Ecosystems and Land Use Stakeholders Engagement Group (ELSEG) Workshop Report

Monday 20th November 2017, Victoria Quay, Edinburgh




Overview

The aim of the workshop was to update stakeholders from organisations with an interest in ecosystem services and land use about progress on our research in the Scottish Government Strategic Research Programme, specifically research on Biodiversity and Ecosystem Services (WP1.3) and Sustainable and Integrated Management of Natural Assets (WP1.4). The discussions provided useful guidance about which specific areas of research could be developed, and have identified some opportunities for collaboration. The workshop was a mixture of plenary presentations, discussion and break-out workshops. It was complemented by a pre-meeting briefing, which summarised the ongoing work for the intended audience. Feedback suggested that although some perceived an imbalance between presentations and discussion, many of the stakeholders welcomed the breadth and depth of information. Afternoon discussions have indicated how work might be developed to make it more readily accessible for timely information provision for those developing policy post-Brexit. However, the discussions also highlighted a need for training researchers in how policy processes work. Overall, most participants found the event useful and stimulating and all wanted to continue to engage with the research.

Contents

Agenda

Time	Agenda Item
10:00	Registration Tea, Coffee and Biscuits
10:30	Introduction to the Day and overview of the Biodiversity and Ecosystems and the Integrated Natural Assets work packages – *Rob Brooker (JHI)*
10:40	**Biodiversity** Overview - *Robin Pakeman (JHI)* Spotlight presentations:) *Chris Ellis (RBGE)* – Lichens in the Landscape: A Macro, Meso and Microscale Mashup) *Tim George (JHI)* – Understanding Scotland's bere barley resource Q&A /discussion
11:20	**Climate Change** Overview - *Glenn Iason (JHI)* Spotlight presentations:) *Lucy Gilbert (JHI)* - Ticks and tick-borne disease: resilience to climate change) *Rebekka Artz (JHI)* - Is peatland restoration future climate-proof? Q&A /discussion
12:00	**Land Use** Overview - *Justin Irvine (JHI)* Spotlight presentations:) *Alistair McVittie (SRUC)* - Natural Capital Accounting – progress on agriculture and forestry sectors) *Scott Newey (JHI)* - CaperMap: Facilitating stakeholder dialogue to promote capercaillie conservation Q&A /discussion
12:40	**Lunch**
13:30	**Plenary Brexit Discussion** Introduction to the afternoon session – *Kirsty Blackstock (JHI)* Spotlight presentations - how our science can help:) *Ruth Mitchell (JHI)* - Understanding changes in Scotland's plant communities – uses of long-term resurvey data) *Alessandro Gimona (JHI)* - Simulating land use change

	) *Anke Fischer (JHI)* – Scenario-based evaluation of policy options and their implications) *Graham Begg (JHI)* - Sustainable agriculture options for the future) *Jessica Maxwell (JHI)* - Coordinating policy instruments that influence soil, water, and biodiversity in Scotland Break out discussions:) What evidence do stakeholders use?) What information might stakeholders need?) Are there gaps that the Work Packages might address? Report back and full group discussion
15:15	Wrap up and next steps – *Rob Brooker (JHI)*
15:30	Close

Notes from morning discussions

Biodiversity

Robin Pakeman (JHI) gave an overview of the work ongoing, then Chris Ellis (RBGE) presented on Lichens in the Landscape and Tim George (JHI) on Understanding Scotland's bere barley resource. There were questions about explaining **what 'landrace' means and also if landrace varieties perform under 'elite' conditions (e.g. in conventional agricultural soils).**

A: Landrace means adapted to specific conditions over many hundreds of years due to selective breeding and whilst the landrace varieties will grow on conventional soils, their yield will not be as high as commercial varieties. The real value is in using the diversity to show where barley could be grown in more marginal soils; the heritage values; and resilience to change. There are no incentives to pursue genetic diversity beyond the commercial premium available.

Another stakeholder asked: **do people care about lichens?**

A: Not *everyone, but many do for many reasons. Firstly, lichens may have more conservation value than most of the mega fauna people associate with Scotland, and can tell an interesting story about ecosystems (symbiosis, adaption to specific niches); visible all year and in all weathers; easy to spot and enjoy for recreational visitor [note the cross-reference to forestry questionnaire – people tend to enjoy mature open woodland with high biodiversity values]. They are also excellent indicators of good air quality; and associated with interesting figures e.g. Beatrix Potter. Scottish Natural Heritage (SNH) are interested in adopting indicators of lichens for biodiversity reporting, although there are issues (as Robin Pakeman noted) about improving the coverage of recordings in inaccessible places.*

Q: Are lichens mainly associated with broadleaf plantations?

A: No, they can grow in plantations; the main factor is the openness of the canopy.

Q: Are there any trade-offs associated with conserving bryophytes?

A: There is a trade-off between maximising timber production and conservation; as regrowth can shade out the habitat.

Q: How do you engage woodland managers in protecting these special temperate habitats?

A: One issue is that these species/habitats are poorly represented in schemes.

Q: Did the governance review look at how well local biodiversity action plans are implemented and the implementation of the biodiversity duty?

A: The duty is currently under review. The governance report was provided to the interested party.

The research on weeds and productivity is a good news story with implications for reducing herbicides and pesticides. It is important to look at both the potential benefits in terms of reduced inputs as well as the possible problems this can generate (e.g. harvesting crops with higher amounts of weed biomass). This is an area that could be addressed in the experimental treatments planned for year 3.

Climate Change

Glenn Iason (JHI) gave an overview of a range of work on climate change. He was asked **whether the resilience to climate change in the woodland research presented within or between stands?**

A: We only presented examples of variation in response to climate change between populations, but the analyses show considerable variation between families within populations.

Lucy Gilbert (JHI) presented on ticks and tick-borne disease: resilience to climate change and Rebecca Artz (JHI) presented on whether peatland restoration was future climate-proof?

Lucy was asked whether there was anything significant about the reduction in Lyme's Disease in 2008-9? As the increase might be associated with increase in staycations and also reduction in sheep stocking numbers – would be interesting to see if there are any spatial correlations between disease and sheep reductions.

Rebecca was asked **to what extent are we contributing to, or aware of and responding to CIP18 data; as CIP09 data is getting a bit old now? UKCIP18 figures will be coming out soon – will these be taken on board?**

A: For the peatland work we're not yet at the level of making predictions for 2050 and 2080. For the larger-scale predictive mapping it should be relatively easy to incorporate the new UKCIP datasets.

Q: Is it possible to identify priority areas for peatland restoration?

A: Maps are not yet good enough as they need the addition of depth data; also the models are not fully validated. Furthermore the data resolution is not useful for some groups, e.g. the state of lichen communities will not be captured by remote sensing data.

Q: Is it more effort to undertake peatland restoration where the future climate will be unsuitable?

A: *Climate-driven loss of capacity for new peat formation should not be seen as indicating the total collapse of peatland systems. So wherever you restore peatlands it will help reduce emissions.*

The peatland work is useful for reducing scepticism about the efficacy of these management approaches. Would suggest there's a need to push eastward with the work to the areas of greater challenge.

Q: What are the plans for associated knowledge exchange?

A: At the start of the work and we will need to develop ways of translating. We are using some novel approaches, e.g. working with film-makers. Worth noting that expanding this work in Scotland can be technically difficult: cloud cover can limit the availability of remote-sensed data.

Land Use

Justin Irvine (JHI) gave an overview of the range of research taking place on land use and land use change. He was asked **why get people to cooperate all the time if they want to coordinate?**

A: It may not be that they don't want to cooperate but the top-down schemes mean it is easier to adopt a coordinated approach; this is about trust. This might change if a payment by results at the landscape scale was adopted. This is very much how Defra seem to want to produce policy. GWCT agreed that trust, and distinguishing between top-down and bottom-up policy, is important.

Then Alistair McVittie (SRUC) gave a presentation on progress on agriculture and forestry sector Natural Capital Accounting (NCA), followed by Scott Newey (JHI) – on the CaperMap: Facilitating stakeholder dialogue to promote capercaillie conservation.

Q: The Office for National Statistics approach to NCA is not necessarily appropriate for Scotland due to the dynamic nature of habitats (e.g. changing definition of 'grassland'). Who is this research for?

A: Working at Scotland level as main client is Scottish Government but interest and potential to work at catchment/estate level, including looking at whether the data are transferable to these different scales. We should/could look at working with Scottish Power in Cumbernauld who are interested natural capital accounting.

Q: Which users were engaged in the development of CaperMap?

A: Due the sensitivity of Capercaillie data, the initial discussions have focussed on those organisations delivering the Capercaillie Framework and the Capercaillie Action Plan. Once CaperMap is up and running as open source application without access to sensitive species data, anyone can work with it.

Q: Will we ask local land managers for their views on providing multiple benefits as they might have a better view of what works than the models, or at least compare the two?

A: Yes, the plan is to work with local land managers to get their perspectives on these issues.

Brexit Plenary Discussion

Kirsty Blackstock (JHI) outlined the purpose of the afternoon session – to focus on how SEFARI research might be able to support policy makers, rather than duplicate the ongoing work being done to simulate what might happen under different Brexit scenarios. A series of five spotlight presentations were given (see agenda) and then participants selected which topic they wanted to discuss in more depth during the break-out groups that followed immediately afterwards.

Notes from afternoon break-out groups

Long-term environmental change – Ruth Mitchell & Glenn Iason

Four people were present at the discussion of long-term datasets: Susan Davies SWT; Adam Smith GWCT; Glenn Iason JHI and Ruth Mitchell JHI

Types and examples of long term datasets and their utility were considered. These included continuous repeated monitoring such as BTO bird survey, game bag data and regular monitoring of special sites such as the Environmental Change Network. Their usefulness cannot be predicted at the time of establishment. The Countryside Survey is good for species level data. Passive sampling which does not take account of sampling effort, but which accumulates records as they arrive, such as NBN data or records of diseases and parasites reported to the statutory authorities are of less use for scientific monitoring purposes.

The revisiting of historical one-off large-scale sampling of vegetation, or other surveys, provides a good vehicle for measuring the nature and extent of environmental change. These include the Birse and Robertson vegetation mapping, described by Ruth in her previous presentation and the International Biological Programme (1964-1974), which included broader environmental variation and function over a very large scale.

The funding of long-term data sets was discussed, and the current decline in funding for such work – e.g. Defra not funding another Countryside Survey. The importance of doing monitoring properly to get good quality data was discussed.

Focussing monitoring at the species level on to umbrella/indicator species seems a sensible approach in order to assess change in a larger proportion of a system. Ideally an indicator species should show changes in structure and function of the system. However the suitability of the indicator needs to be assessed. For example if the indicator has a commercial value e.g. a game bird, then the population of the indicator may be propped up artificially while the rest of the system declines.

If a time-repeated methodology is being proposed then a prior expectation of variation between time points should be formulated. Otherwise then interpretation of a non-changing index could range between the index is insensitive, to the system being very stable, resistant and/or resilient to change.

Can we use long-term, historical data to act as a base-line against which to assess payment by results for agri-environment schemes? Can we have methodology that allows farmers to do their own monitoring? Payment should be based on creating the right conditions for the species not necessarily on the species being present. For example payment for lapwings should be based on monitoring to assess habitat condition (plus presence/absence of predators), not just on number of lapwings present.

There is a wealth of specialist groups who can and do, of their own volition collect and provide very good quality data on their taxonomic group of interest. Systematisation of this to provide information relevant to long term environmental change might be a helpful route in future environmental monitoring programmes, although quantification of sampling effort may be absent.

It was suggested that implementation of long-term monitoring should ideally be conducted in association with experimental manipulation of the system to test its responses.

Citizen science can provide information with caveats regarding data quality and with regard to the educational, motivational and community involvement benefits of citizen science. The limits of what citizen science can provide was discussed; not all long-term monitoring can be replaced by citizen science data collection.

Other systems for useful collection of data include culling returns; an issue was raised regarding incentivizing contributors to data collection. Some data are not readily available that would provide long-term information e.g. some of the agricultural statistics, data for EIAs for planning permissions – e.g. windfarms, and monitoring post construction for windfarms.

There is a clear need to collate the long-term datasets that are already available – or at least provide a list of what long-term datasets are available. So far as we are aware there is not currently such a list.

Simulations – Alessandro Gimona & Rob Brooker

- Seem to be contradictions in the Land Capability for Agriculture approach with differences across the UK.
- Integrate UKCIP18 data, especially with respect to calculating soil moisture deficit.
- Need more unified working across the UK.
- Standardising data at international level e.g. UKCIP vs WORLDCLIM.
- Lack forward projections of some factors, e.g. pollution (N deposition), soil loss.
- May need a framework of expectations – policy
  - Match models to policy goals
  - Integrate policy into storylines
  - Can act as a reality check – what's actually needed to achieve a goal?
- Can be useful in figuring out the best place to do things, e.g. management interventions.
- Need to link models to demonstrations.
- Dynamic models are a useful tool.
- Need unifying scenarios that multiple studies can work from.
- Would be good to get a layman's guide to models which includes examples.

Scenarios – Anke Fischer & Justin Irvine

Scale

Scenario-based approaches can be useful at national and *local* scales.

Scenarios can be a mechanism to take local-scale results and synthesise for national relevance (or to scale up findings from studies at the field-scale to the wider region) and vice versa, to take national-level scenarios based on drivers of change and explore the consequences locally.

However, some aspects of policy are more relevant in some regions than others.

In participatory approaches: Three important aspects: *process*, *accessibility* (illustrate and visualise) and *learning* mean that scenarios can be useful

- Scenarios work for people – provide a description & visualisation (pictures) (*accessibility*)
- Scenarios for adaptive management (*process*)
- Bringing different knowledge and different datasets together (from different stakeholders) (*process, learning*)
- Allows iteration to reflect on mistakes/new knowledge (*learning*)

Scenario-based work can be integrated into a long-term process that builds trust between stakeholders and, in turn, builds on this trust. However, power relations can be a challenge, e.g., in meetings and workshops that needs to be taken into account.

In the future, EU policies may have less relevance; therefore how will we decide on new policies? A participatory process seems appropriate here to complement the democratic (but rather indirect) current approach. Tools such as scenario evaluation mean we engage the relevant stakeholders in the process of informing policy. (Participatory) Scenarios could be part of system where policies are iteratively reviewed and adjusted in an adaptive way.

However, Participatory Scenario Assessment is likely to be resource intensive; therefore we will have to be selective with regard to the question which policies to use them on, e.g.

- Scenario-based approaches could be useful for the Land Use Strategy – 3-6 scenarios could be selectively considered according to local context
- Scenarios might be particularly useful where there is more uncertainty about the way the system is working. i.e. to identify aspects for the system where there is understanding about how it will respond as well as aspects where there is uncertain knowledge or disagreements.
- Scenarios can also facilitate the bringing together of fine scale local knowledge with strategic political criteria together.
- A first step may be that scenarios can be used to establish where there is agreement among stakeholders over the existing knowledge base and where there is uncertainty or disagreement.

Sustainable agriculture – Graham Begg and Robin Pakeman

Current agri-environment policy and schemes (AES) are not perfect and there is an opportunity to make improvements with the replacement of the EU Common Agriculture Policy post Brexit.

Broad agreement exists around the importance of several features for future AES such as focussing on the payment of public goods; they should operate at the landscape scale, options should be based on evidence, make payments based on results and provide knowledge support to farmers, and work in concert with management options derived from other land-use policies such as those on agricultural inputs.

Discussion within this break-out group addressed some of these points, considering both underlying assumptions and issues arising from them.

Public goods: The principle of providing payment for delivery public goods was generally accepted. However, the difficultly of identifying appropriate public goods and making an accurate valuation of these was recognised. No clear solution to this was proposed in the short discussion but the need to address this was highlighted if a 'payment by results' approach was to be possible.

Evidence base: The evidence that options within current schemes are effective in delivering the intended outcomes is variable. Some options, for example those supporting farmland birds have been shown to be effective. For others such as the CAP greening measures the ex- ante justification is very general and lacks ex post confirmation of their effectiveness.

Results based payments: Current schemes predominantly top down/prescriptive with payments based on the correct implementation of the management option. It was reported that one consequence of this approach is that RPID staff spend a significant amount of time verifying that land managers have adhered to the implementation specification with little consideration of the likely benefit. The difficulty in measuring the delivery of a public good was raised as a barrier to results based payment approach; for example indicators have to be defined and monitored, while the complexity of ecosystem function could mean that an option is not successful despite the land-managers best efforts. However, it was pointed out that results based payment schemes are already being used elsewhere (e.g. http://ec.europa.eu/environment/nature/rbaps/index_en.htm) and pilot schemes should be pursued in Scotland.

In addition to the points set out above, discussion touched on social aspects associated with effective AES. This included recognition of the important role of land managers in delivering ecosystem services, based on their experience and practical insight. This could be put at risk if a shift from farming to the delivery of public goods via environmental husbandry encouraged farmers to quit.

The question of how to set the appropriate level of payment with AES was also put. Consideration of this should include an appreciation of the level of payment that would be acceptable to society while also proving necessary support to farmers and ensuring income forgone is appropriately compensated.

Finally it was pointed out that AES in some form will be required in the absence of the EU CAP as an environmental plan is needed to comply with World Trade Organisation rules.

Coordinating policy instruments – Jessica Maxwell & Kirsty Blackstock

Present: Eric McRory (SEPA); Heather McCabe (Scottish Government); Sandra Marks (RESAS); Jessica Maxwell (Hutton); Kirsty Blackstock (Hutton); Anne Brown (Hutton)

Q: Where did the research originate from and what outcomes do we seek?

A: Origin/Purpose

Linda Fleming and Sally Thomas encouraged us to focus on policy delivery mechanisms related to the Land Use Strategy. We now have an increased focus on developing a strategic approach to environment and an interest in using public money to pay for public goods. Therefore, we are focusing on the identification of areas of overlap and duplication between policy instruments; and where there can be improved linkages between instruments to deliver multiple benefits. This should help to identify what we should keep on doing (i.e. what is working) and what we could change (i.e. what isn't working so well).

Q: How and why did you choose the 10 instruments?

A: We recognised that we could not analyse all 60+ instruments related to soil, water and biodiversity in sufficient detail. We felt it was better to learn from 10 instruments based upon how they have been implemented in practice, than to try to cover all instruments. We will hopefully be able to use our findings to develop recommendations and observations that will be relevant to the longer list of 60+ instruments. We aimed to evenly cover policies related to soil, water and biodiversity (when possible) and those that affect biodiversity, water and soil. We covered the range of different approaches to policy from incentives to regulations through advice and hybrid approaches; so we have different aspects to compare and contrast.

Additional notes from the discussion

- Important to consider the unintended consequences of policies (both positive and negative).
- Opportunity to step back and ensure that we avoid duplication and focus on how best to achieve desired outcomes without complications.
- Take a look at what we need to keep to achieve outcomes; and what we can get rid of or reduce. Once this is done, we also need to consider the way to package this up and 'sell it' to the end-users and also how to administer it in terms of monitoring and auditing.
- A clear and simple policy environment is most efficient - many non-compliance issues picked up by SEPA are due to confusion by the business operators – particularly in the rural domain where many are small enterprises without legal expertise, so making it clear and having a one stop shop would be excellent.
- Many policy instruments are written in 'legalese' and not clear about what is necessary.
- Important that we are aware of CXC projects on PES and soil governance [subsequent contact has been made].
- We asked how this work might help them:
    - Would help SEPA with their 'beyond compliance' approaches; and also to help them help businesses comply with existing regulation, taking a more risk based approach to regulation.

- We were asked 'what are the policy questions we are trying to answer with this work?'
  - Our work can contribute to the work of the Post-EU Strategy Unit focus on strategic environmental policy.
  - There is a tension between more simplicity and ensuring there is sufficient clarity about what should be done and how to do it.
  - There is a dearth of research on how to achieve this even if we agree it is needed.
- There is a need to make it simple and clear for the land manager to make decisions for multiple benefits.
  - Good discussion about whose job is it to ensure land managers know about the requirements? SAC and NFUS? Is it fair to expect them to keep their members informed about multiple instruments and contexts?
- We asked whether we should move into looking at new instruments or work more on the implications of these findings.
  - Best to focus on which instruments should stay and which should go.
  - Perhaps this research could help to tidy up the policy landscape behind the scenes, repackage it and present it to users.
  - Make sure it is simplified and useful with logical groupings for easer use.

Brexit Plenary Discussion

Participants returned from their breakout groups and rapid feedback was provided from all five sessions, before further questions and comments were invited.

How will Scottish Government relay the relevance of the important work we're doing to Defra? – This evidence could help Scottish Government influence Defra and SEFARI should be having a role there.

What do researchers need going forward in order to engage with Brexit? Very varied – dialogue is essential because this helps to address issues of timing and the timeliness of our research. We are trying to participate and anticipate, e.g. our current interactions with the Agriculture Champions.

Few researchers ask how policy making processes work and helping researchers to understand that would be really useful. Useful info is provided in for example blogs and books by Paul Cairney at Stirling: https://paulcairney.wordpress.com/

Researchers need to use simpler language when communicating about their science.

Don't forget that parliament can also influence policy, so it's another route for policy engagement.

We are probably looking at a transition period to 2020 and then more fundamental change. There is a large evidence base in Scotland (perhaps a better one than in England currently?) and this represents an opportunity to promote Scottish science.

Researchers need to focus more on cost when explaining potential different outcomes, e.g. this is what could happen and this is how much it could cost/save.

Appendix One: Feedback received from participants

Feedback forms were received from 9 researchers and 16 stakeholders.

Overall, these respondents found the meeting useful or very useful. The reasons given were that it provided an overview of relevant work, an opportunity to make contacts, both amongst the research community and with other stakeholders, and a chance to identify new sources of data or evidence. Many people commented on the breadth of research underway in terms of topic, approach and geographical focus. Those responding could clearly see how the research was relevant to their own, and their organisations' work, and welcomed the opportunity to keep informed about progress.

The facilitation, format and quality of interaction were generally rated good or very good. However, the agenda was ambitious and we will reflect on how to improve the balance between presentations and discussion, particularly in break out groups, in future events. There was also useful feedback around ensuring material is focussed on the outcomes and purpose, with less on methodological details.

Most respondents agreed, or strongly agreed, that the meeting had: given them new knowledge about the Strategic Research Programme, helped them understand how the research might benefit them; believe the information they provide will be used; and would like to attend future meetings.

In terms of future participants, respondents suggested inviting those organisations listed below. Most of these were invited but were unable to attend. However, those highlighted were not on our mailing list and will be added for the next meeting.

- Farming interests
- Crofters
- LEAF
- NFUS
- Policy makers
- Scottish Land and Estates
- Representatives from community buy-outs of land.
- National Trust Scotland
- RSPB
- Local authorities
- Local government representatives/policy officers
- National Park Authorities
- SE Link/NGOs
- Business interests

Appendix Two: List of Participants

Name	Affiliation
Adam Smith	Game & Wildlife Conservation Trust
Alessandro Gimona	James Hutton Institute
Alistair McVittie	Scotland's Rural College
Anke Fischer	James Hutton Institute
Andy Wells	The Crown Estate
Bruce Howard	Ecosystems Knowledge Network
Bruce Wilson	Scottish Wildlife Trust
Chris Ellis	Royal Botanic Garden Edinburgh
Darren Moseley	Forest Research
David Donnelly	James Hutton Institute
David Michie	Soil Association
David O'Brien	Scottish Natural Heritage
Debbie Bassett	Scottish Natural Heritage
Edward Baxter	LEAF Farmer
Eric Baird	Glen Tanar Estate
Eric McRory	Scottish Environment Protection Agency
Freddy van Hulst	James Hutton Institute
Glenn Iason	James Hutton Institute
Graham Begg	James Hutton Institute
Heather McCabe	Scottish Government
Ilkka Leinonen	Scotland's Rural College
James Hutchison	Joint Nature Conservation Committee
Jenny Johnson	Scottish Natural Heritage
Jessica Maxwell	James Hutton Institute

Joanna Drewitt	Scottish Government
Justin Irvine	James Hutton Institute
Katrin Prager	James Hutton Institute
Keith McWhinnie	Scottish Government
Kirsty Blackstock	James Hutton Institute
Lucy Gilbert	James Hutton Institute
Mark Brewer	BioSS
Marc Metzger	ESCOM
Mary Christie	Scottish Natural Heritage
Rebekka Artz	James Hutton Institute
Rob Brooker	James Hutton Institute
Robin Pakeman	James Hutton Institute
Ruth Mitchell	James Hutton Institute
Sandra Marks	Scottish Government
Sarah Govan	Centre of Expertise on Climate Change
Scott Newey	James Hutton Institute
Steven Thomson	Scotland's' Rural College
Susan Davies	Scottish Wildlife Trust
Tim Hall	Woodland Trust
Tim George	James Hutton Institute

Appendix Three: Presentation Slides

The following pages show the meeting presentation slides.

