems, utilising recent proven advances in imagery analysis from the remote sensing world, made the cost-effective capture of the habitat data a possibility. This was based on a combination of novel image segmentation and classification techniques in conjunction with traditional air photo interpretation and field checking using existing data sets.

The outputs currently include maps and data on Phase 1 Habitats, BAP and LBAP habitats and a hedge / linear features data set. The poster demonstrates the methods used and the results to date, and discusses accuracy; an initial calculation of network connectivity and landscape patch dynamics is presented. The poster will conclude by setting out some future uses including development planning, responding to planning applications and scheme works e.g. SRDP, RBMP and targeting of new schemes such as woodland planting.

## **Claire Morgan-Davies**

Scottish Agricultural College Hill and Mountain Research Centre, Crianlarich  
Claire.morgan-davies@sac.ac.uk

Other Authors: Tony Waterhouse

### **Policy simulations for the Scottish hills: where does biodiversity fit?**

In this study, we set out to understand stakeholders' preferences regarding different land-use policies for the hills of Scotland. We used the market simulation function within an adaptive conjoint analysis (ACA) to establish a series of policy profiles that reflected current land-use issues in the Scottish hills. Seven policy profiles were created – Carbon Footprint, Wild Land, Livestock, Forestry, National Parks, Biodiversity and Tourism – using a range of policy statements from different government agencies and NGOs to provide a series of different visions and priorities for hill land in Scotland. These profiles were then compared with actual results of stakeholders' preferences obtained from the ACA, where individuals were asked for their preferred policy action to support various approaches for a hill system. Results showed that none of the policy profiles created were very good fits to overall preferences. Some stakeholder groups favoured the "Tourism" or "Livestock" profiles, but the "Biodiversity" profile best fitted the overall stakeholders' preferences. This demonstrated that policies based on a mixture of different outcomes were more likely to be preferred to more singular ones, and that a policy profile focussed on biodiversity had strong support from a wide spectrum of stakeholders concerned with the Scottish hills.



## **Robin Pakeman**

Macaulay Institute, Aberdeen  
r.pakeman@macaulay.ac.uk

Other Author: Jenni Stockan

### **Biodiversity: carbon trade offs in crofting systems**

Until recently, the impacts of agricultural change (whether intensification, extensification or abandonment) have been seen as a trade-off between productivity and biodiversity. Now there is growing recognition that agriculture, as well as other land uses, delivers a range of ecosystem goods and services. The provision of these services may or may not be optimised alongside biodiversity. Results from a study of biodiversity and ecosystem function in a crofting landscape are used to illustrate the potential trade-offs between biodiversity and carbon sequestration.

## **John Parrott**

Scottish Native Woods, Inverness  
john.parrott@scottishnativewoods.org.uk

### **Aspen 2020 Vision – developing Aspen habitat networks**

Aspen (*Populus tremula*) supports many specialist species, especially fungi, lichens, mosses, flies, beetles, and moths. Aspen is also a preferred food-source for beavers. Five Aspen-dependent species are UK Biodiversity Action Plan (BAP) Priority Species. These species' Action Plans emphasise the importance of increasing available habitat and linking existing Aspen stands to secure the future of these species and facilitate their dispersal.

Elsewhere in its range, Aspen is valued in forestry for its fast growth and versatile timber. With its attractive appearance at all seasons, its value for wildlife and its commercial potential, Aspen could make an important contribution to the Scottish landscape and rural economy.

The project will address four principal tasks:

- to assess current distribution and status of Aspen stands in Scotland;
- to improve the supply of local origin Aspen for planting;
- to support actions to manage existing Aspen woodland and establish new stands to enhance functional connectivity between Aspen stands;
- to improve knowledge and awareness of Aspen among both land-managers and the general public.

The project will involve a wide variety of agencies, research institutions, NGOs and land-holders to achieve its objectives.