Introduction & Overview

Ecosystems and Land Use
Stakeholder Engagement Group
20th November 2017

Scottish Government
Riaghaltas na h-Alba
gov.scot

SEFARI

ELSEG

- A joint activity of WPs 1.3 and 1.4 of the SG Strategic Research Programme
- Complements ELPEG (Ecosystems and Land Use Policy Engagement Group)
- Ensures voices from wider stakeholder interests can be informed about, and inform, our strategic research direction
  - Complements more focussed KE within a project
  - Give a flavour of some specific projects
- Annual event to help us adaptively manage

Agenda

10:30	Introduction to the day and overview - *Rob Brooker (JHI)*
10:40	Biodiversity – *Robin Pakeman (JHI)* + 2 spotlight presentations
11:20	Climate Change – *Glenn Iason (JHI)* + 2 spotlight presentations
12:00	Land Use – *Justin Irvine (JHI)* + 2 spotlight presentations
12:40	Lunch
13:30	Brexit Discussion – *Kirsty Blackstock (JHI)* + 5 spotlight presentations Break out discussions: - What evidence do stakeholders use? - What information might stakeholders need? - Are there gaps that the Work Packages might address? Report back and full group discussion
15:15	Wrap up and next steps
15:30	Close

SEFARI

Housekeeping

- Fire exits
- Toilets
- Agenda timings
- Catering

Theme 1 – Natural Assets

Currently managed by **Robin Matthews** (JHI)

- **1.1 Soils** - Quantify ecosystem services provided through soil systems in Scotland (Allan Lilly, JHI)
- **1.2 Water resources and flood risk management** – Improve and integrate evidence base on water quantity and quality (Marc Stutter, JHI)
- **1.3 Biodiversity and ecosystems** - Link improved understanding with development of practical management options for maintaining provision of ecosystem services and functions (Rob Brooker, JHI)
- **1.4 Integrated and Sustainable Management of Natural Assets** - Develop innovative solutions for managing natural assets for multiple benefits (Kirsty Blackstock, JHI)

Work Package 1.3 – Biodiversity and Ecosystems

WP1.3 aims to improve our understanding of the **functioning and resilience** of our **natural assets**, particularly biodiversity, providing **new approaches and metrics** for sustainable land management, leading to a **healthier and more resilient environment**.

(a) Understand what underpins a healthy ecosystem;

(b) Understand how systems provide services, and if we can rebuild “lost” services through good management;

(c) Understand what makes a system resilient, and how we can manage for resilience;

(d) Provide a knowledge base for key biodiversity-management actions.

Work Package 1.4 - Sustainable and Integrated Management of Natural Assets

WP1.4 aims to illustrate the **multiple benefits** that **natural assets** provide to **Scottish society** and to use this understanding to **support decision making** on trade-offs and management at **multiple scales.**

(a) use a dynamic natural assets register (NAR) and natural capital accounts (NCA) to illustrate how assets contribute to Scotland's green growth aspiration;

(b) identify and quantity trade-offs and impacts on multiple assets and ecosystem services (ESS) to illustrate where we are living beyond planetary limits;

(c) support integrated decision-making and adaptive management to protect multiple natural assets and maximise benefits in socially acceptable ways; and

(d) illustrate how existing and novel measures can deliver integrated delivery of benefits.

SEFARI - Scottish Environment, Food and Agriculture Research Institutes

SEFARI is the collective of six Scottish Research Institutes:

- Moredun Research Institute;
- Scotland's Rural College;
- The James Hutton Institute;
- Royal Botanic Garden Edinburgh;
- Biomathematics and Statistics Scotland;
- The Rowett Institute, University of Aberdeen.

https://sefariblog.wordpress.com/

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SEFARI Gateway – Knowledge Exchange Hub

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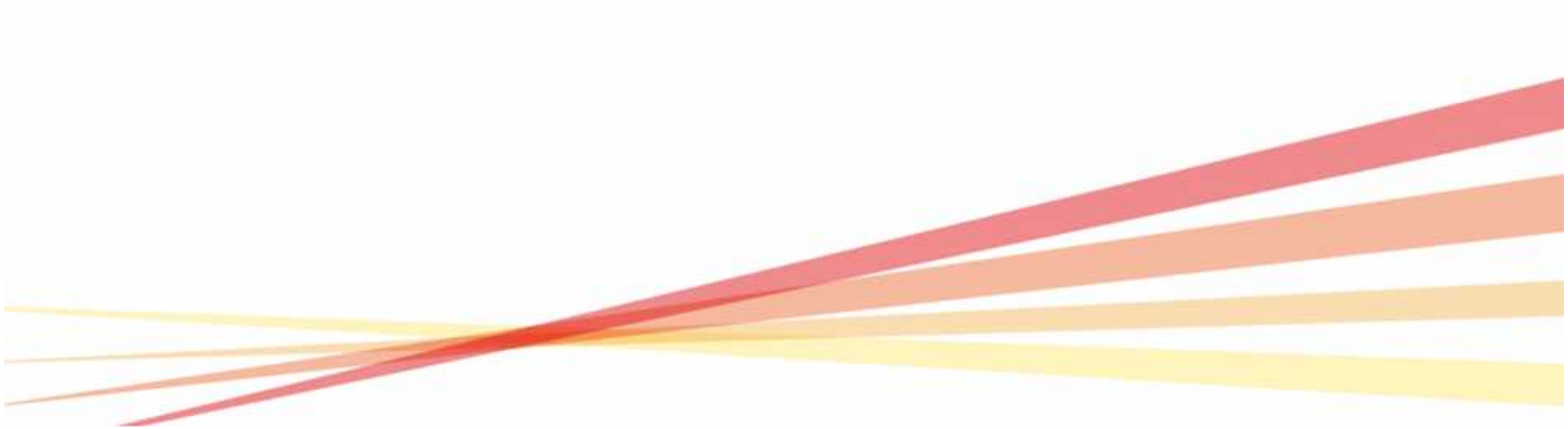


Next Steps….

1. Collation of notes from the day.
2. Production of a draft report from the day and circulation for comment.
3. Finalising of report and posting online – WP and SEFARI web pages.
4. Individual discussions to follow up on particular relevant issues concerning specific pieces of work.

Many thanks for your time and thoughts!

Before you go… feedback forms from Anne

Biodiversity work (a few brief highlights)

Main relevant policies

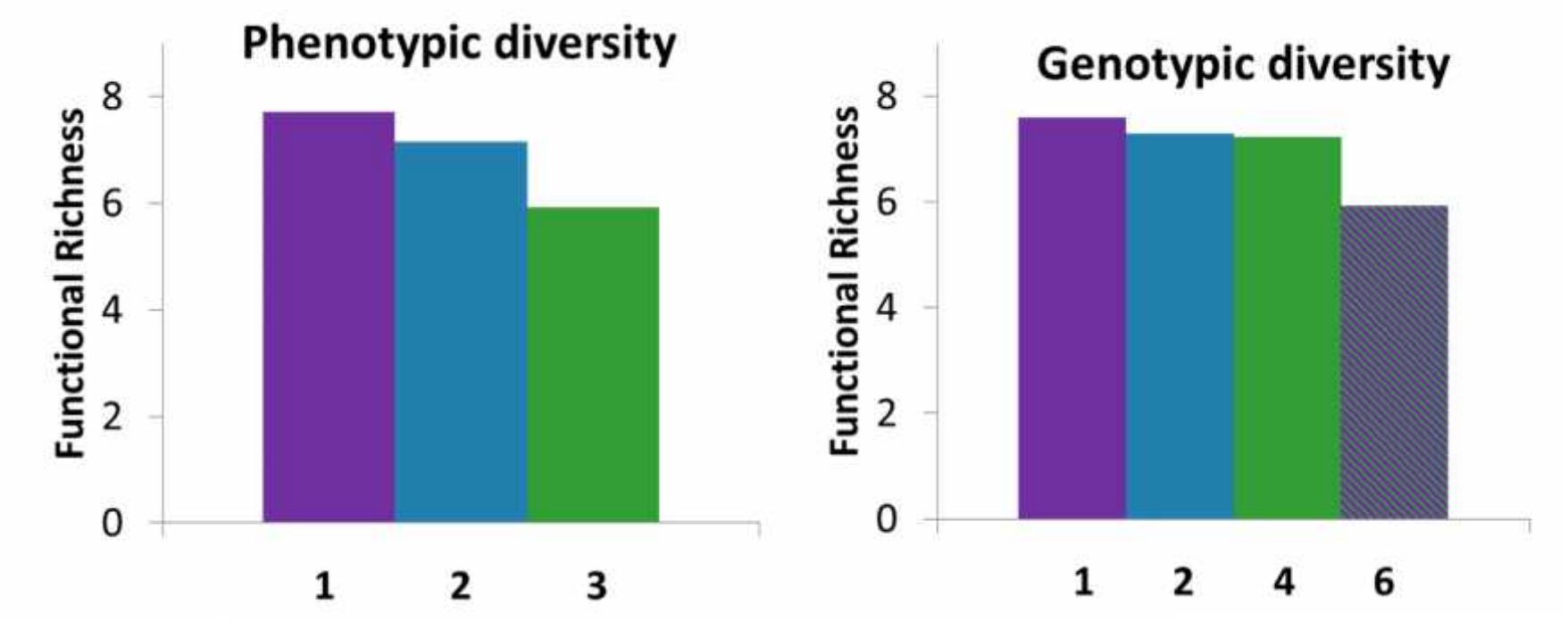
Supporting and directly contributing to:

- UN Sustainable Development Goals, #15 “Protect, restore and promote sustainable use of terrestrial ecosystems…”
- Scottish Biodiversity Strategy
- Scottish Rural Development Plan
- Invasive Non-Native Species

Understanding ecosystem function

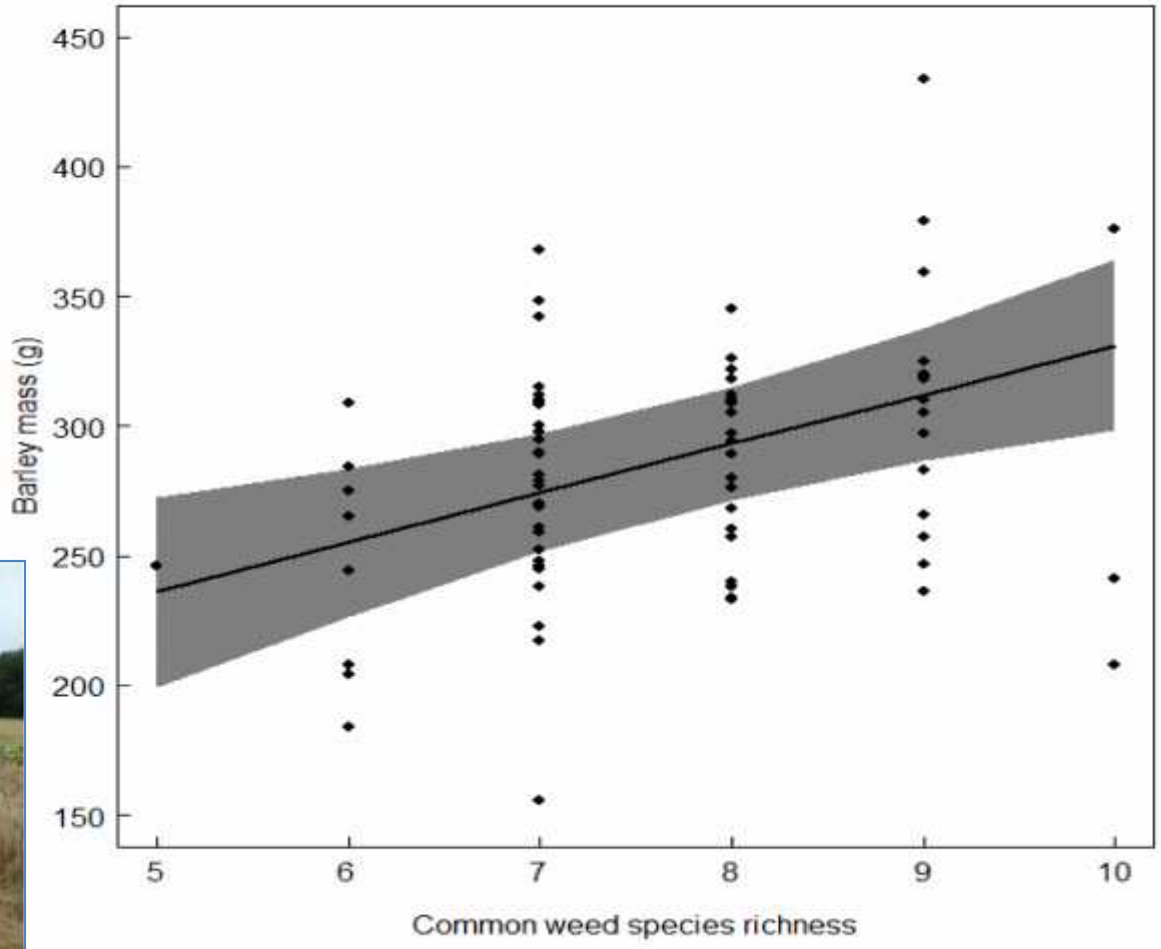
Crop:weed interactions

- Field experiment – varied phenotypic and genotypic diversity of barley



Crop:weed interactions

Intriguingly:



Support from EU

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DIVERSify

Designing InnoVative plant teams for Ecosystem Resilience and agricultural Sustainability

- Overall goal: To develop a novel system for sustainable food production by optimising crop species mixtures or ‘plant teams’ to improve yield stability, reduce pest and disease damage, and enhance stress resilience

Landscape scale patterns

Lichens – Chris Ellis on next

Understanding trends

Ruth Mitchell – long-term vegetation change later

Coastal habitats

- Re-survey data of vegetation between 1970s and 2010/11
- Richness gains - where habitats remain part of an agricultural management system
- Richness losses - driven by acidic deposition and reduced grazing

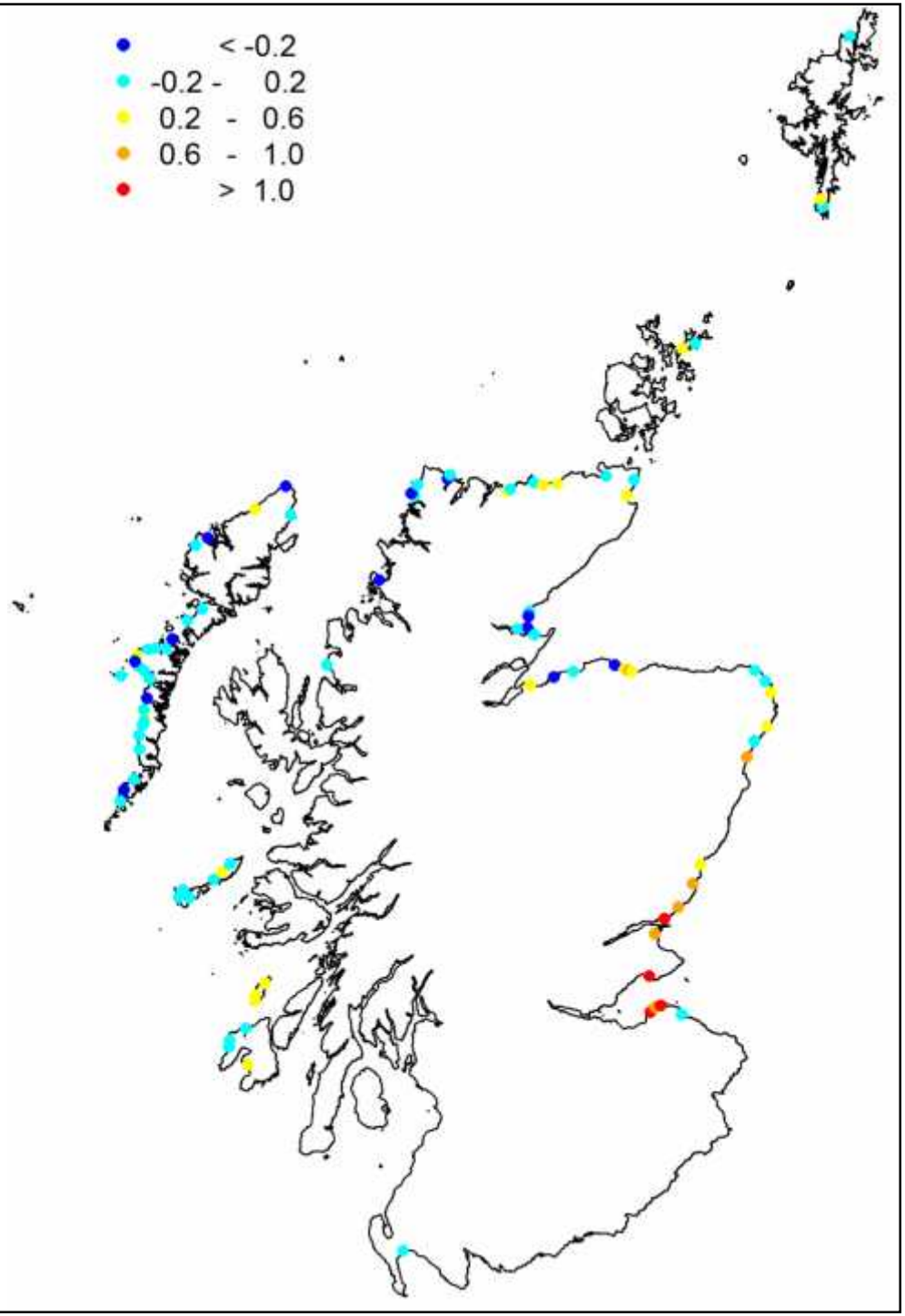
Coastal habitats

Site mean change in Ellenberg Indicator Value for Nitrogen

Scale from 1 to 9

1 = *Drosera rotundifolia*

9 = *Rumex obtusifolius*



Impacts – ash dieback

Ash supports 955 species:

- 45 species ‘obligate’ to ash
- 65 species highly associated with ash
- Unique ground flora

Impact on processes different from other trees:

- Faster litter decomposition
- Higher top soil pH
- Greater nutrient concentrations in litter
- Lower C:N ratio in litter

Can we mitigate impacts of ash loss on biodiversity?

- Role of alternative tree species?
- Identification of suitable species

Advice to managers

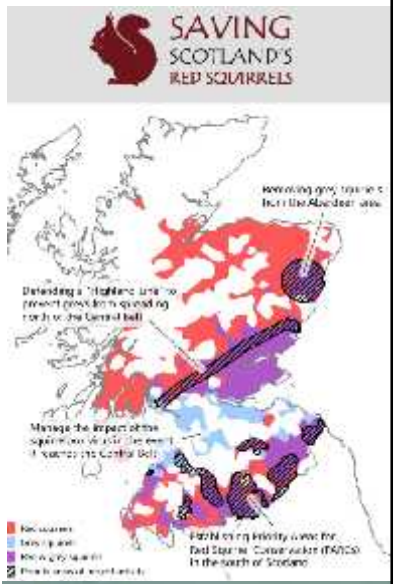
Workshop: Ruth Mitchel, Hutton Institute and Alice Broome, Forest Research
Can we manage for ash-associated biodiversity?

Current work on Oak biodiversity and management, developing similar tools for oak

Impacts - squirrelpox

Using serology we have been tracing the emergence of SQPV in Scotland

- First grey squirrels carrying virus found in the borders in 2005 and now spread to central Scotland
- The first outbreak in red squirrels in 2007
- Management aimed at preventing virus reaching the core population in the north of Scotland
- Integrated management of the problem includes many partners and many approaches



Conservation

Bere barley – Tim George on soon

Cicerbita alpina - alpine sow-thistle

- Very rare alpine plant
- Occurs in only four sites in the Cairngorms
- Ex-situ breeding and cross breeding
- Translocations to new sites

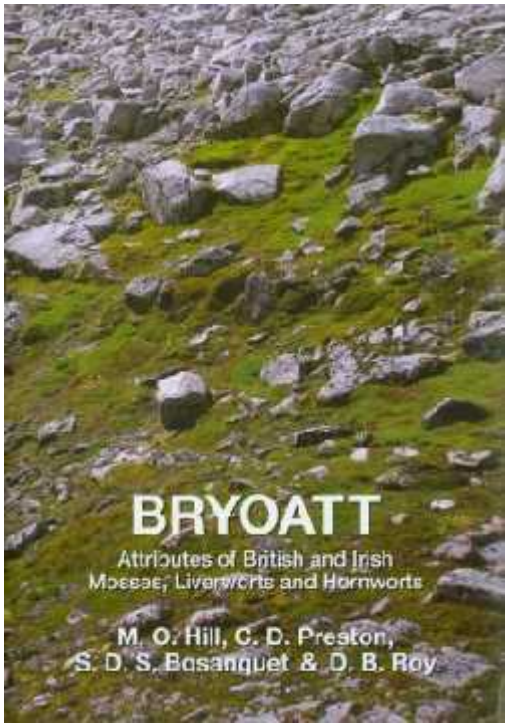
Plant (and human) health and biosecurity challenges

Ecosystem Health Indicators

Advice provided on Greenspace indicator

Bryophyte indicator in development

Dated records
x plant traits =
reduced recorder
effort bias



Agri-environment

Review of gaps in current AECS, headlines include:

- Pollinator specific options
- More emphasis on winter stubbles
- Payments to manage coastal systems
- Widen the options for peatland management
- Adapt arable options for fruit growing areas

Targeting biased toward mammals, birds and higher plants.

Agri-environment governance

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Review of governance mechanisms

- No one mechanism superior to the rest
- Depends on design and implementation
- Also, biodiversity is influenced by processes at different scales and feedbacks
- Successful governance likely to require multiple governance mechanisms at different scales and multiple actors, and not just the state.

Liver fluke risk and agri-environment

Management for biodiversity could conflict with animal health

- Wader scrapes increase area of wet ground
- Conservation grazing needed to maintain habitat for natterjack toad
- Liming could increase mud snail (fluke host) numbers alongside other invertebrates



Thank you

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LICHENS IN THE LANDSCAPE
A Macro, Meso and Microscale Mash-Up

Scottish Government
Riaghaltas na h-Alba
gov.scot

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Temperate rainforest:
< 1% global land area
15% in Europe
40% European resource in Britain
Scotland = best remaining examples

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Temperate rainforest:
< 1% global land area
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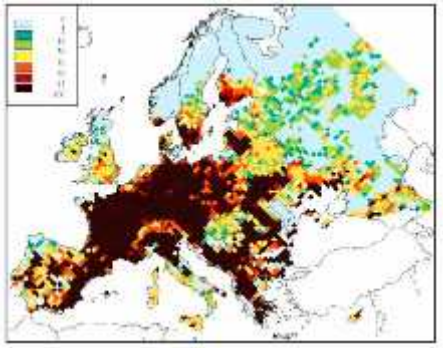


Areas of Highest Potential Suitability (hotspots)

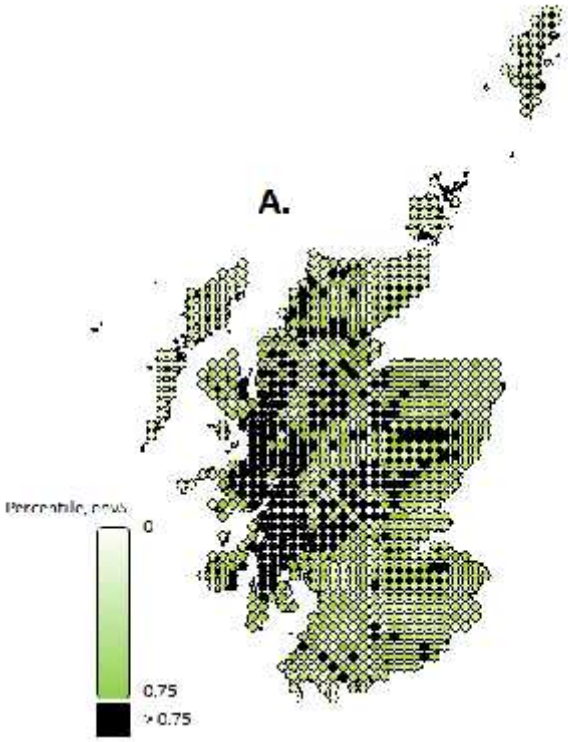
> Low pollution

> Long-continuity of woodland in landscape

Areas of Highest Potential Suitability (hotspots)

> Low pollution

> Long-continuity of woodland in landscape



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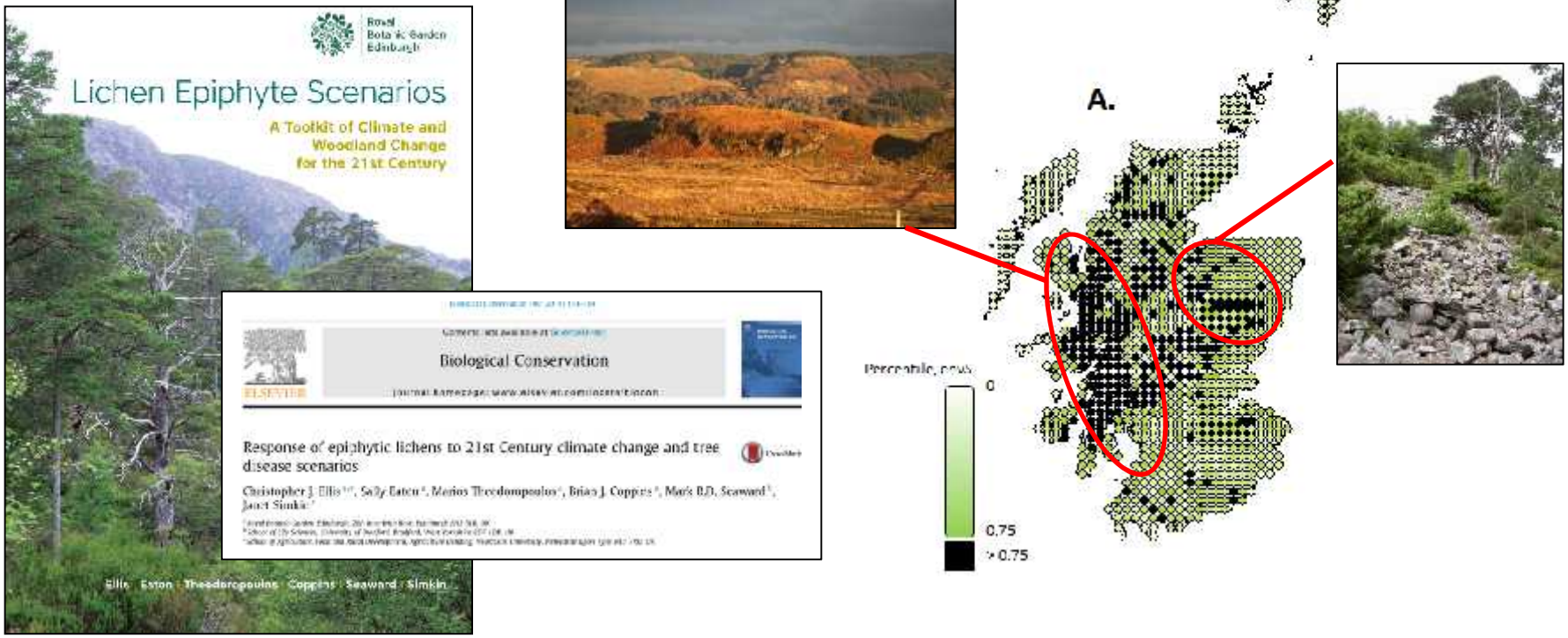

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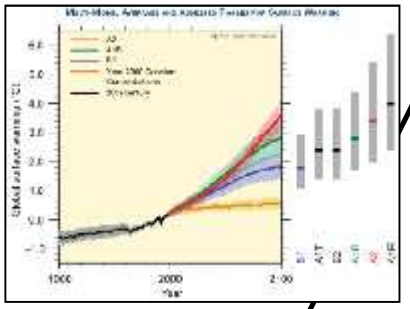
Cardona *et al*. (2012) In *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation*: Intergovernmental Panel on Climate Change (IPCC)
Crichton, D. (1999) In *Natural Disaster Management*, (Ed. J. Ingleton). Tudor Rose, London. pp. 102-103.

Hazard



RISK

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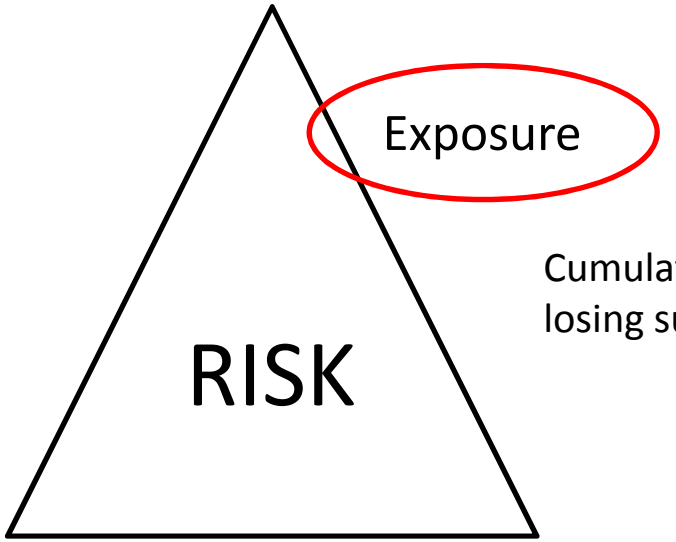
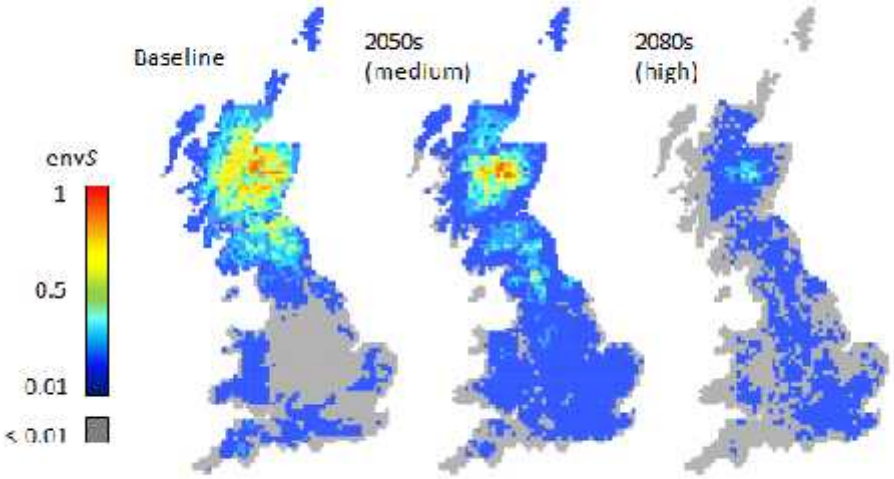


Cumulative decline in environmental suitability, for species losing suitable environmental space (climate change scenarios)



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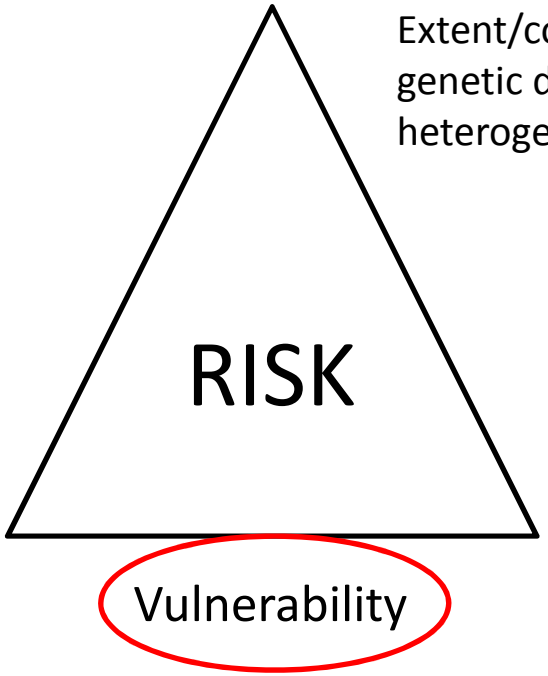
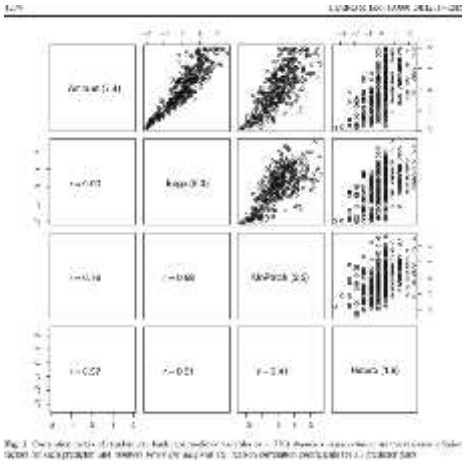


Extent/connectivity of woodland; higher population size = increased genetic diversity; gene flow among populations (adaptation); increased heterogeneity = microclimatic refugia

RESEARCH ARTICLE

Confronting collinearity: comparing methods for disentangling the effects of habitat loss and fragmentation

Adam C. Smith · Nicola Koper · Charles M. Francis · Lenore Fahrig



Amount of habitat =
area of forest cover
Fragmentation =
habitat edge
mean patch size
Heterogeneity

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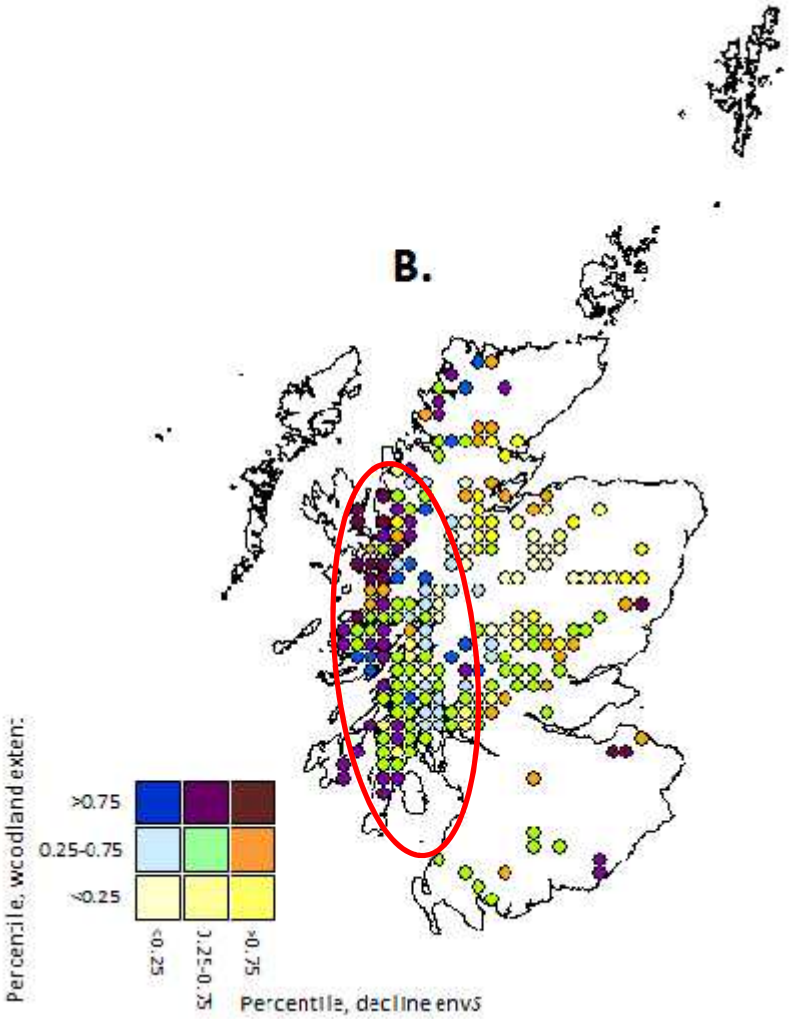

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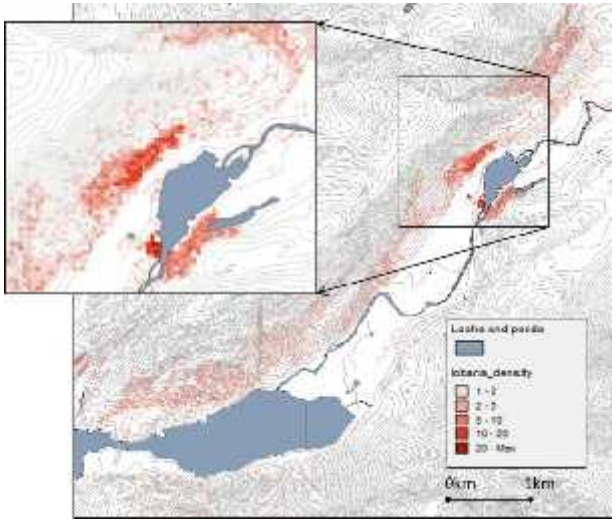

SCOTTISH NATURAL HERITAGE

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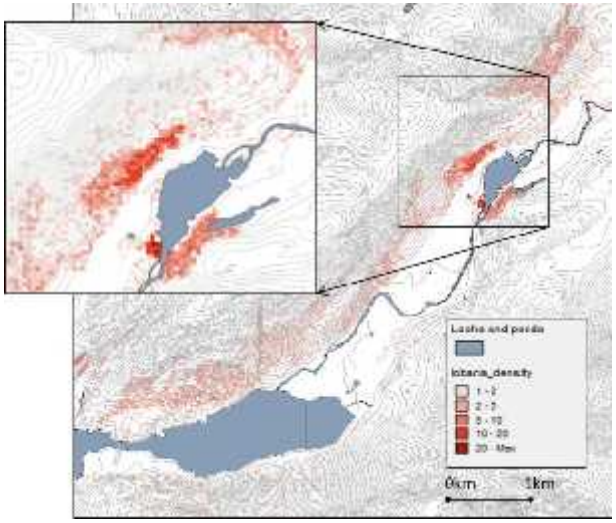

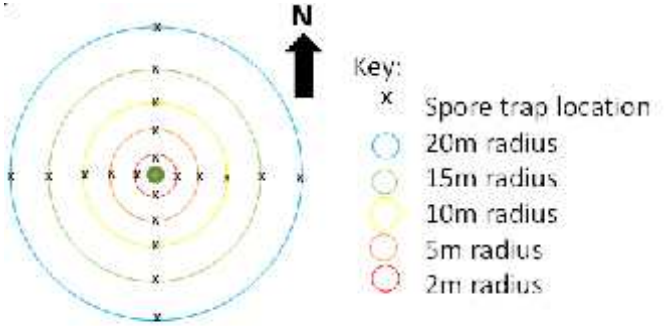

SCOTTISH NATURAL HERITAGE

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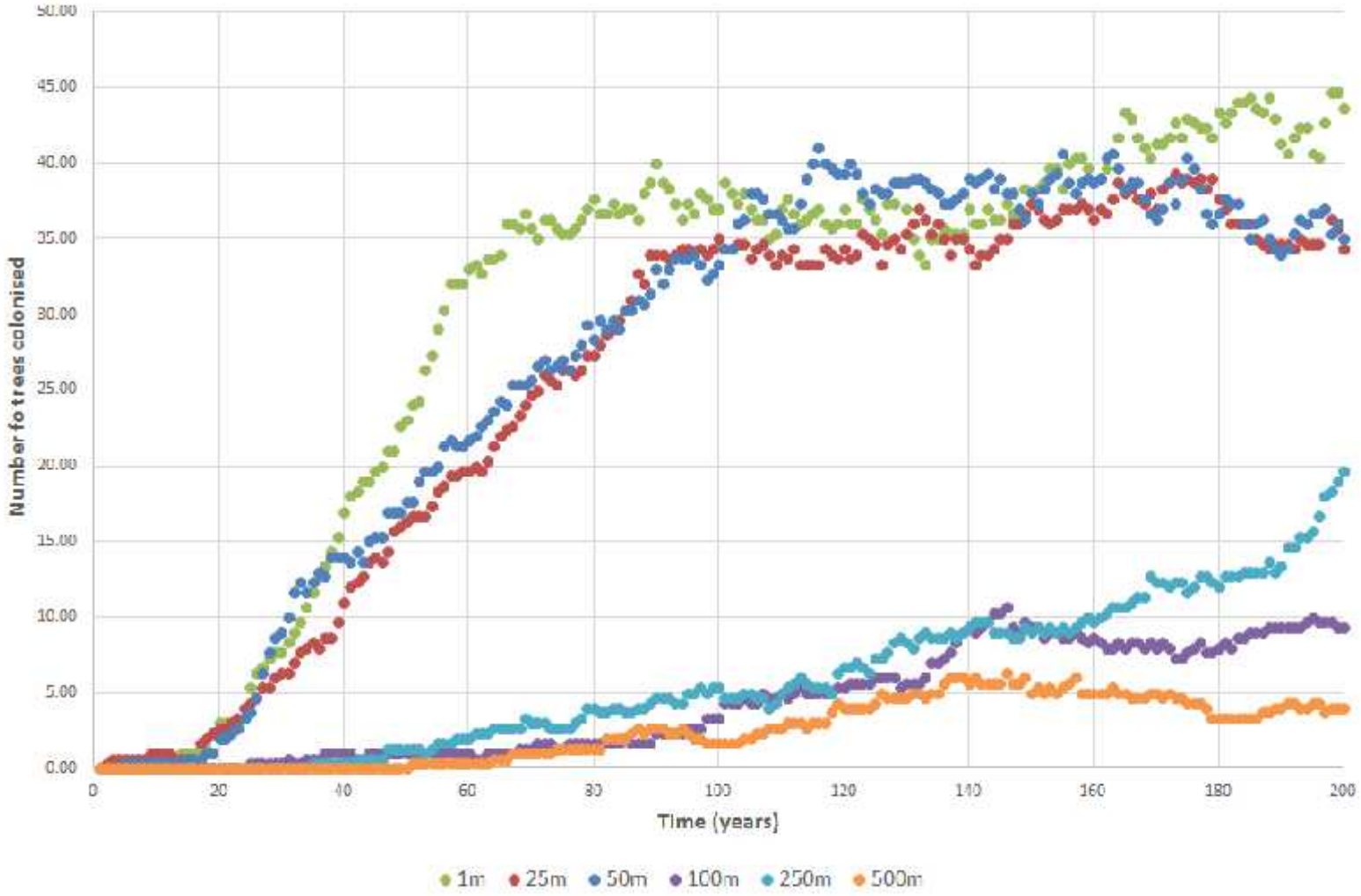

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SCOTTISH NATURAL HERITAGE

LOCH LOMOND & THE TROSSACHS NATIONAL PARK

Forestry Commission

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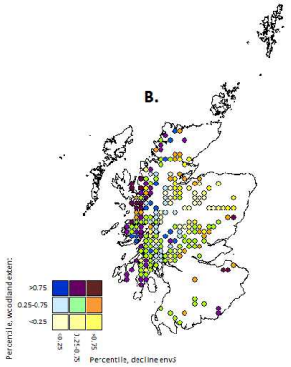
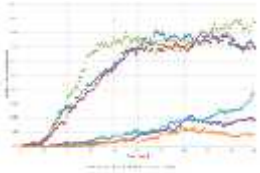
MACRO
1.3.1: O3.3 (16/17)

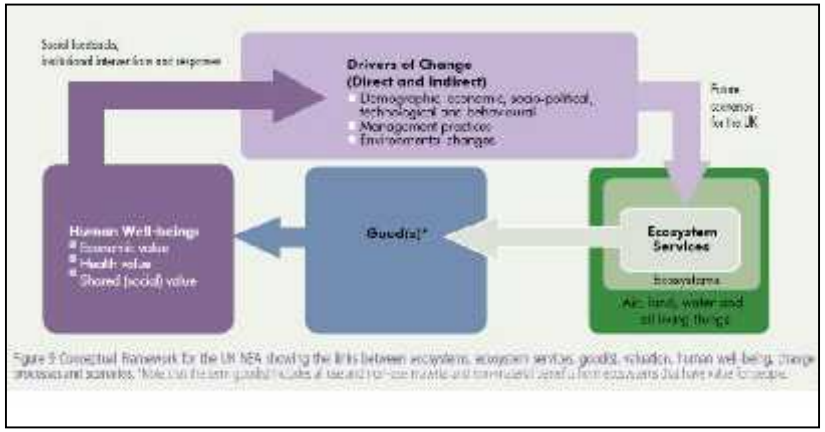


MESO
1.3.1: 03.3 (17/18)



MICRO
1.3.2: O1.5

1.3.2 (Fischer/Eastwood) - Valuation



Spotlight Presentation: Bere Barley Scotland's Landrace

Ecosystems and Land Use Stakeholder Engagement Group (ELSEG)

Tim George

Potential Benefits of Landraces

- Heritage Value
- Adaptation to specific environment
- Continued *in-situ* natural selection – participatory breeding
- "Survivalomics"

Genetics & genomics

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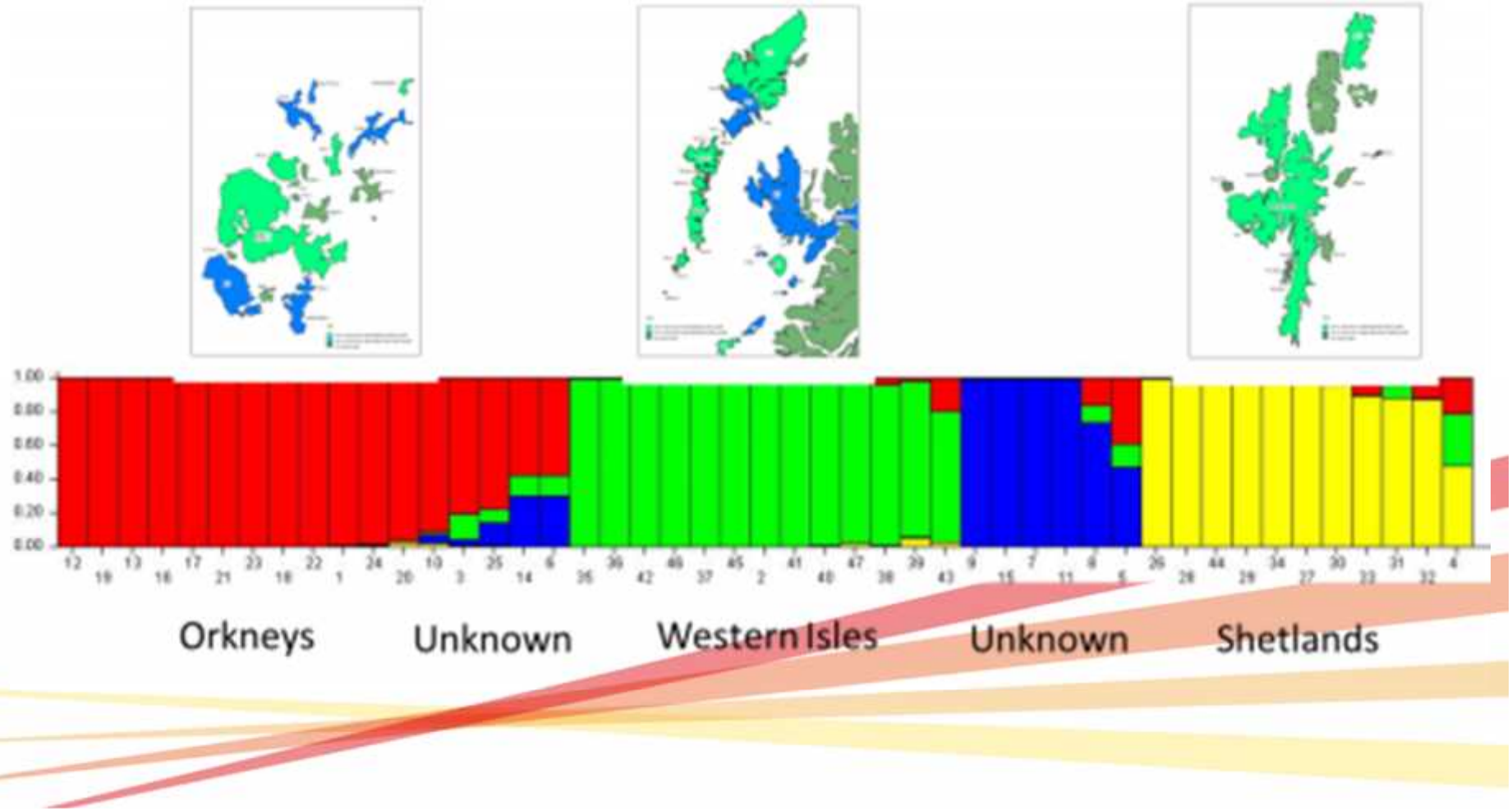
Genotypically and geographically distinct island patterns



Agronomy

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Replicated field trials –Dundee & Orkney

- **Common garden**
- **Mn efficiency**
- **Seaweed fertilisation**

Physiology – Tolerance of Alkaline Soils

Bere barley superior ability to accumulate Mn, Zn and Cu compared to elite barley

Table 1: Mn Efficieciency measured by chlorophyl fluorescence (green = efficient; amber = marginal; red = inefficient)

Genotype	Fv/Fm Predicted val
Bere 59 A 37 Uist	0.825404033
Bere 44 A 22	0.824059182
Bere 43 A 21	0.82377145
Bere 47 A 25	0.817465908
Bere 53 A 31	0.806043131
Bere 24268 A 71	0.794766955
Bere 45 A 23	0.777129959
Bere 52 A 30	0.760700716
SASA 27 A Bere North Uist	0.743366968
Bere 49 A 27 Shetland	0.626784638
Bere 113	0.550561752
Bere M08	0.545588092
Morayshire Gold 180	0.538726212
Prize Prolific 196	0.520611221
Bere 4828 A 63	0.509688333
New Cross 181	0.493636613
Common 132	0.491801924
Camton 129	0.475109249
Cornish 133	0.450737762
Rigel 199	0.448046914
Millenium 219	0.438089637
Hen Hardd Eulii 78 A	0.43679525
Spratt Archer 37/6/3 205	0.433299984
Haidd Garw 159	0.428406359
Padstow 189	0.421520397