## **Meg Pollock**

Scottish Agricultural College, Crianlarich  
Meg.pollock@sac.ac.uk

Other Authors: John Holland; Tony Waterhouse

### **Reduced sheep grazing: implications for biodiversity indicators**

Current rural policies and the economics of upland farming mean that sheep grazing is declining in the uplands. This work starts to assess the biodiversity implications of this change.

A set of potential indicators of upland biodiversity was developed with input from workshop participants and experts. A number of these indicators were measured in the field at 12 paired sites where sheep grazing had been reduced on one part of a hill and maintained nearby. We found that, where sheep grazing had been reduced, deer often appeared to be more abundant than where it had been continued. Reduced sheep grazing was related to: 1) increased heather abundance and decreased abundance of rough grasses; 2) taller vegetation; and 3) a non-significant trend towards a reduction in heterogeneity. The next step in this work will be to ask people with expertise in different elements of biodiversity how the changes we have observed are likely to influence the species of which they have detailed knowledge.

A greater understanding of the biodiversity impacts resulting from reduced sheep grazing will facilitate the development of future policies and agri-environment schemes.

## **Gerald Schwarz**

Macauley Institute/Humboldt University  
schwarzg@agrar.hu-berlin.de

Other Authors: Andrew Moxey, Davy McCracken, Sally Huband, Roger Cummins

### **Exploring the potential for pay-by-results agri-environment schemes**

Agri-environment schemes have been an important policy tool within the EU for over 15 years. Currently, such schemes tend to be action-based, i.e. they offer payments for adherence to management prescriptions that are assumed to deliver environmental benefits, rather than making payments conditional on realisation of the benefits themselves. This prescription-based approach is a pragmatic response to the measurement and monitoring problems associated with many environmental benefits which can be difficult to identify, value, and ascribe to causal factors with total certainty. However, payment-for-actions does lead to economic inefficiencies. As a result, the potential for payment-by-results (PBR) as an alternative approach is generating increased international interest under a variety of different names.

This study was conducted for the UK Land Use Policy Group. The main aim was to investigate the practical feasibility of a PBR approach and to derive generic criteria for applying the approach to agri-environment schemes within both the UK and EU. The study considered how best to develop agri-environment measures based entirely on PBR and on partial use of the concept. The advantages and difficulties associated with 16 selected examples of existing PBR agri-environment schemes were reviewed. A set of generic principles for the implementation of PBR schemes was suggested and discussed in more detail, in relation to potential applications at habitat or wider landscape scale. The full report can be downloaded from the Land Use Policy Group website at: <http://www.lupg.org.uk/>

**Anna Wilkinson**

Institute of Biological and Environmental Sciences, University of Aberdeen  
r05aw7@abdn.ac.uk

Other Authors: Anna Wilkinson, Ian J. Alexander, David Johnson

**Genotypic diversity of soil fungi regulates CO<sub>2</sub> efflux and productivity**

Population genotypic richness is an emerging component of biodiversity that can have important consequences for the functioning of plant communities. However, the importance of intraspecific diversity in cryptic species like soil fungi is unknown, despite the crucial roles they play in regulating terrestrial biogeochemical cycles, particularly in north temperate and Boreal biomes.

We investigated the relationship between genotypic diversity and substrate quality on the CO<sub>2</sub> efflux and productivity of strains of the ectomycorrhizal fungi *Paxillus obscurusporus* in pure culture. The more diverse assemblages of *Paxillus obscurusporus* genotypes produced significantly greater amounts of CO<sub>2</sub> and mycelial biomass than the genetically impoverished populations. Furthermore, intraspecific diversity had a much stronger influence on CO<sub>2</sub> efflux and productivity than the four-fold carbon:nitrogen ratio manipulation of the growth medium. The effects of genotypic diversity on biomass and CO<sub>2</sub> efflux were underpinned by strong effects of individuals, and genotypic richness also increased the propensity of populations to over-yield, indicating that both complementarity and selection effects were operating. Our data demonstrate the importance of genetic diversity in species such as soil fungi, and the need to consider both the richness and composition of populations in biodiversity targets and policy.