Commercialisation

Bere as source for traditional Heritage products ‘on farm conservation

KE EVENT – Orkney 2017

SEFARI

Back to the Future: Understanding the heritage of Bere barley for a more sustainable future

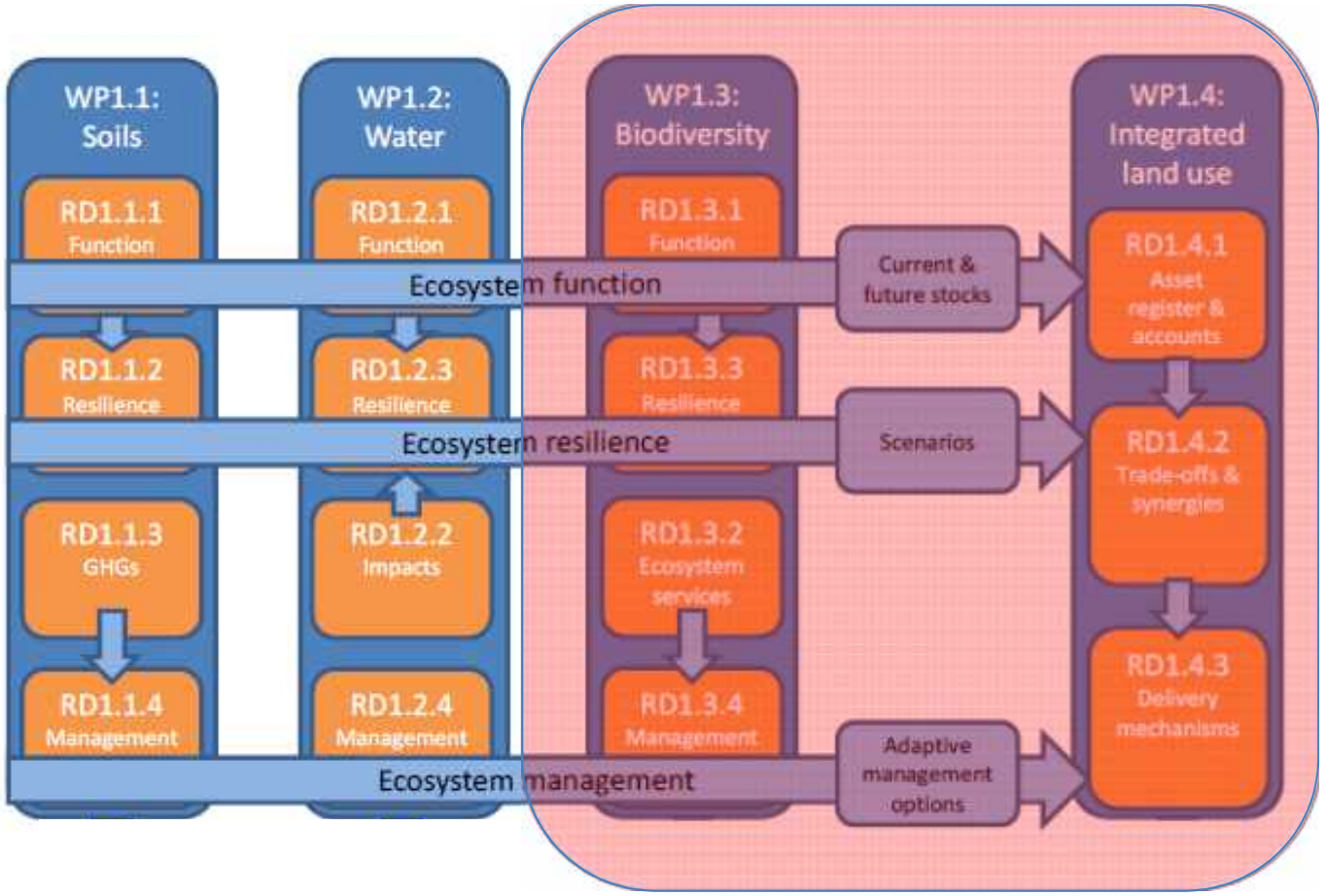
Acknowledgements

- Hutton – Joanne Russell, Lawrie Brown, Allan Booth
- KWS – Peter Werner
- University of Highlands and Islands – Peter Martin
- University of Copenhagen – Søren Husted and Sidsel Birkelund Schmidt
- Birsay Heritage Trust, Bruichladdich Distillery, Valhalla Brewery, Isle of Arran Distillers
- Scottish Government RESAS RD 1.3.1

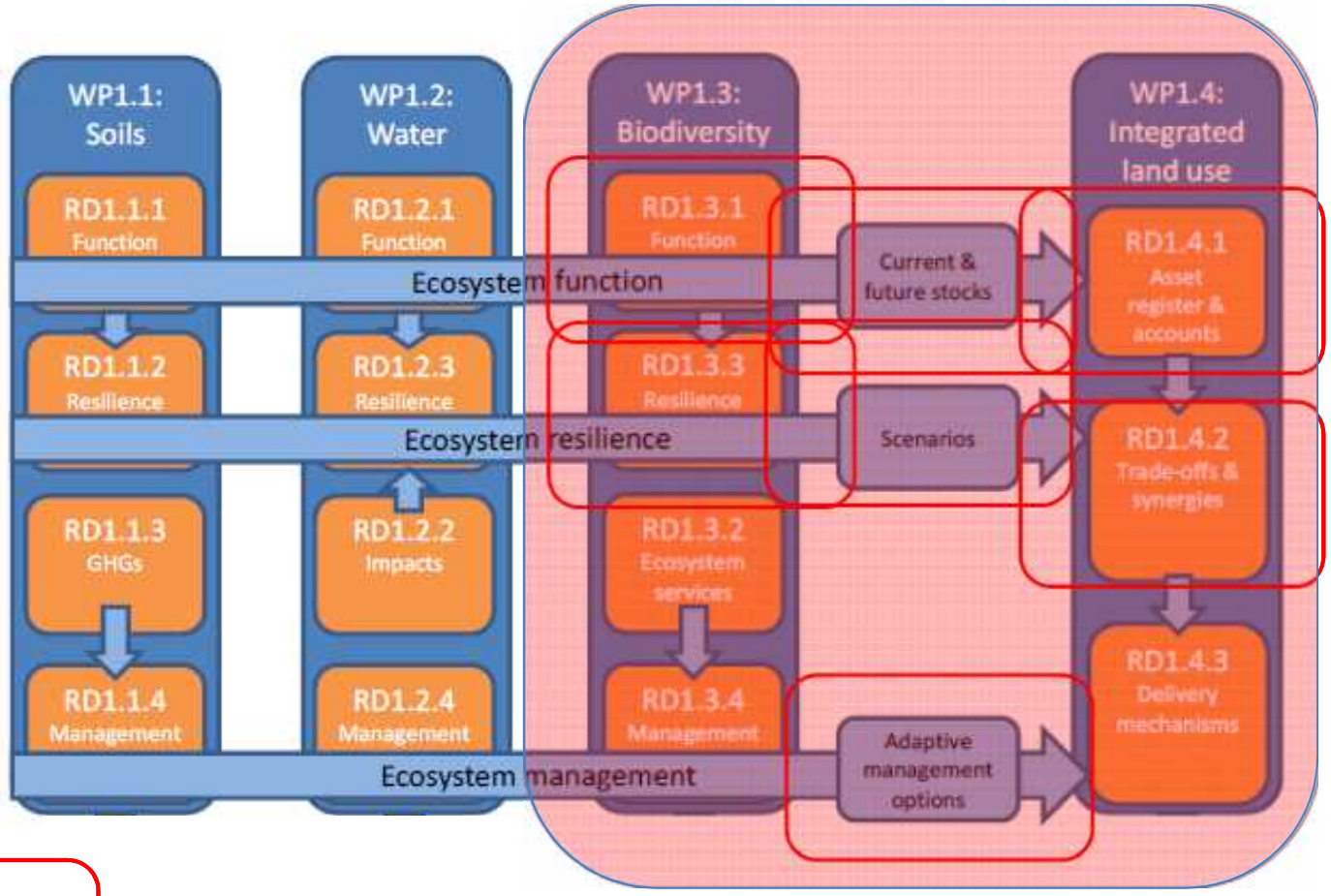
Climate Change Research

ELSEG 20th November 2017

Strategic Research Programme
Theme 1 – Natural Assets



Strategic Research Programme
Theme 1 – Natural Assets



+ CxC

- **Beef Supply Chain**

The effects of alternative uses of distillery by-products on GHG emissions (cattle feed vs. source of renewable energy + fertilisers)

Ilkka.Leinonen@sruc.ac.uk

Main Finding:

Use of the by-products as cattle feed can lead to a similar reduction in net GHG emissions as using them directly for renewable energy (in anaerobic digestion plants).

Rural Policy Centre
Research Briefing

SRUC

September 2017 (RPC RB 2017/05)

Distillery by-product use and greenhouse gas emissions from Scottish malt whisky production

Ilkka Leinonen, Michael MacLeod and Julian Bell

Key message: Different uses of distillery by-products can influence the level of greenhouse gas (GHG) emissions associated with whisky production. By-product use as animal feeds leads to a similar reduction in net emissions as using them in bio energy generation.

Main Findings

- The Scottish spirits industry produces significant amounts of by-products. In malt whisky production, these include draff, pot ale syrup and distillers dark grains with solubles (DDGS), which are currently used mainly for livestock feed. However, their alternative use as a source of renewable energy is increasing.
- Alternative uses have different environmental and economic impacts. For example, use as livestock feed reduces the amount of crops that need to be grown. Use in anaerobic digestion (AD) plants displaces fossil fuels to generate electricity and heat. The digestate (remaining material from the AD process) also replaces synthetic fertilisers used in crop production.
- Analysis indicates that significant GHG emissions reductions are achieved when by-products are used to replace soymeal. This is because soybean cultivation in South America is associated with land use change (including deforestation) that potentially releases large amounts of carbon dioxide to the atmosphere.
- Potentially the reductions achieved by replacing feed crops can be as high as those achieved

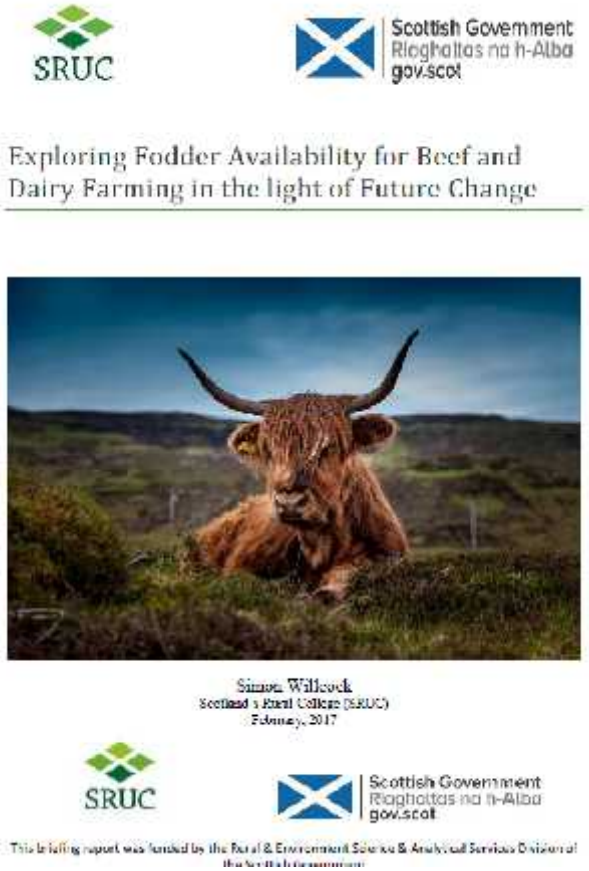
• Beef Supply Chain

Exploring fodder availability for beef dairy farming in the light of future climate change (Simon Willock - SRUC – contact: Ilkka Leinonen).

Main Finding:
Most crops associated with the beef and dairy industry will likely increase in total production (yield and area) as a result of climate change.

Win-wins : Biodiversity
Food production.

Trade-offs : Stored carbon
Timber production
Pesticides
Fertiliser



Assessing multiple land use options

- National-scale multi-criteria land use modelling
  - to include climate adaptation and mitigation impacts
- Intensification/extensification scenarios
  - trade offs of woodland expansion/agriculture
- Mapping of trade-offs
  - scenarios of afforestation and peatland restoration

Assessing multiple land use options

- National-scale multi-criteria land use modelling
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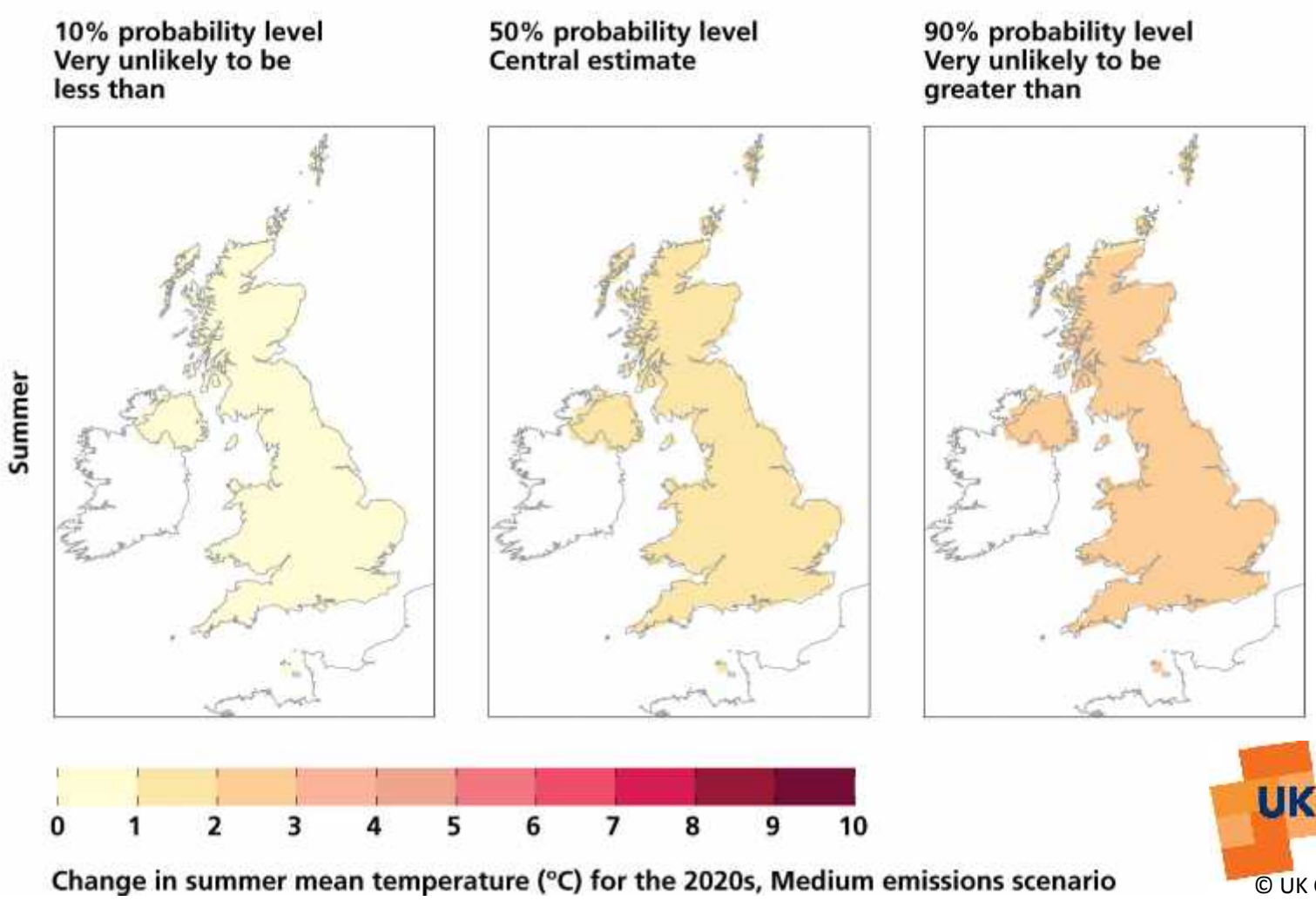
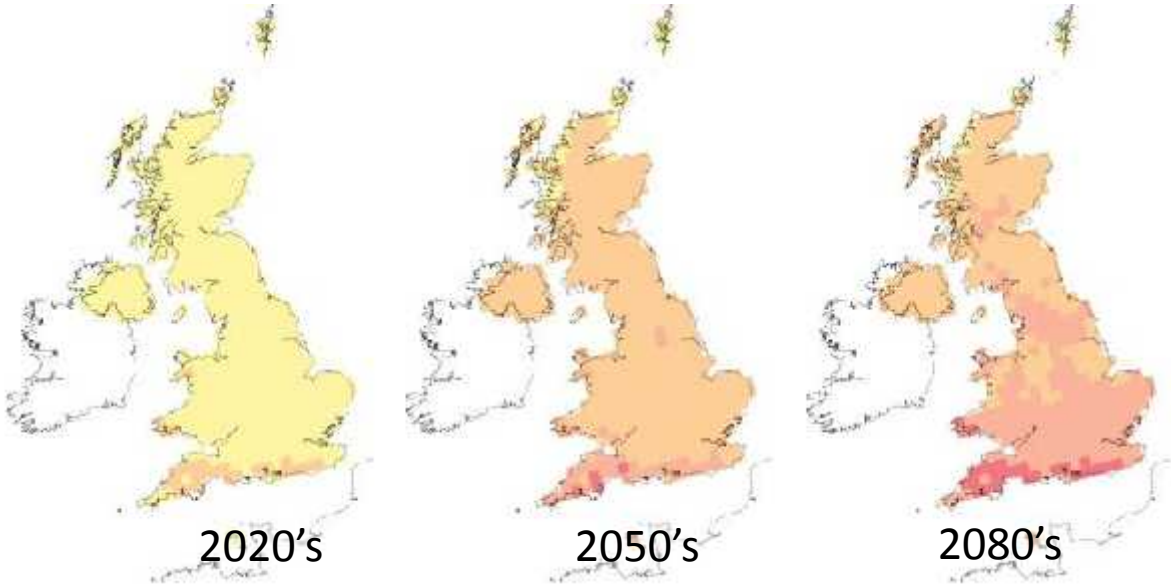
- Mapping of trade-offs
  - scenarios of afforestation and peatland restoration
- **Method development**

Climate change predictions are not certain – they are probabilistic

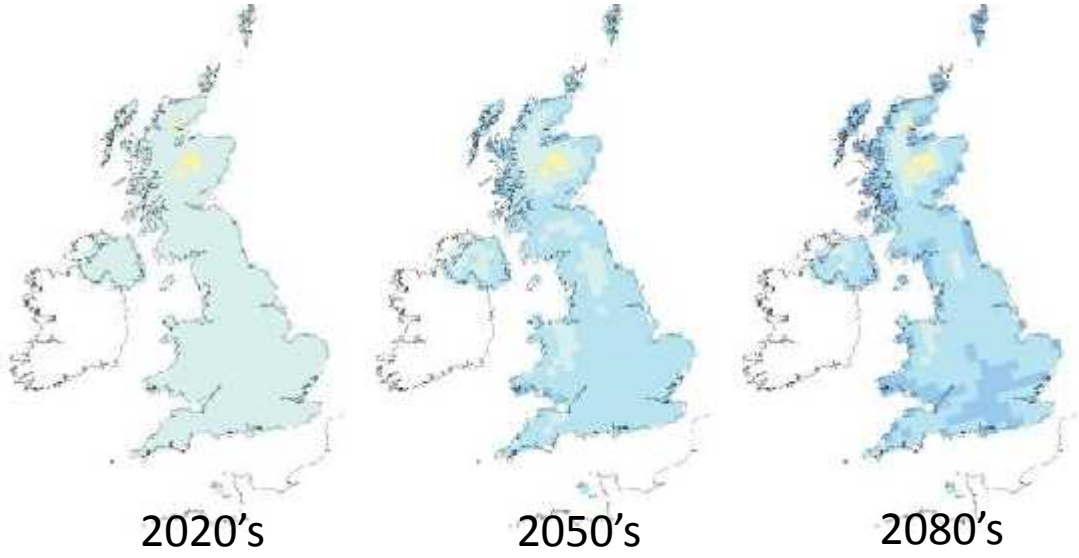


UK CLIMATE PROJECTIONS

Mean summer precipitation

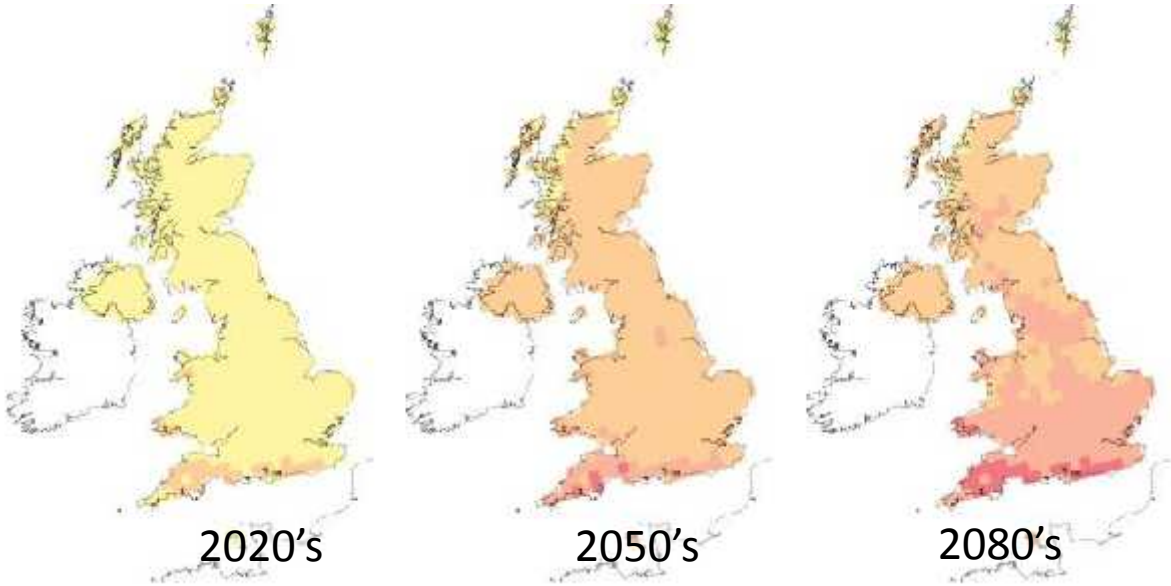


Mean winter precipitation

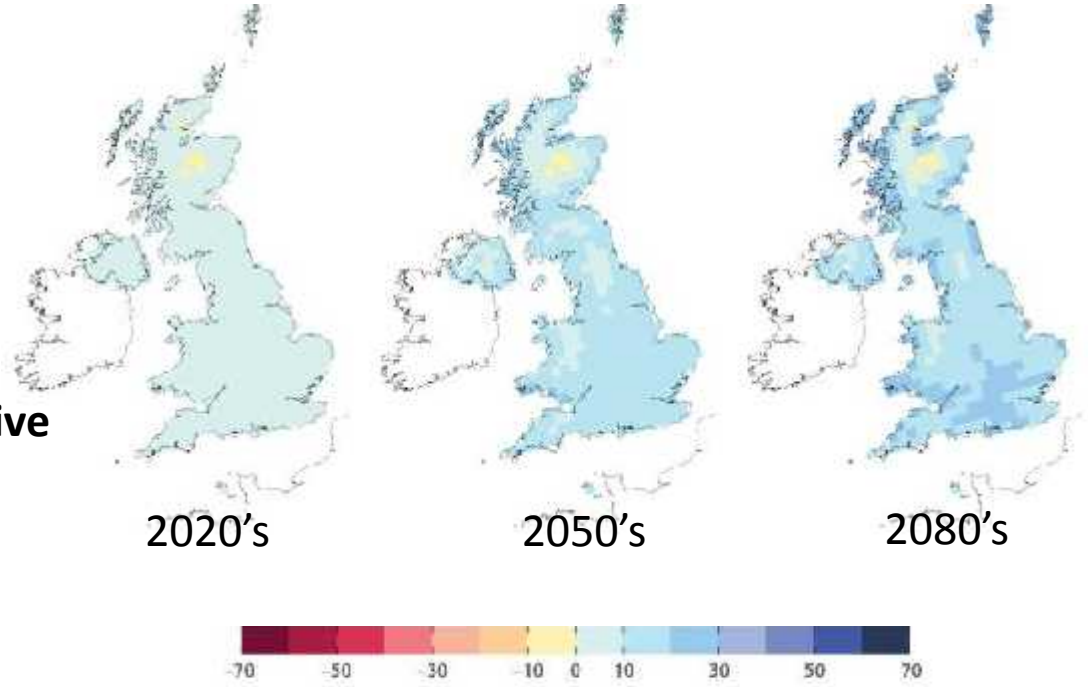


UK CLIMATE PROJECTIONS

Mean summer precipitation



Mean winter precipitation



- **Annual figures not informative**
- **Seasonal differences**
- **Even at coarse 25km scale - spatial variation**

Methodological development

Enhancing the WorldClim data set for national and regional applications

Laura Poggio, Enrico Simonetti, Alessandro Gimona

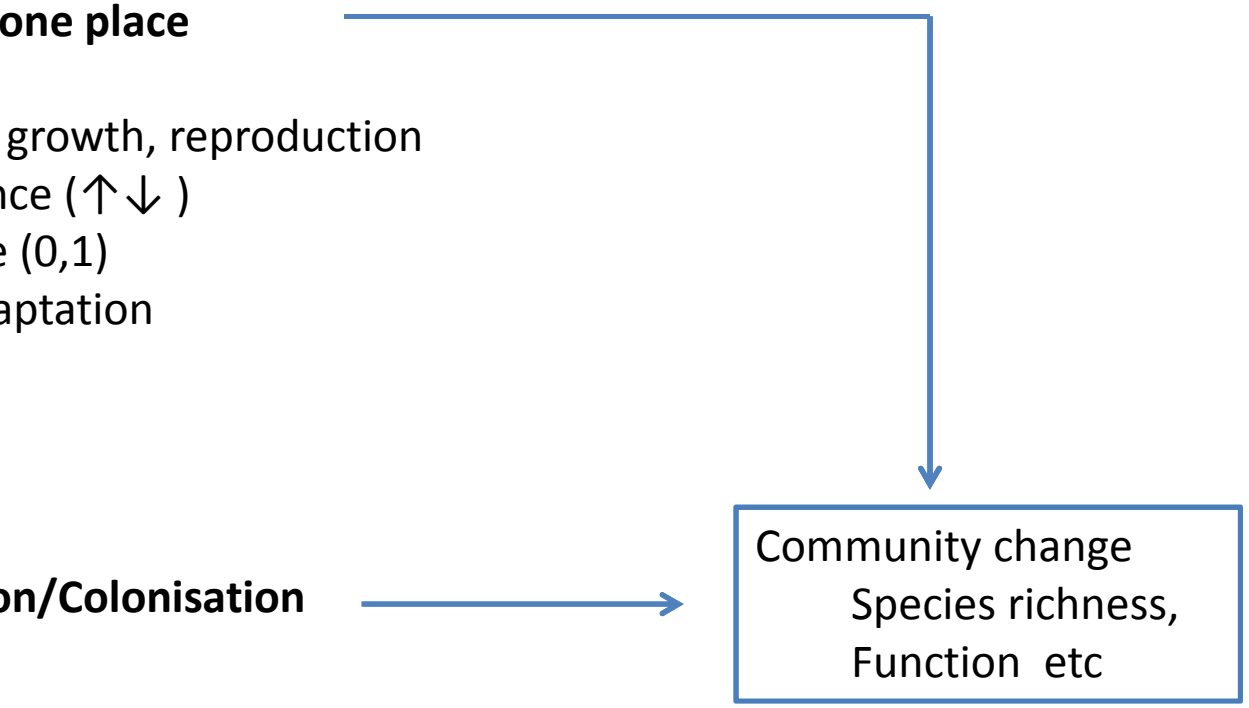
- WorldClim : 1km gridded data for climate predictions
- Erroneous due to topographical variaton especially in mountainous areas
- Especially erroneous for R-factor (Rainfall intensity)
- Now integrated with local (UK) climatic data and topographical information give interpolated spatial 100m grid.
- Downscaled WorldClim to give predictions at finer (100m) resolution.

Responses to Climate Change

Organism stays in one place

Survival, growth, reproduction
Abundance (↑↓)
Presence (0,1)
Local adaptation

Dispersal/Migration/Colonisation



Responses to Climate Change

Organism(s) stay in one place

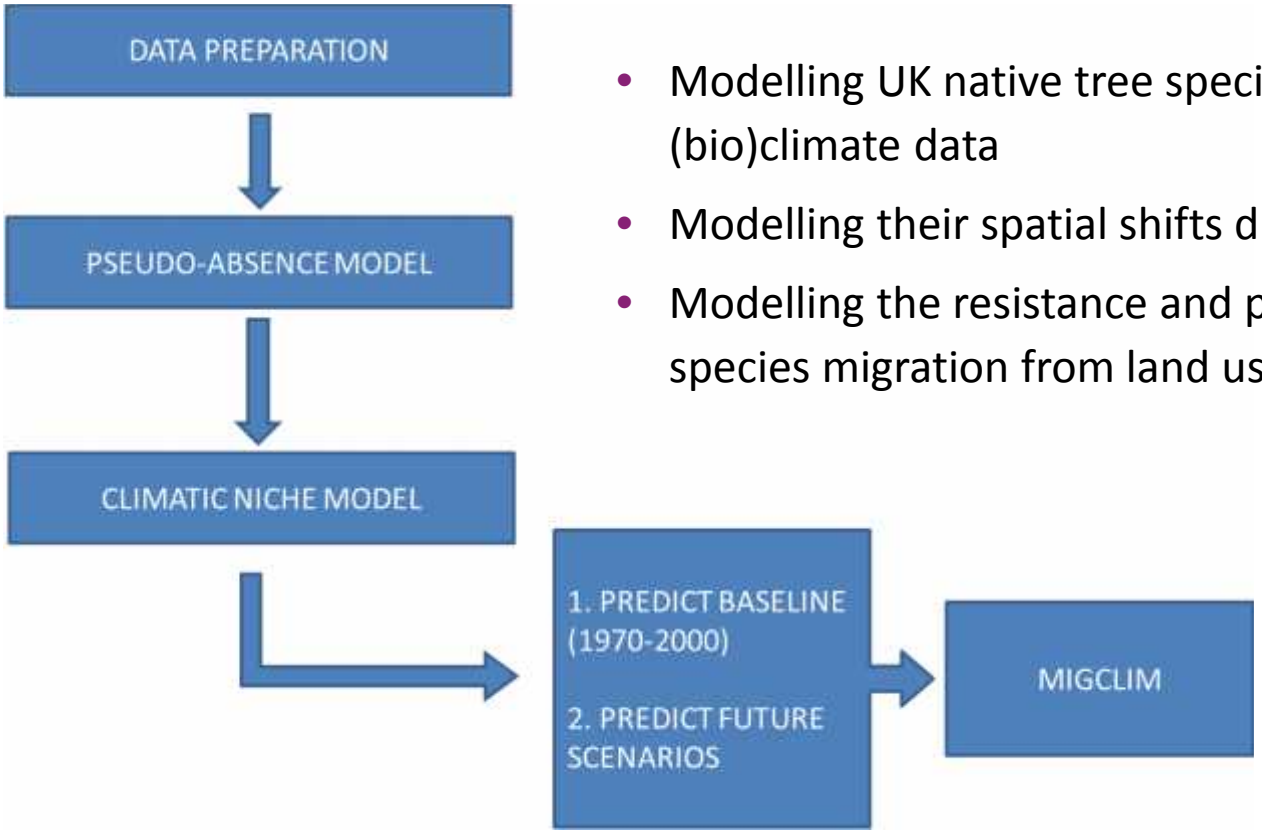
Survival, growth, reproduction
Abundance (↑↓)
Presence (0,1)
Local adaptation

Dispersal/Migration/Colonisation

Community change
Species richness,
Function etc

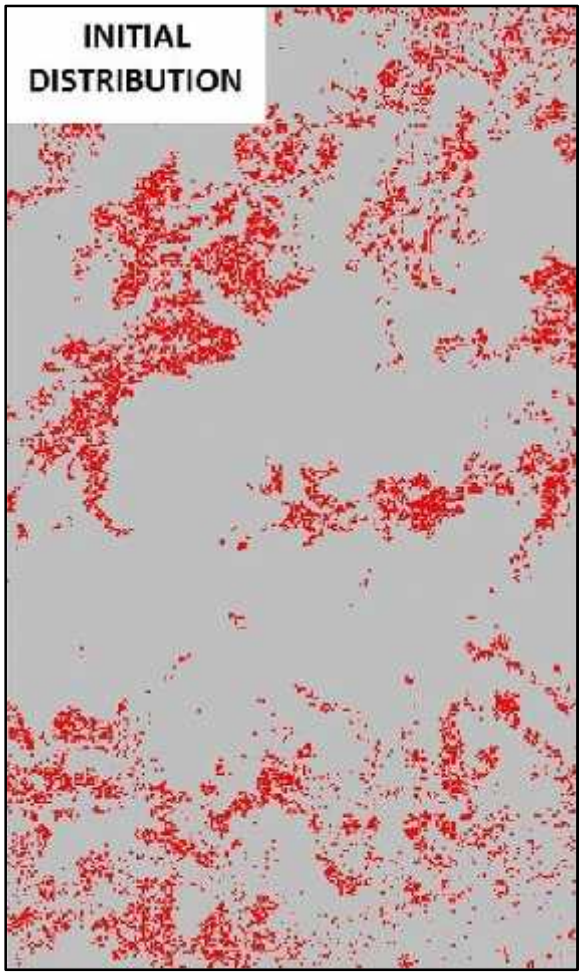
Modelling climate-induced range shifts of UK native tree species

- **PhD research: Enrico Simonetti**
- **Part of larger project** involving Alessandro Gimona, Laura Poggio, Alison Hester, Roberto Canullo



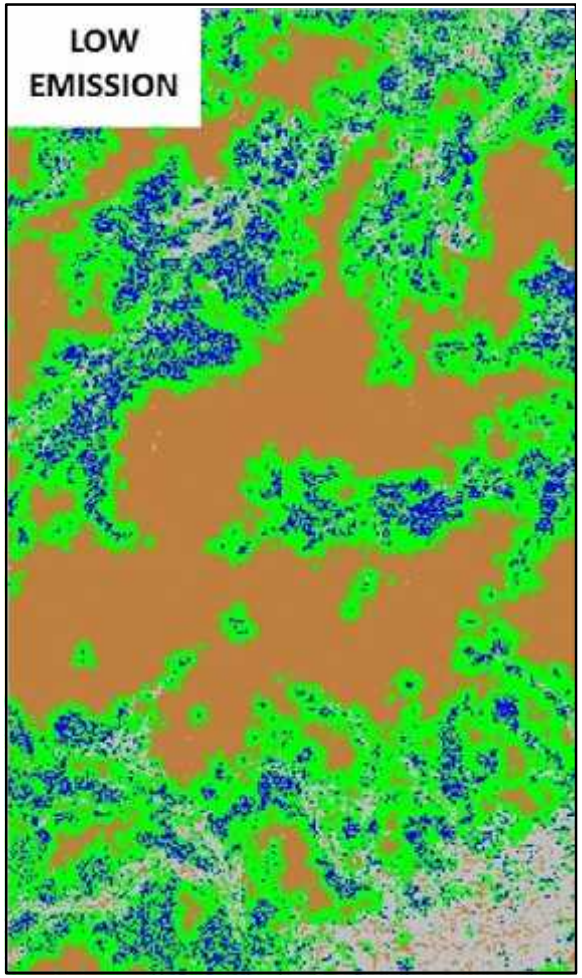
- Modelling UK native tree species distribution using (bio)climate data
- Modelling their spatial shifts due to climate change
- Modelling the resistance and permeability to species migration from land use configuration.

Dispersal (MigClim): *Pinus sylvestris*



Presence
Absence

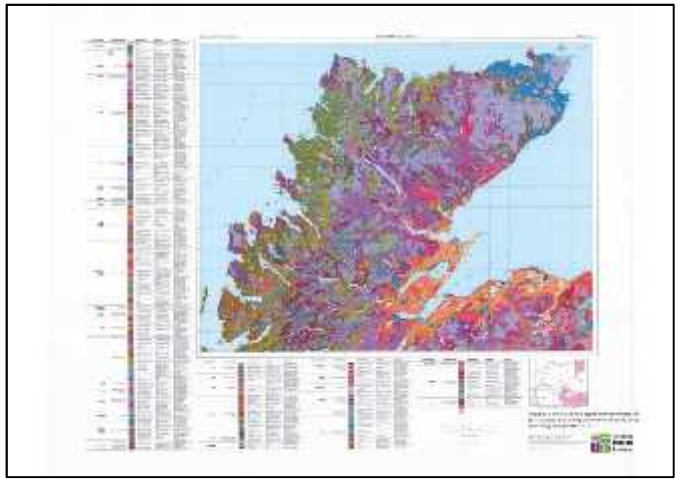
Inputs: **distribution, suitability, land use**



Presence
Absence
Colonisation
Potential habitats

Next steps…

- Modelling the relationships between bioclimatic species niches and soil properties (Scotland has good soils data – big benefit!)
- Evaluate and incorporate land use impacts (e.g. grazing) on future species distribution predictions
- Integrate this new model with the Native Woodland Model - to develop a ‘dynamic’ woodland suitability model for Scotland that can track predicted climate change impacts for key tree species…



Responses to Climate Change

Organism stays in one place

Survival, growth, reproduction
Abundance (↑↓)
Presence (0,1)
Local adaptation

Dispersal/Migration/Colonisation
Pests & Diseases
eg Distribution of ticks

Community change
Species richness,
Function etc

Growth and Budburst Phenology of Scots pine
- in relation to climate

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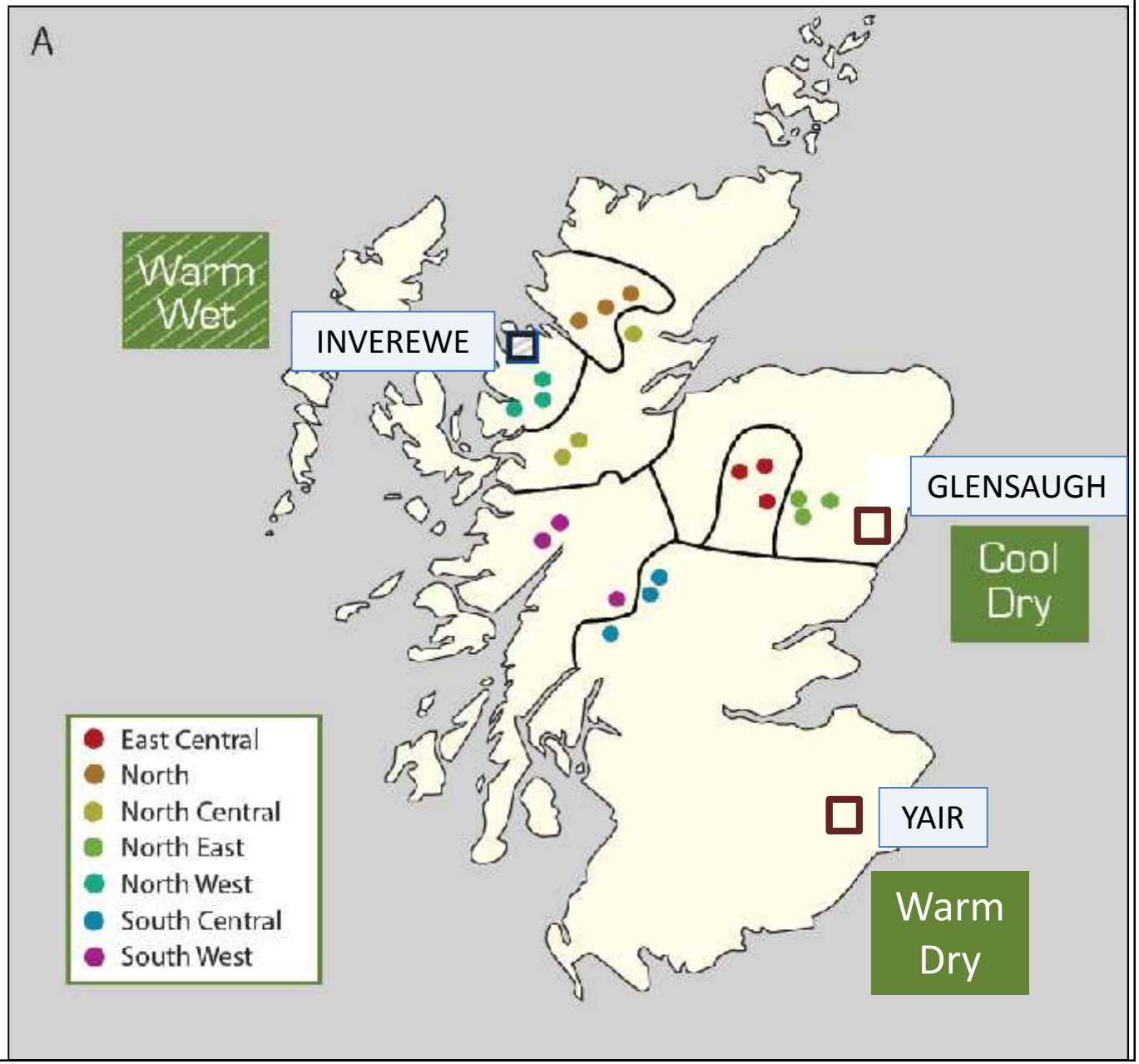
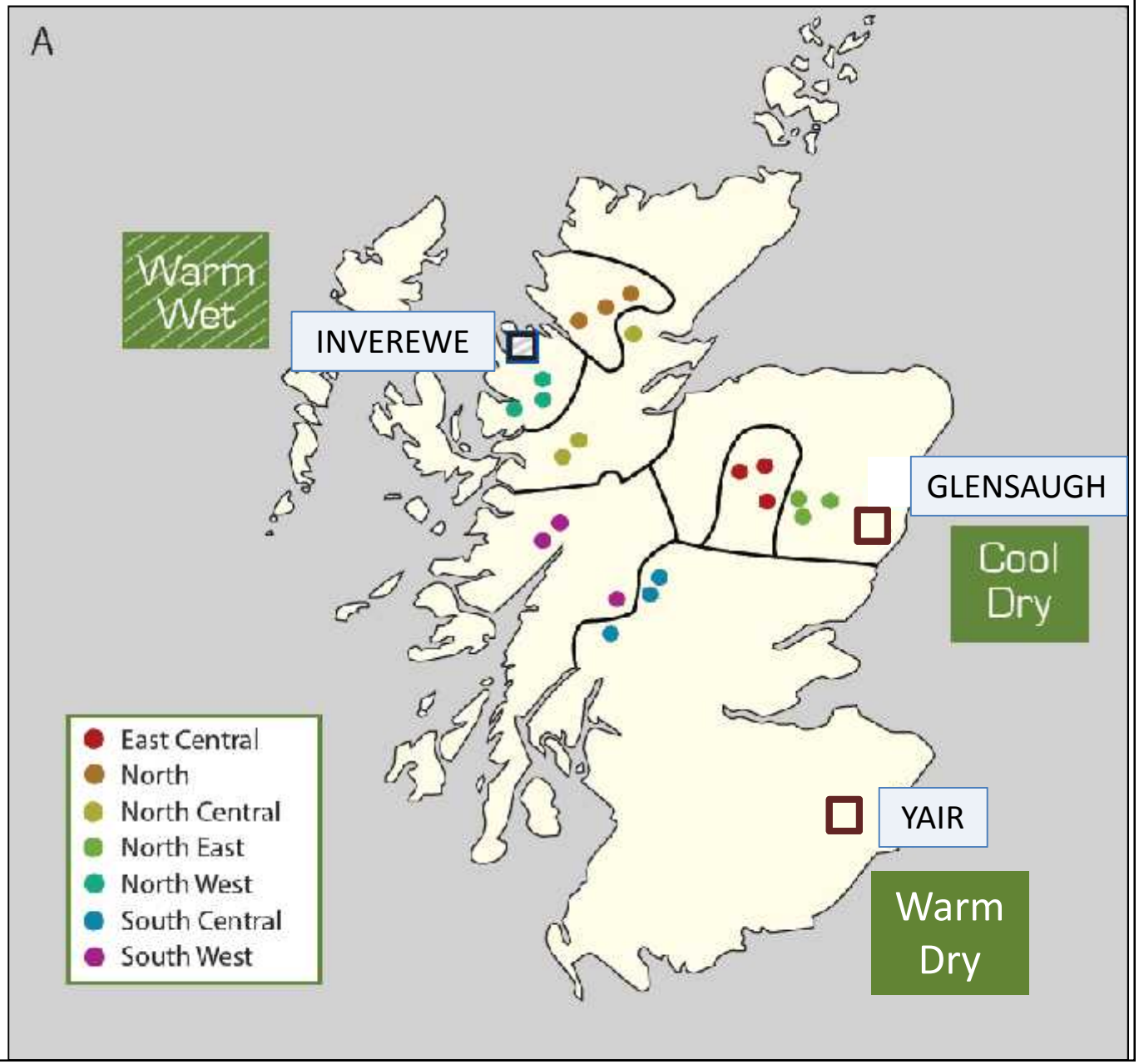
Centre for Ecology & Hydrology
NATURAL ENVIRONMENT RESEARCH COUNCIL

Forest Research



Growth and Budburst Phenology of Scots pine
- in relation to climate

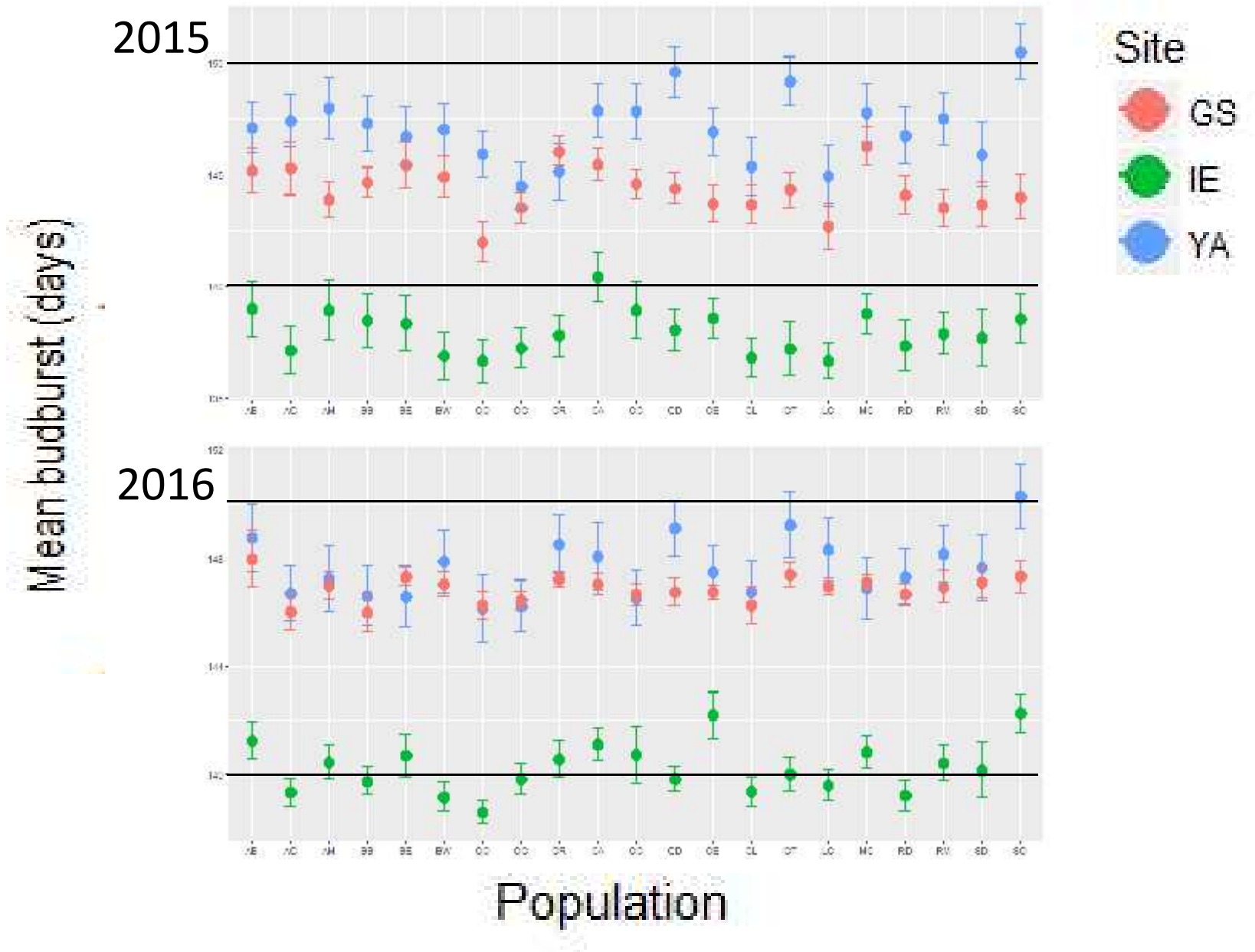
- Three sites
- 21 source populations
- 8 families/ population
- 3 or 4 blocks
- Seed collected 2007
- Experiment planted 2012



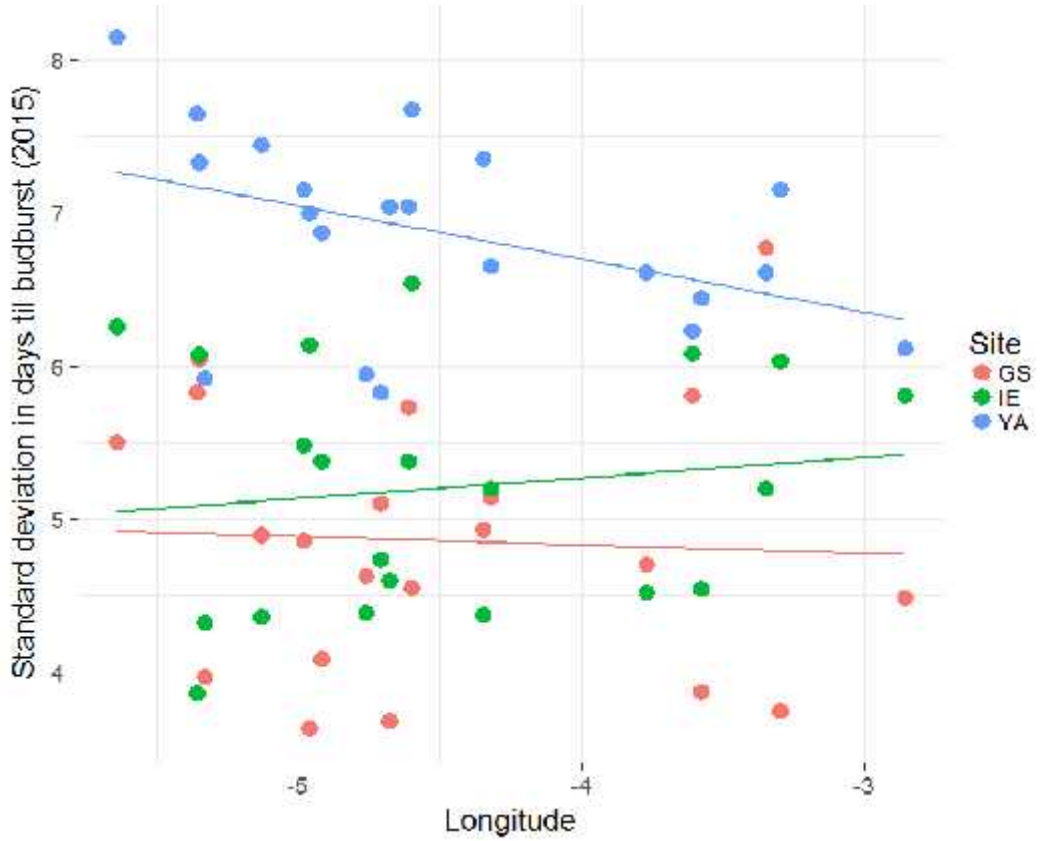
Budburst Phenology

1	2	3	4	5	6	7
Dormant	Bud swelling	Scales open at base	Scales open – no needles	White tipped needles	Green needles	Needle separation

Budburst Phenology – Site Variation and Year to Year

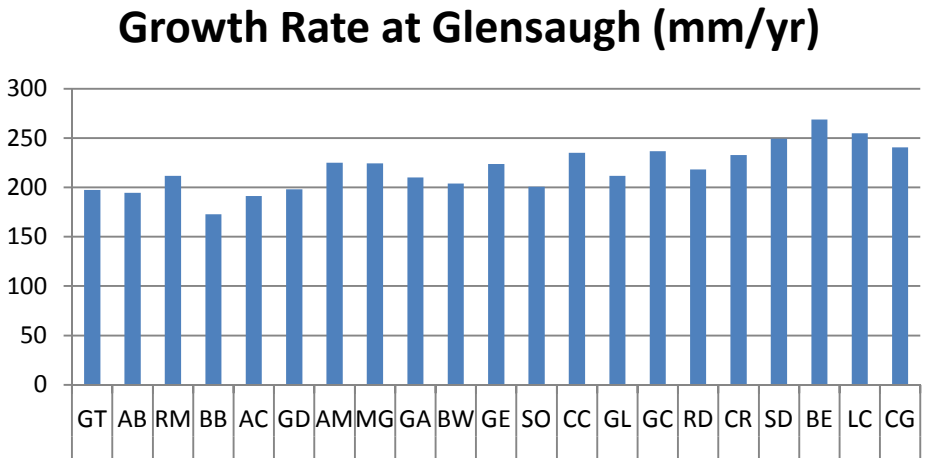


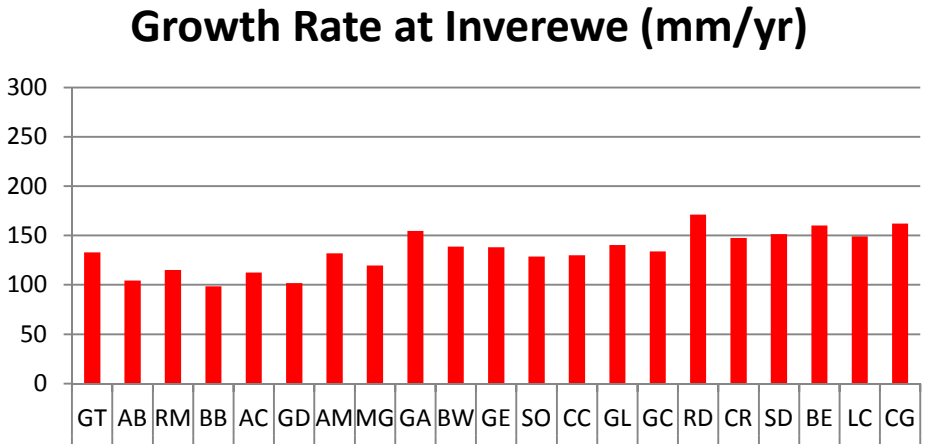
Bud burst more variation at Yair - novel site?



Bud burst phenology quite 'plastic' – site and year variation
Variation among provenances and family within provenance

Growth in relation to provenance/climatic distance





Climatic Gradient of Provenance

East → West

Main effect is planting site (nutrients?)

Westerly provenances grow faster regardless of site

Significant variation explained by 'family' within provenance

Summary – Scots pine

Much genetic variation for natural selection to act upon = good news

Budburst and growth seem very ‘plastic’ but underlying genetic limits not known

Climate responses under investigation

Summary – Scots pine

Much genetic variation for natural selection to act upon = good news

Budburst and growth seem very ‘plastic’ but underlying genetic limits not known

Climate responses under investigation

Additional work

Biodiversity responses to climate/origin
- Invertebrates
- Needle endophytic fungi (CEH,RBGE)

Tree ‘defence’ responses to climate
- Resistance to Dothistroma needle blight
- Resistance to Pine tree lappet moths

Responses to Climate Change

Organism stays in one place

Survival, growth, reproduction
Abundance (↑↓)
Presence (0,1)
Local adaptation

Dispersal/Migration/Colonisation
Pests & Diseases
eg Ticks and tick-borne diseases

Community change
Species richness,
Function etc
eg peatland communities

Budburst Phenology

BORDERS		Adjusted MS		Variance components (using Adjusted SS)	
Source of variation	df	2015	2016	2015	2016
Provenance	20	69.63	36.29		
Block	3	148.96*	224.52***	1.37%	2.84%
Family (Provenance)	147	65.24***	54.41***	12.51%	11.99%
Error	483	41.69	35.18	86.12%	85.17%

GLENSAUGH		Adjusted MS		Variance components (using Adjusted SS)	
Source of variation	df	2015	2016	2015	2016
Provenance	20	37.15	8.025		
Block	3	29.22	23.461*	0.18%	1.05%
Family (Provenance)	148	32.12**	10.824*	10.49%	8.00%
Error	495	21.95	8.039	89.33%	90.95%

INVEREWE		Adjusted MS		Variance components (using Adjusted SS)	
Source of variation	df	2015	2016	2015	2016
Provenance	20	20	17.874		
Block	3	38.59	14.925	0.43%	0.48%
Family (Provenance)	147	29.51	12.083	3.83%	7.81%
Error	303	26.53	9.757	95.75%	91.72%

1.3.3 Resilience of ecosystems and biodiversity

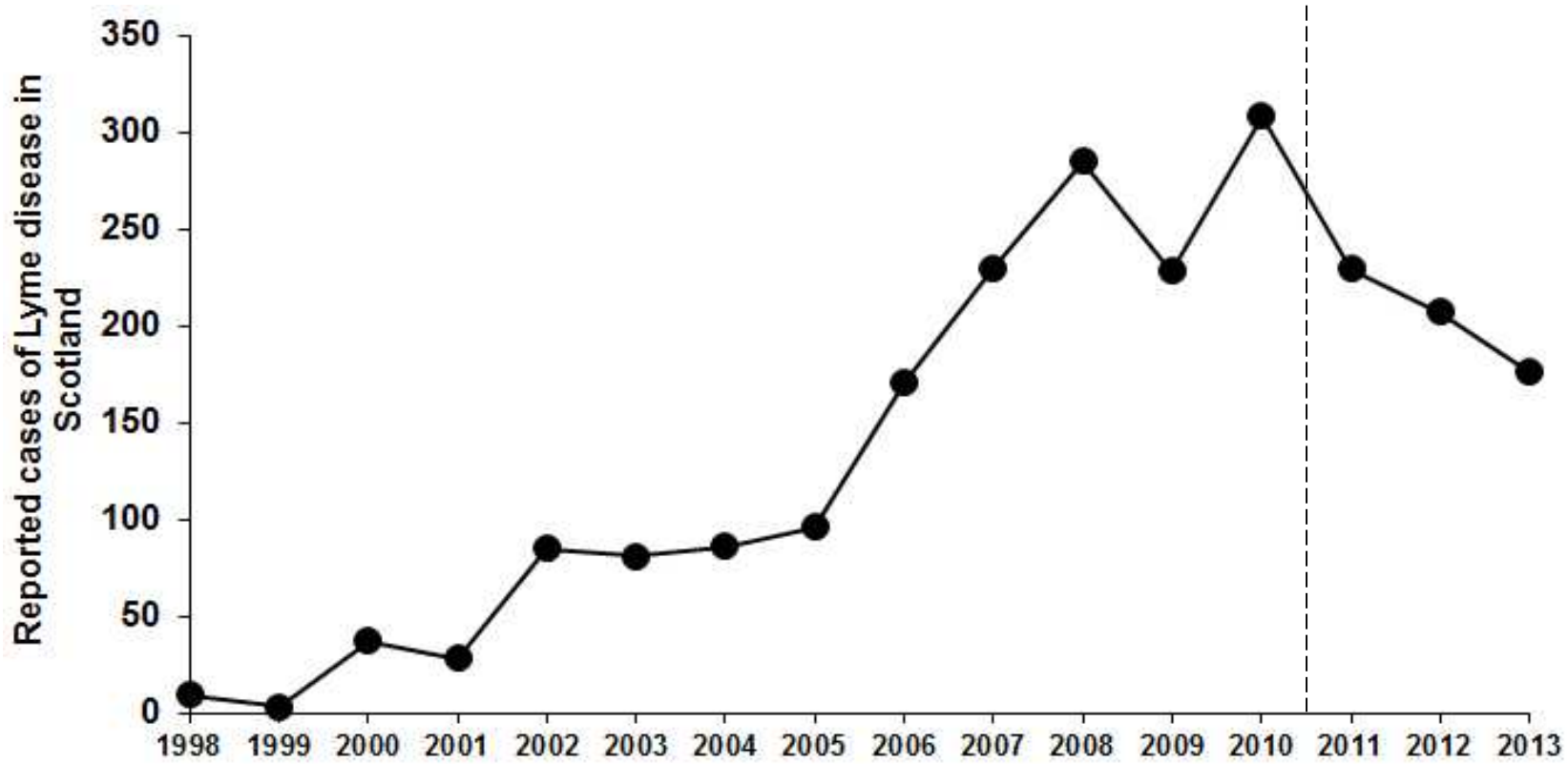
Objective 2: The consequences of environmental and climate change for ecosystem resilience

2b: Spatial range changes, species and community shifts

2b.i. Range shift and resilience of ticks to climate change

Rationale

Ticks are the most important vector of zoonotic pathogens in Europe.
Lyme disease is the most prevalent tick-borne disease in the Northern Hemisphere.

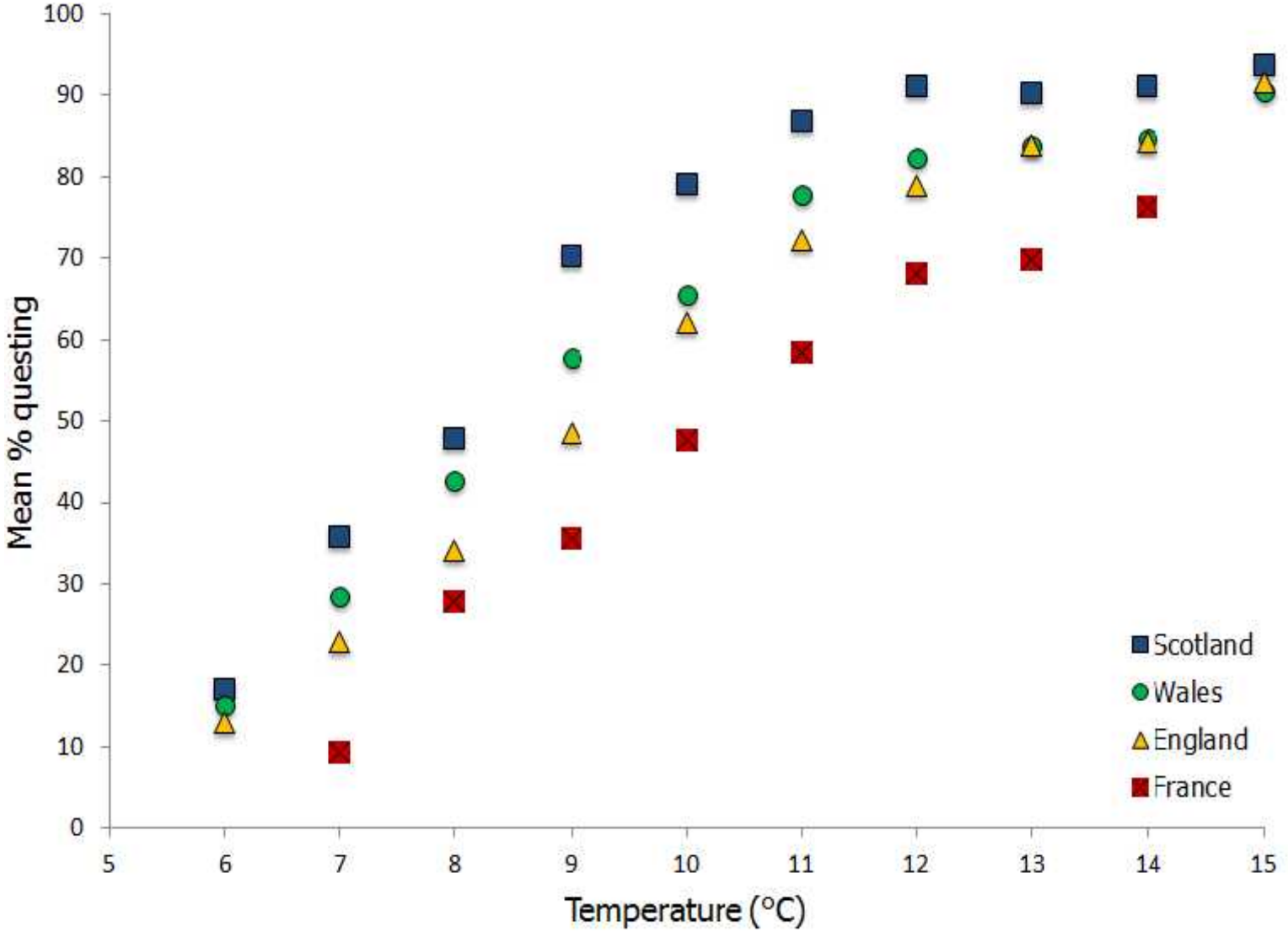


Strategic policy relevance:

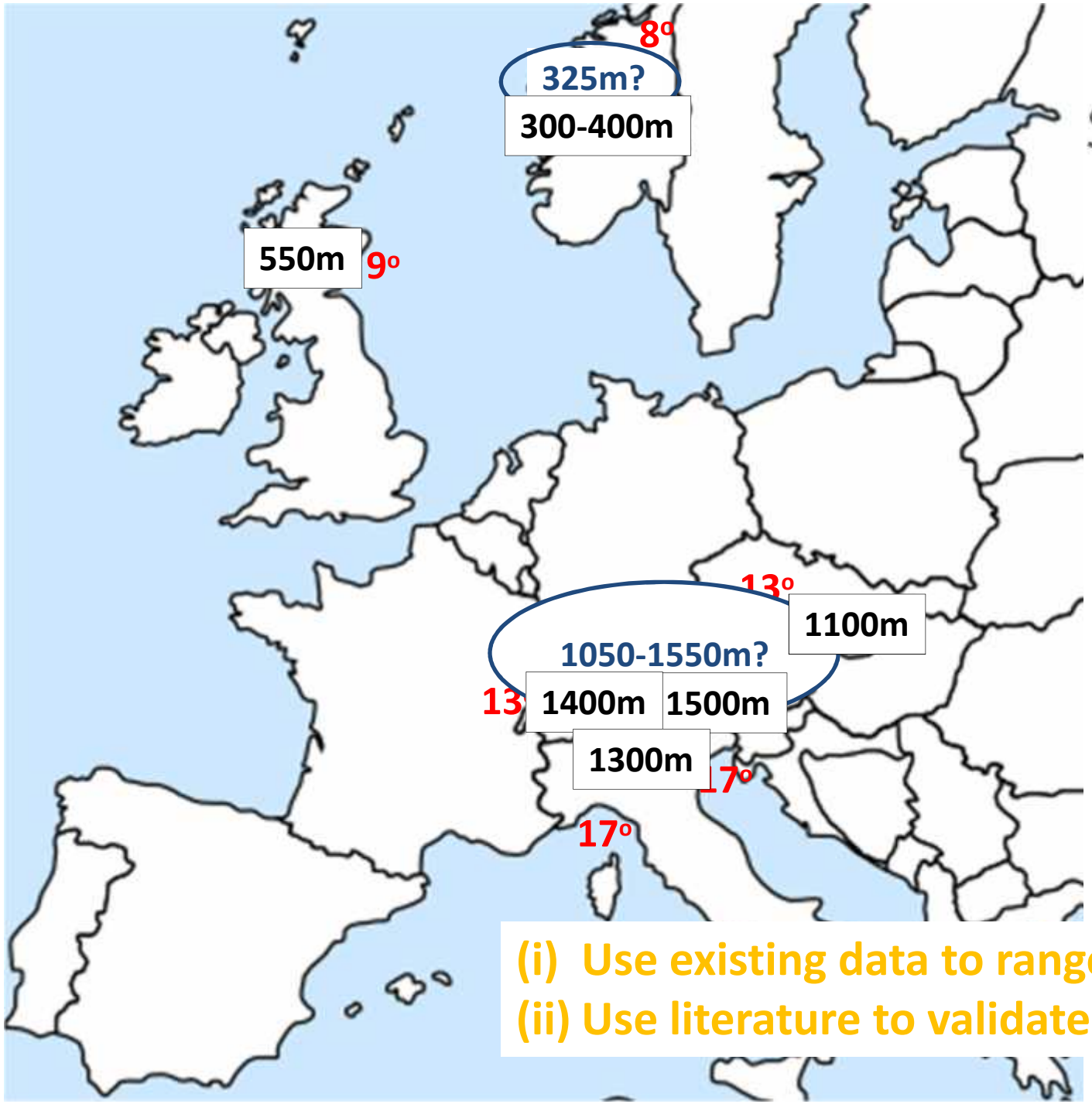
- **Debated in the House of Lords in October 2015**
- **Listed as a priority research area in "Scotland's Wild Deer: a National Approach" (WDNA) Action Plan 2015-2018.**
- **Parliamentary questions in Scottish parliament**

Approach

Use existing data and literature to parameterise models of current latitudinal and altitudinal limits of ticks



Gilbert, Aungier, Tomkins (2014) *Ecology & Evolution*

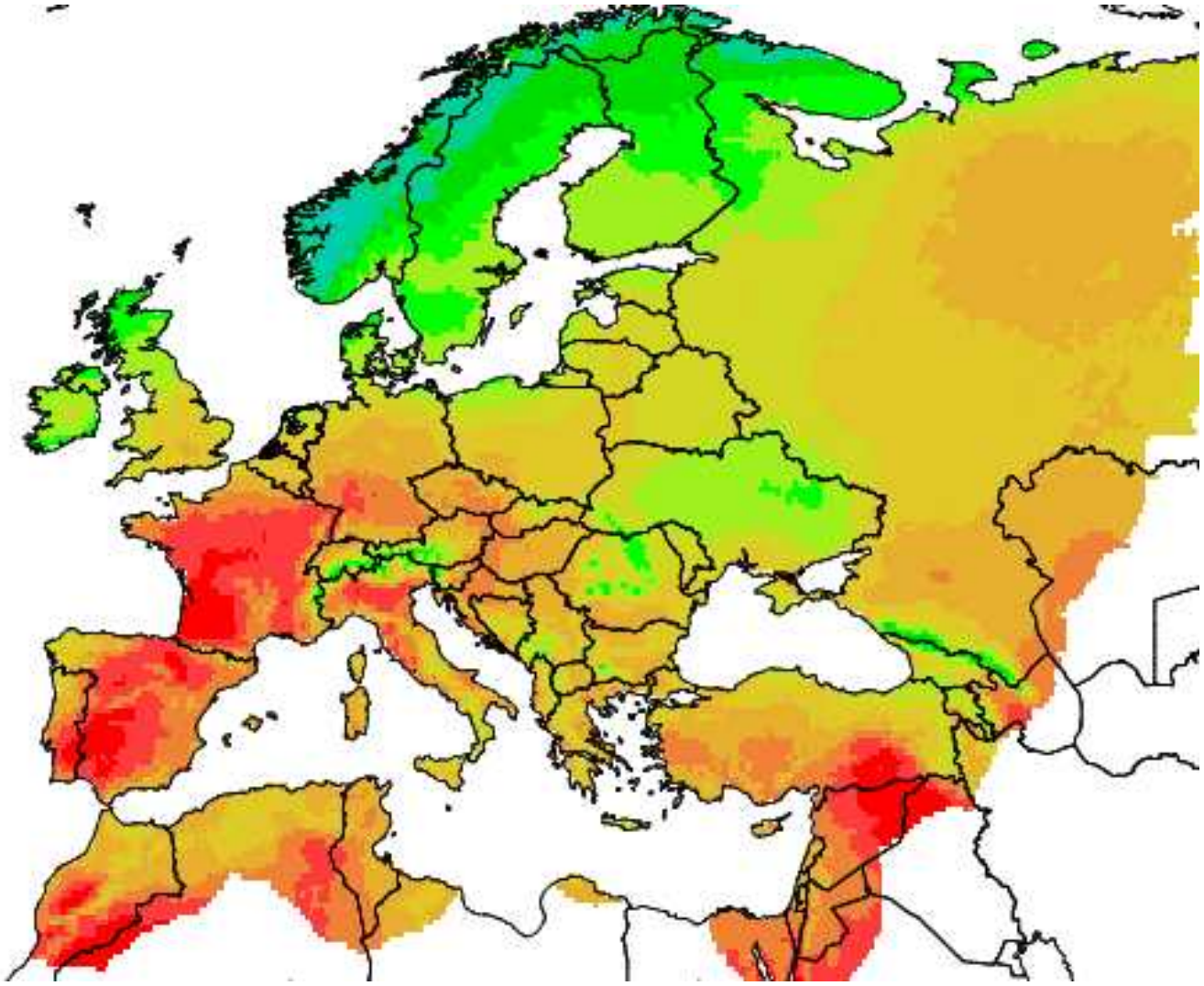


SEFARI

(i) Use existing data to range limits

(ii) Use literature to validate the relationship

Climate data over Europe



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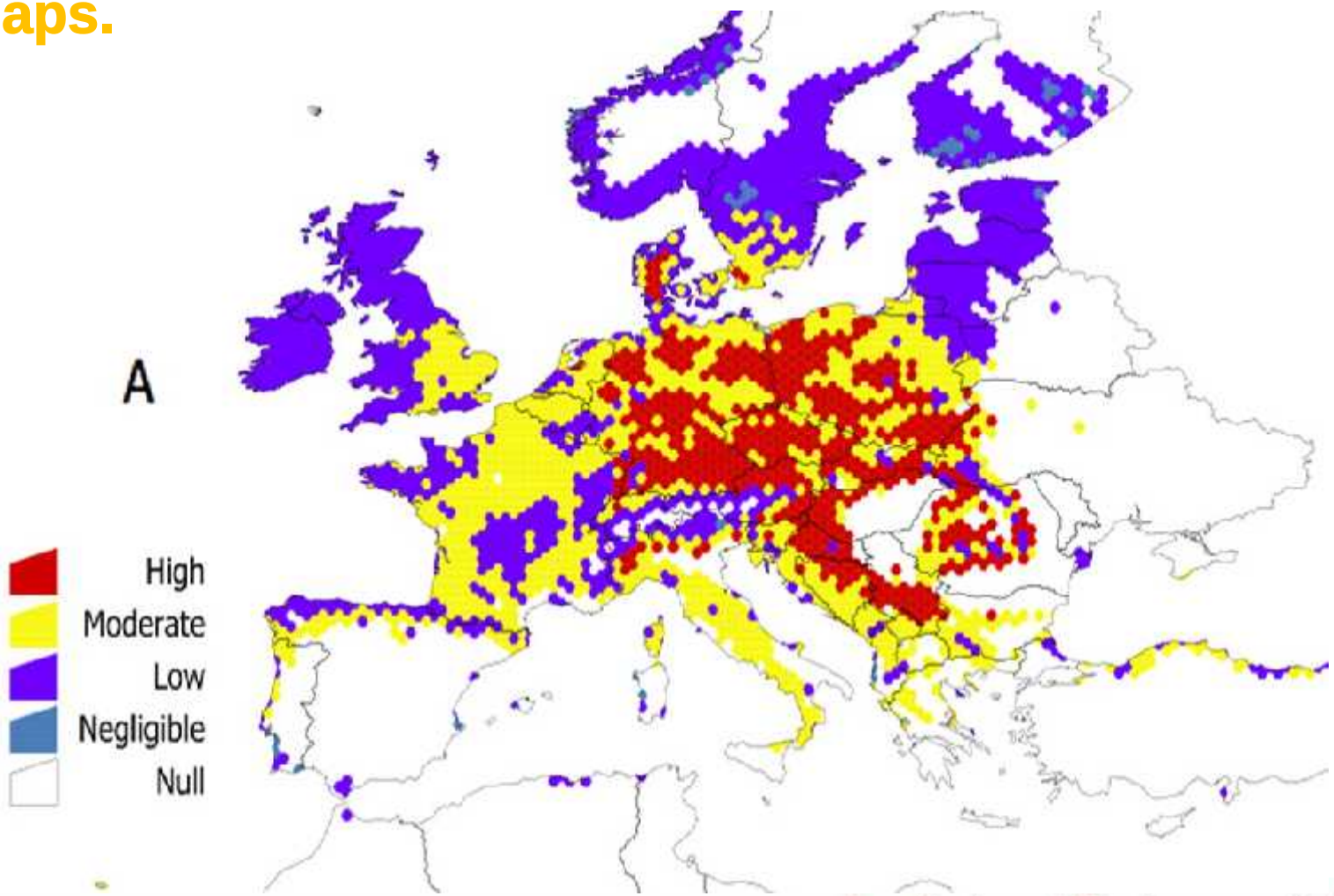
Next step is to roll out our validated relationship of ticks with temperature and altitude over Europe according to the climate maps.

SEFARI



Agustín Estrada-Peña et al. Appl. Environ. Microbiol. 2011;77:3838-3845

Applied and Environmental Microbiology

Then…

With a new collaboration set up with Oxford University and China (Dr Sen Li), we aim to use cellular automaton modelling methods to

convert the tick predictions into Lyme disease predictions (Yr 3).

Final model stages (Yr 4) will be to examine the RESILIENCE of ticks to climate change due to their ability to adapt to local climates.

Links

Model predictions of tick range shifts will feed into models in CoE EPIC III.
The management implications will be informed by results from RD2.3.3 (effect of deer on tick-borne diseases).

Thank you

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gov.scot

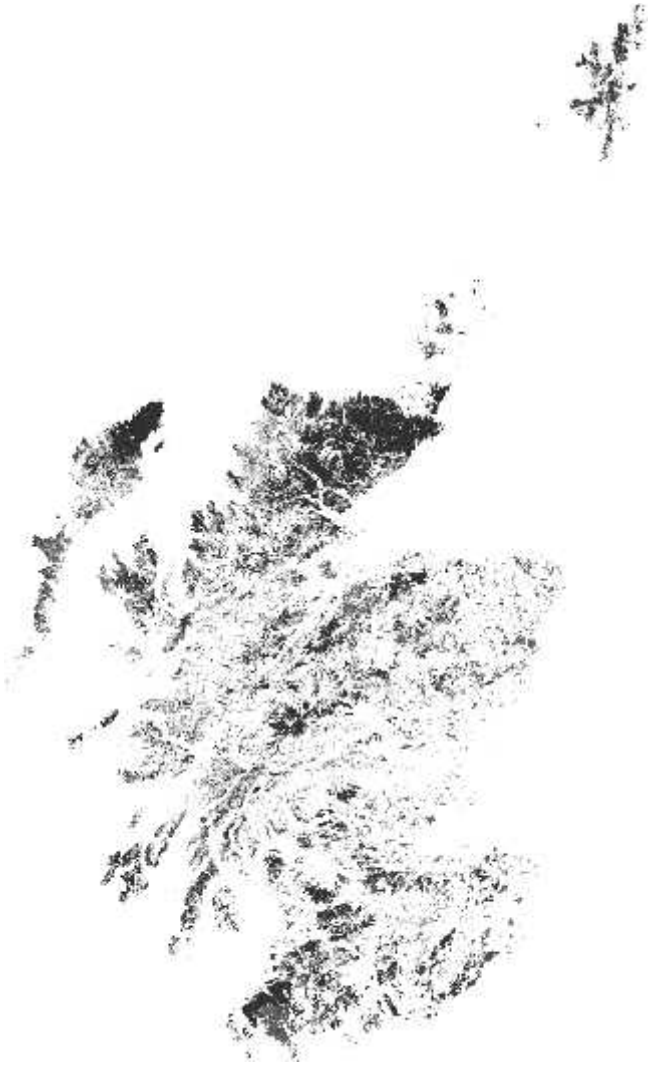
Is peatland restoration future climate-proof?

Rebekka Artz

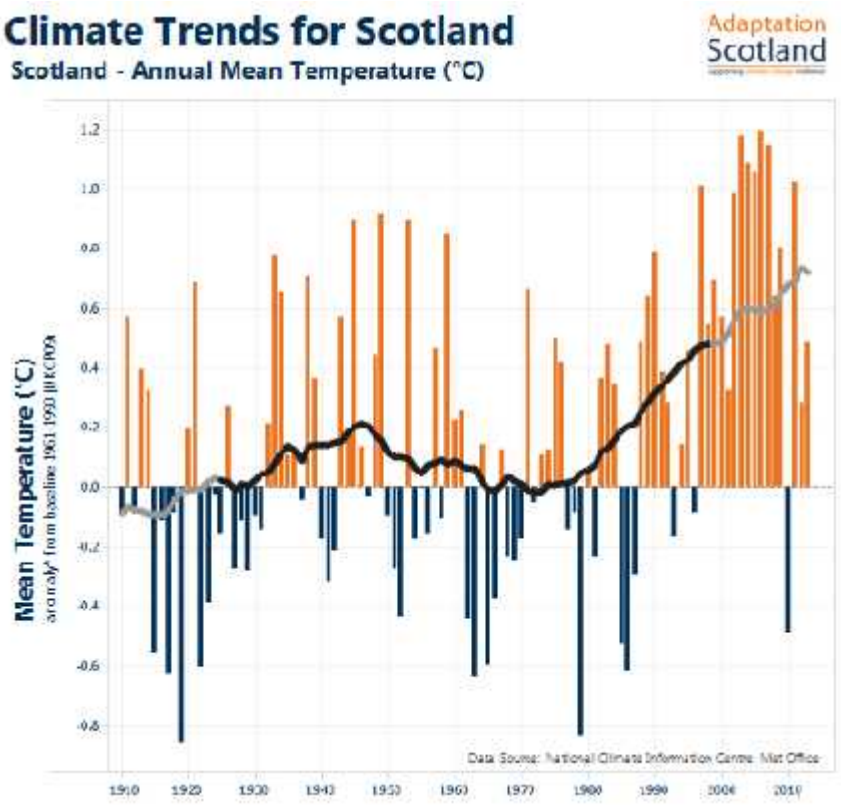
James Hutton Institute

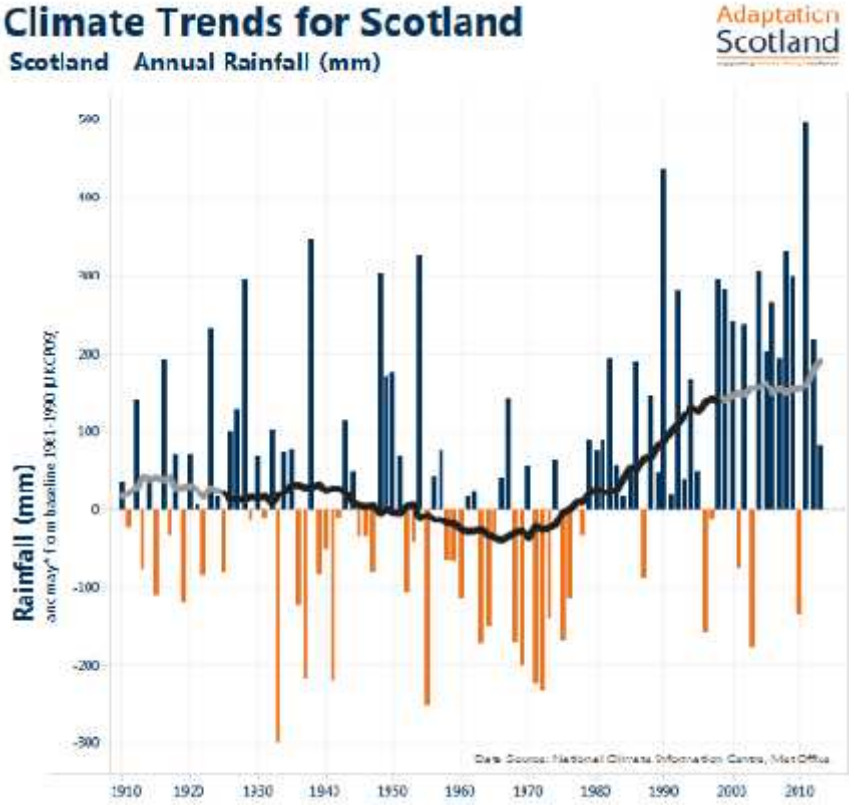
Introduction

- Peat soil covers 24% of Scotland, much of it is degraded and is no longer peat forming habitat
- Peatland restoration aims to re-wet damaged sites, lower evapotranspiration, and ultimately recreate peatland habitat (Climate Change Plan, Aichi Target 15)
- Future climate forecasts: rainfall / temperature and effects on peatland distribution/condition
- RESAS Programme work so far
- *Limited by effort (0.74 FTE per year) ! Please reign in your expectations….*

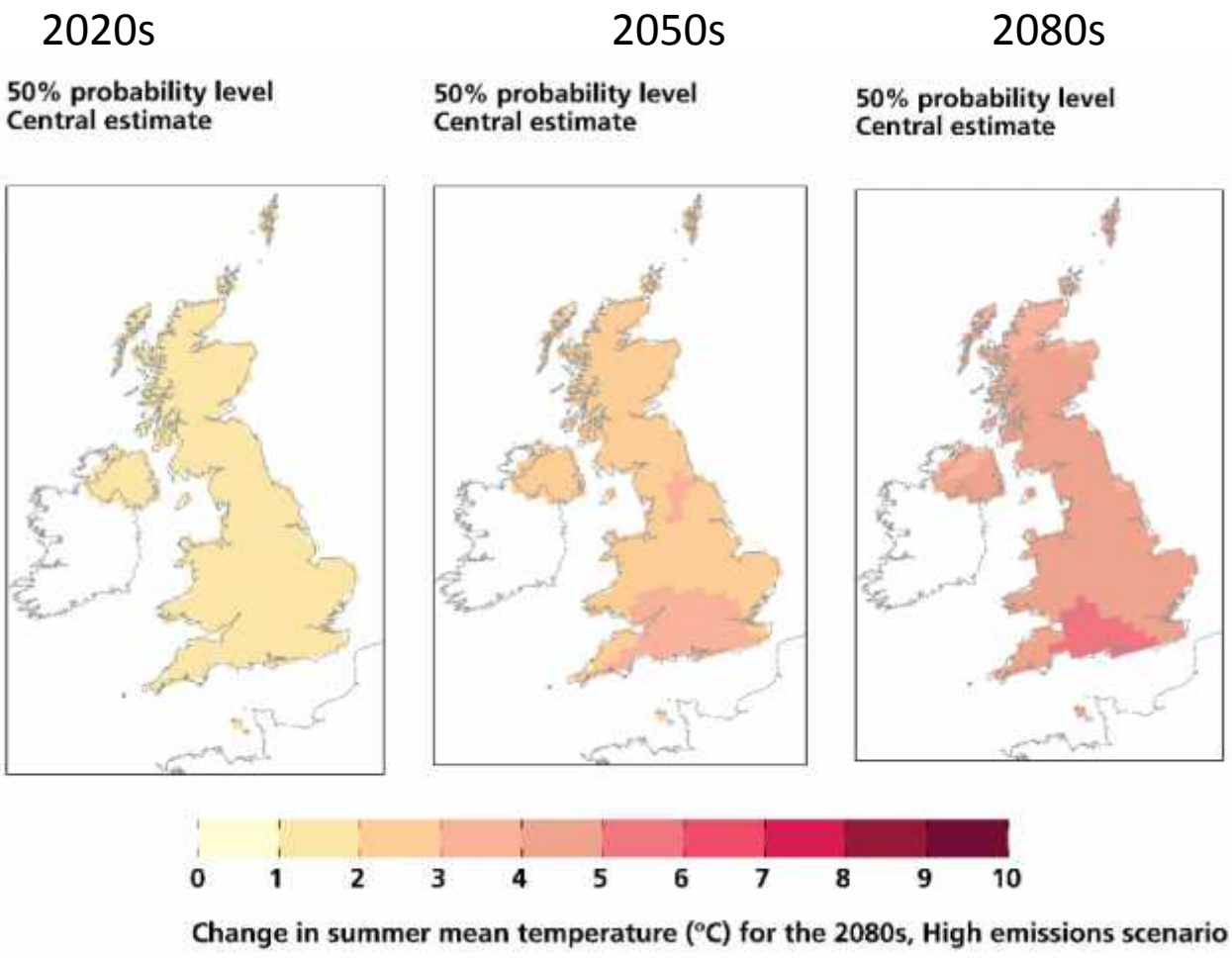


Long term climate trends

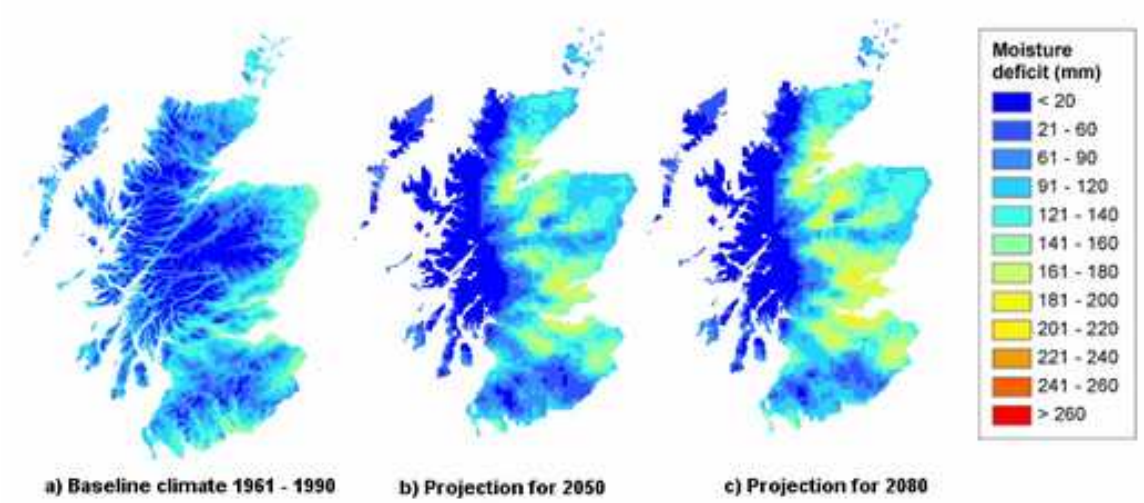




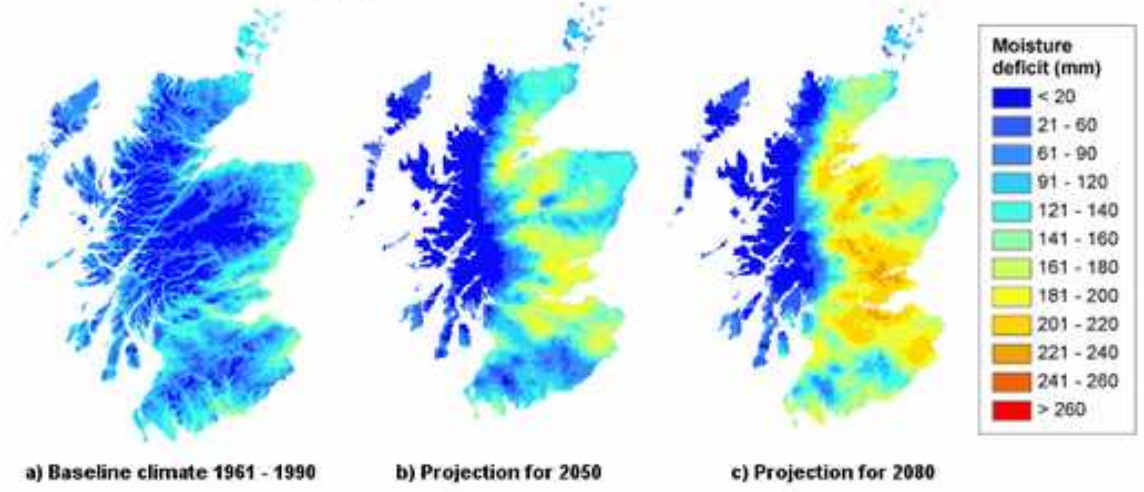
Projections UK Met Office (UKCIP09)



Moisture deficit (UKCP02)



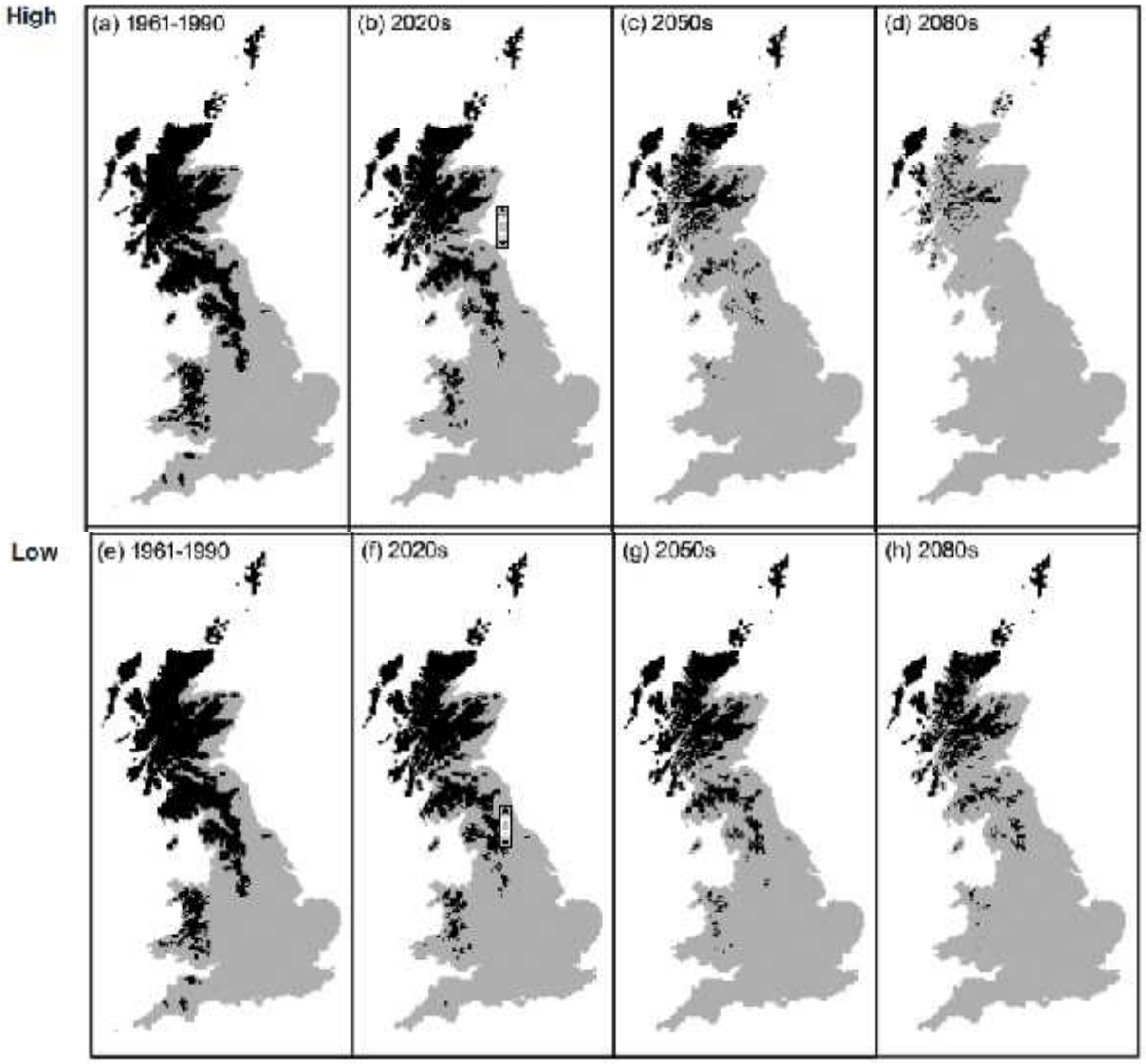
Low emissions scenario projections



High emissions scenario projections

Forestry Commission

Blanket bog bioclimatic envelope



Gallego-Sala, et al., and Clark et al., (2010).

UKCP02-based

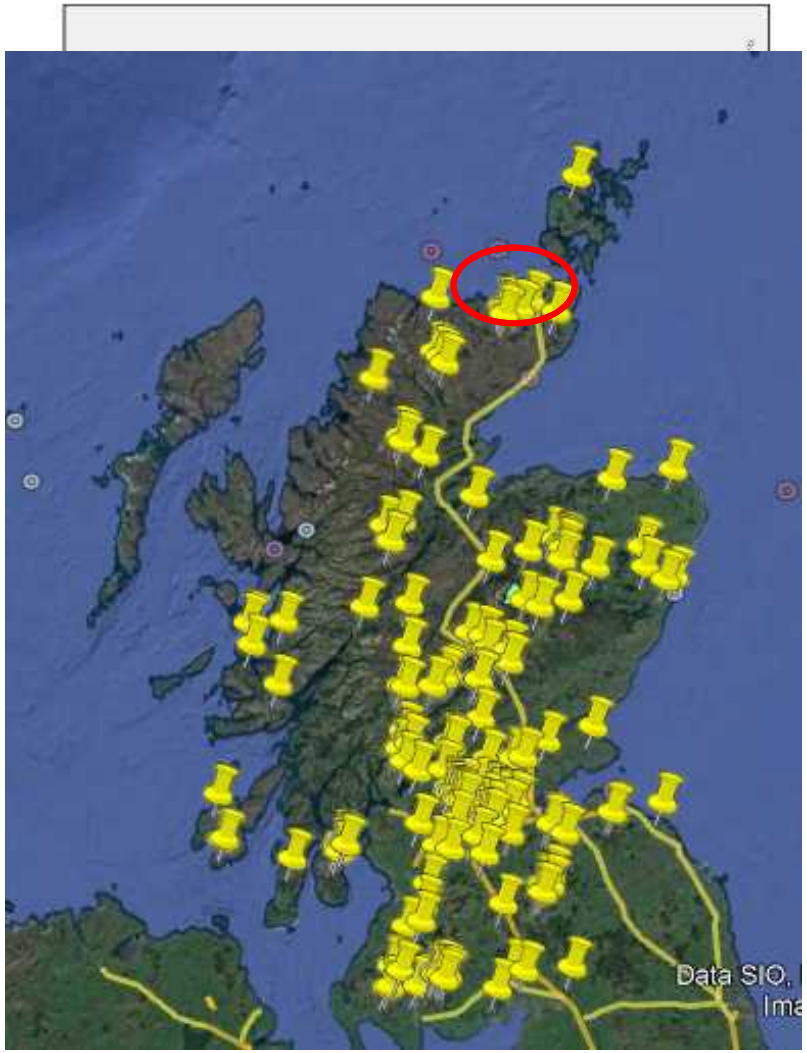
Highest model sensitivity: summer temperature.

Shows areas deemed still suitable for blanket bog development…
BUT: input was peat soil distribution rather than active blanket bog

Results to date

- Site condition modelling with Earth Observation (EO) data
- Direct monitoring of restoration success
- Modelling restoration success with EO data

Peatlands - modelled condition (MODIS)



Much worse than low or high BEM output!

Combined effect of historic land use pressures and climate change.

Will this look different once the restoration projects mature?

SAVI= Soil Adjusted Vegetation Index
NDWI=Normalised Difference Water Index
LSTn=Land Surface Temperature Night

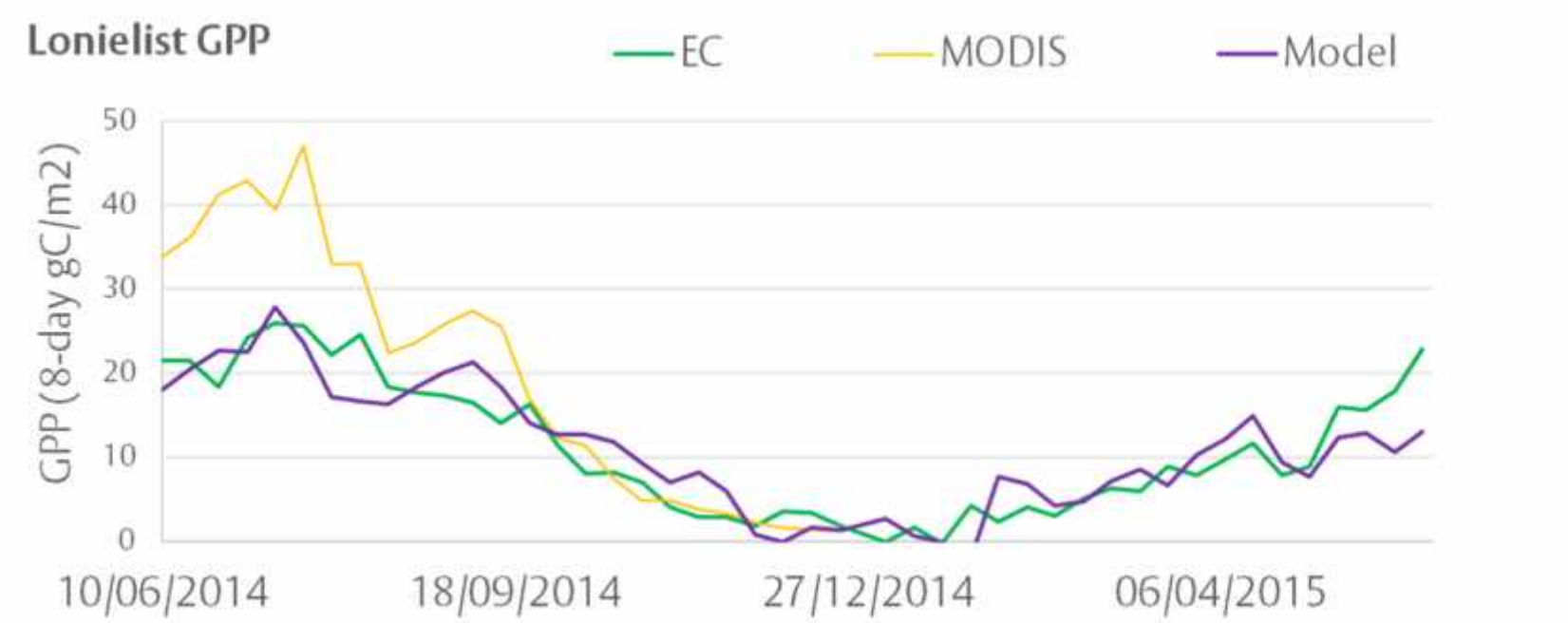
2nd Validation with Peatland ACTION data pending

Poggio and Artz (in prep)

MODIS-based modelling of Gross Primary Productivity (GPP)

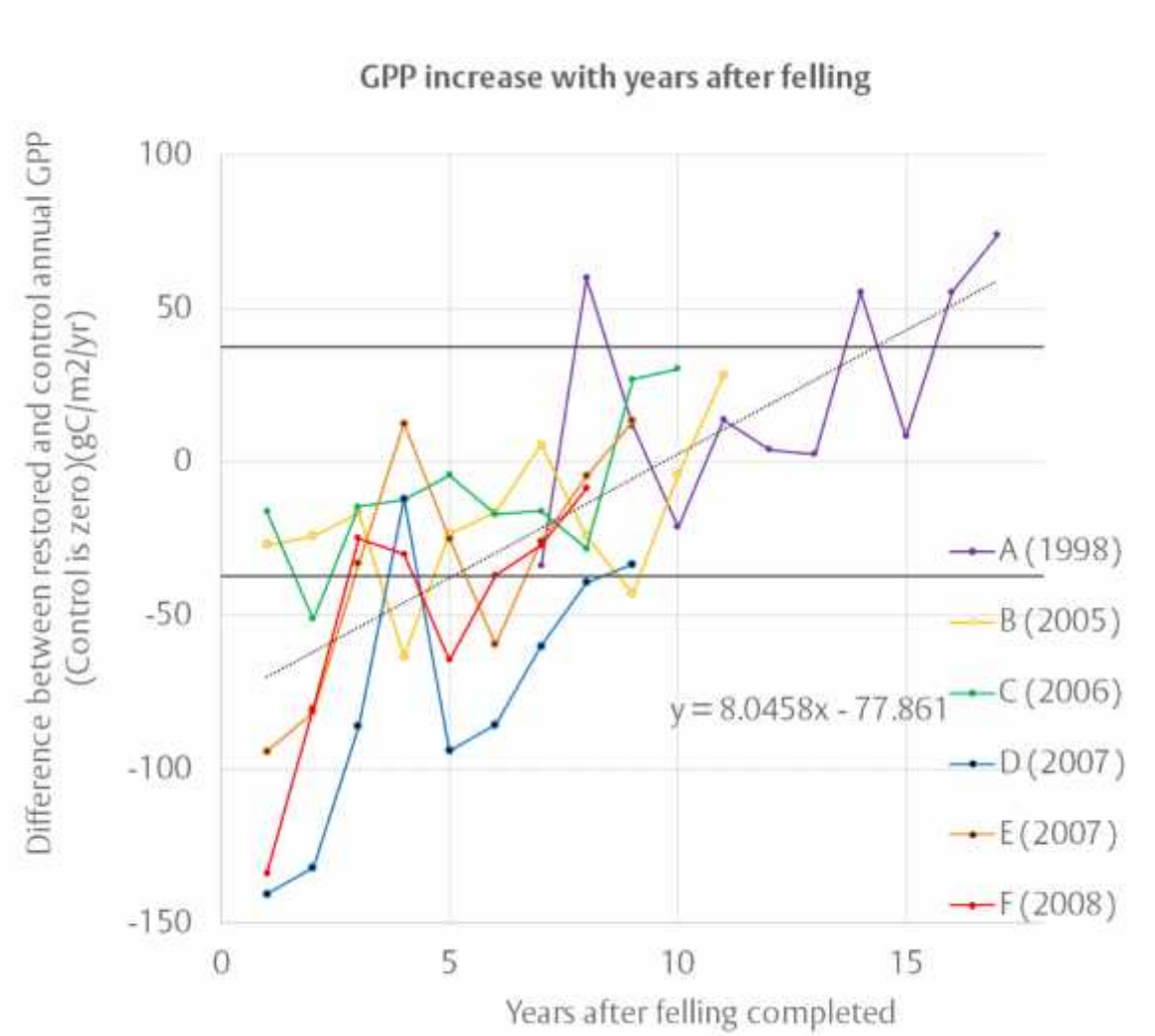
MODIS used as Sentinel archive does not contain enough data yet. Based on the TG model created by Sims et al. (2008). The model used:

GPP = NDVIs x LSTs x m (currently being updated to include seasonal NDWI)



Lees, Artz, Khomik, Clark and Quaife (in prep)

Gross primary productivity recovers in ca. 8 years



1. Is this relationship applicable across Scotland?

2. What happens where there are likely future moisture deficits?

Lees, Artz, Khomik, Clark and Quaife (in prep)
Also Lees et al., 2018

Conclusions

- Gallego-Sala et al., essentially assumed that current distribution of blanket peat soil = functioning blanket bog.

- Our model suggests this is not the case, and current poor condition/failed restoration attempts may make the outlook potentially worse.

- However, data from Forsinard experiment suggest restoration can restore at least some elements of peatland functioning (if not full habitat value) in a decade or two.

Future work

- Assemble MODIS/Sentinel-2 data 2015-2020 and suitable ground observations (vegetation, water table, site condition)
- Assess restoration outcomes at local level (Forsinard) using UAV data with the aim to parameterise EO-data based models
- Check trajectory of national level restoration management on NDVI/NDWI/(GPP) based on EO data
- Longer term aims: predict restoration timelines and outcomes.

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Thank you!

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Land Use
How can decisions about land use deliver improved benefits?
Justin Irvine
Scottish Government
Riaghaltas na h-Alba
gov.scot
SEFARI

Scottish Government Strategic Research Programme 2016-2021
Land Use relate research in the Research Programme

The James Hutton Institute

- Effectiveness of Agri-environment schemes
- - gaps and novel measures
- Uptake e.g. waders
- Taking a landscape scale approach (ECAF, and catchment scale land use)
- Catchment management in practice
- Delivering multiple benefits from woodland
- Strategic scales: e.g. Forest Strategy to deliver multiple benefits
- Local scale evaluations: benefits to people from woodland, learning for decision making, woodland expansion scenario visualisation and evaluation (inc CaperMap?
- Regional partnerships?
- Natural Capital Accounting

Strategic Research Programme 2016-2021

- Evaluate whether current system can help to *safeguard production and the benefits the environment provides* to society. i.e. multiple benefits
- Assess current management options and gaps
- Managing land at a catchment scale

Land Use Strategy

Recognise, understand and value the importance of our land resources, and where decisions about land use will deliver improved benefits:

- working with nature to contribute more to Scotland's prosperity.
- Responsible stewardship delivering more benefits.
- more people enjoying the land and positively influencing land use

Scotland = 7.8 million hectares

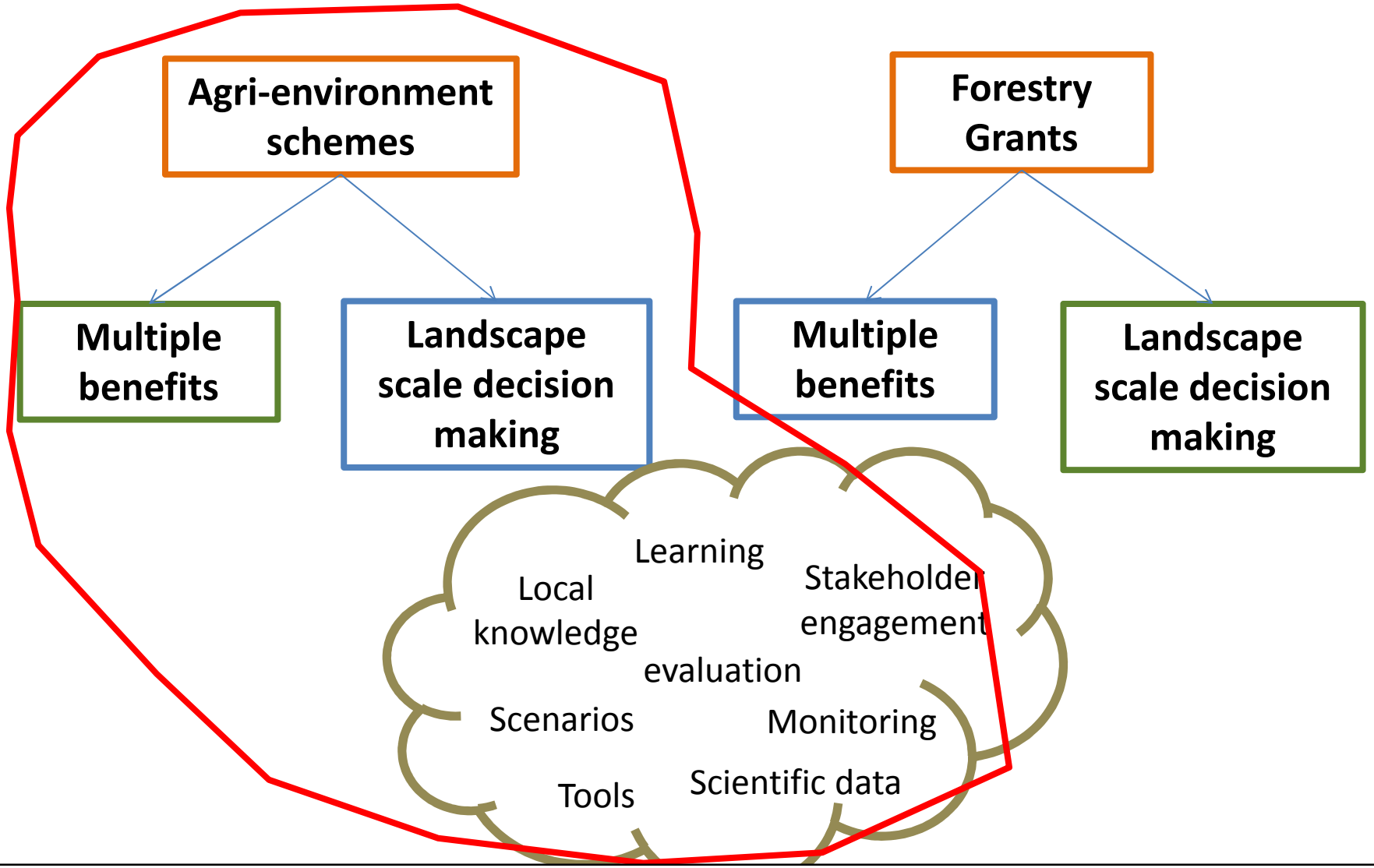
- 5.7Mha = agricultural holdings
  = 73 per cent of Scotland's total land area.
- About 50% is rough grazing
- About 25% grass,
- About 10% for crops or left fallow.
- 1.4Mha Forest.
- 0.6 Mha is used for the common grazing

http://www.gov.scot/Topics/Statistics/Browse/Agriculture-Fisheries/agritopics/LandUseAll

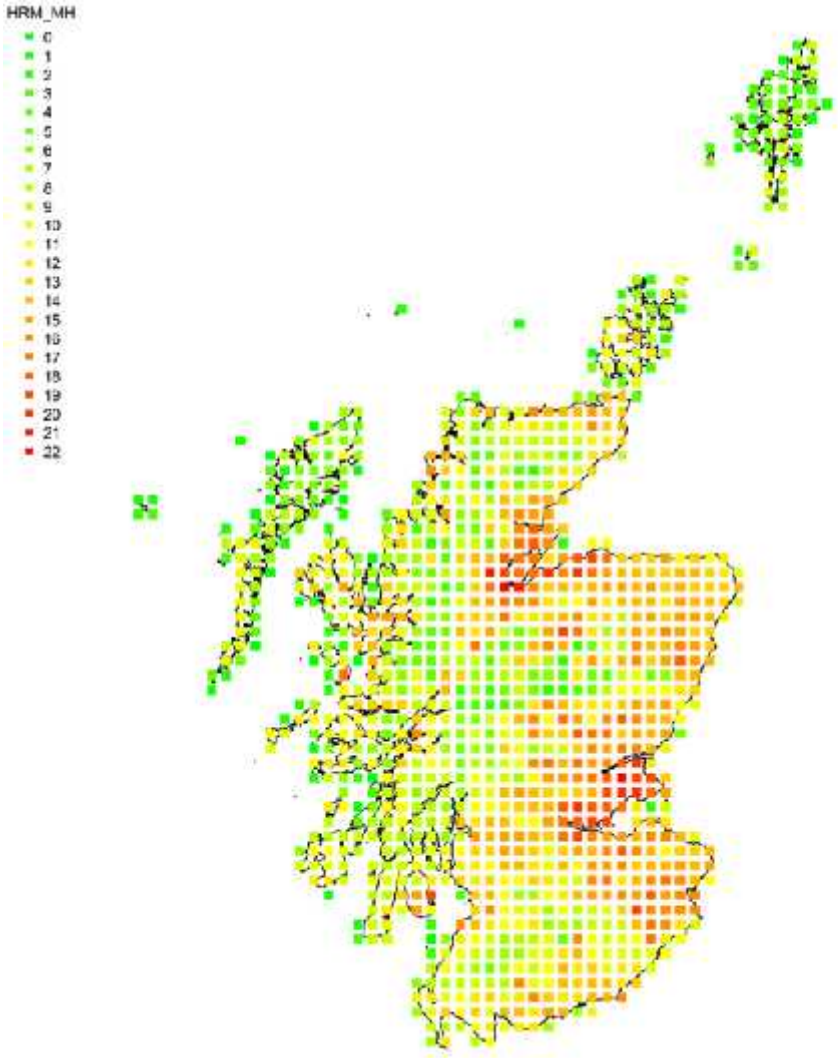
LUSII:
Agri-environment targeting

- Alternatives? Novel approaches?
- Improve spatial targeting?
- Payment by results?
- Regional assessments of Ecosystem Health
- Landscape scale action

What are the wider benefits of current land use and how can these be enhanced?



Agri-environment targeting



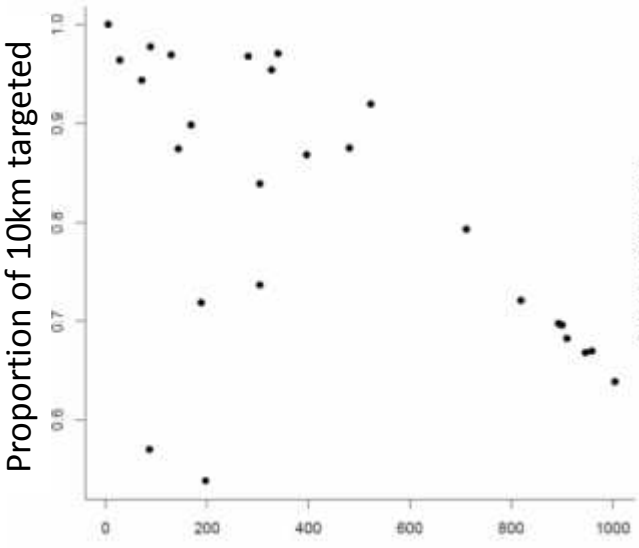
Richness of species benefitting from management of hedgerows. Can target on:

- Raw richness
- Richness weighted by rarity
- Overall coverage of species

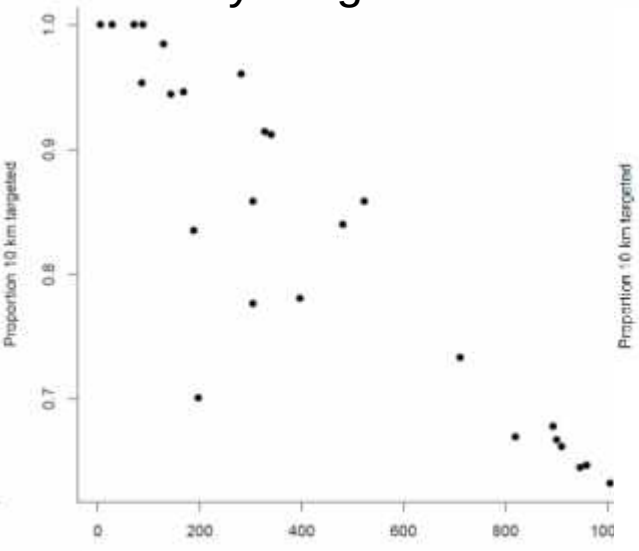
Robin Pakeman

Coverage of species

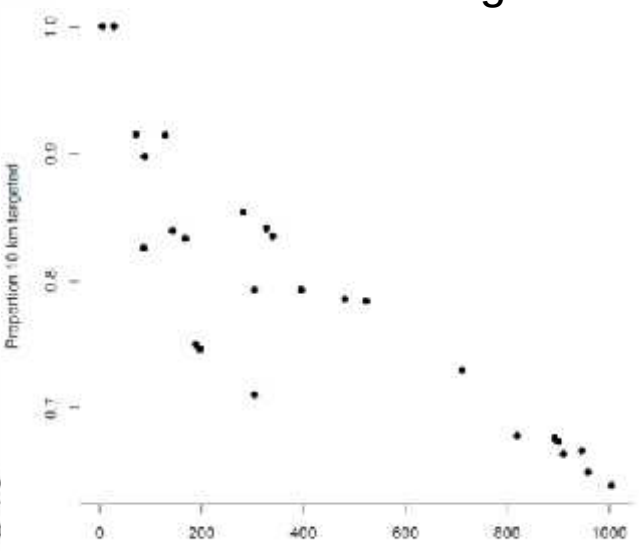
Raw richness



Rarity weighted



Overall coverage



	Mean coverage of species	Minimum coverage of species
Raw richness	0.81	0.54
Rarity weighted	0.83	0.63
Overall coverage	0.79	0.64

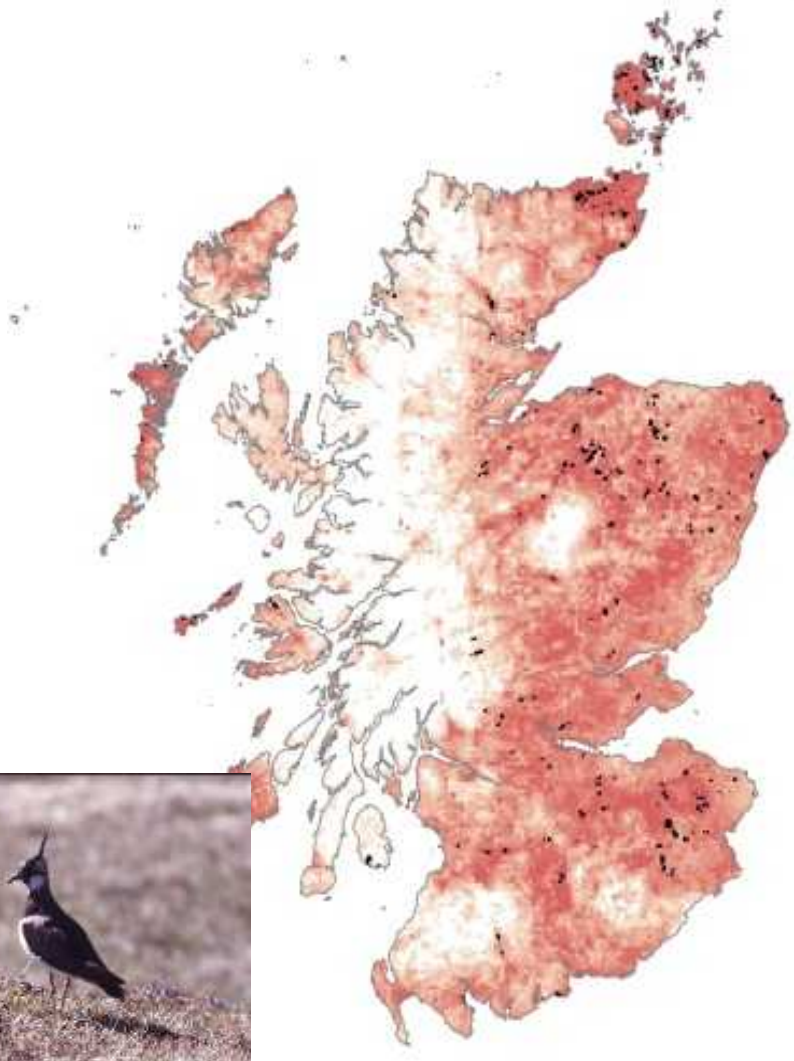
Uptake and targeting: Wader related options

- Particular concerns over the decline in farmland waders (National Indicator)
- Does the uptake of wader related AECS options relate to the distribution and abundance of these species?
- **Results:** in general, wader-related *AECS options are more likely to be taken up in areas where waders are present* and, to a lesser degree, that the more waders there are, the more likely it is that wader options will have been taken up
- But do we need to enhance wader populations in areas of suitable habitat where they have disappeared or are at historically low densities?

Scott Newey, Debbie Fielding and BTO

Wader grazed grassland target area and uptake

Lapwing abundance & distribution



Cooperation: How can agri-environment schemes be implemented more effectively? *Landscape scale*:

To achieve aims such as that for waders, there is a need for landscape scale coordination.

- What Factors affect cooperation and collaboration?
- Can this deliver multiple benefits?
- Look at opportunity mapping in catchments

Environment Cooperation Action Fund (ECAF)

- Scheme launched 2015/16 → 41 applications
  - **Applicants:** Local councils, fisheries trusts, consultants, researchers, other NGO's
  - **Top topics:** (out of 8 priority options)
    - Conservation of Vulnerable Priority Species (11)
    - Habitat and Degraded Ecosystem Restoration (7)
    - Control of non-native plant species (6)
    - Catchment Management for water quality (6)
  - **Area and duration:** Median area size: 18 000 ha, most projects 3-5 years
- **Scheme withdrawn 2017** due to issues around EU auditing

Katrin Prager, Freddy van Hulst, Laure Kuhfuss

Insights from practitioners:-

Interviews with ECAF applicants:

- ECAF could make AECS environment schemes more effective → higher returns from public money
- Most applicants favouring 'co-ordination' over 'co-operation':-
  - *Co-ordination*: one to one contact with land owners, but management actions are targeted for catchment benefits
  - *Co-operation*: land owners get together in groups and collectively decide on management actions

Farm event on collaboration:

"Conservation of Vulnerable Priority Species" needs cooperation but

- *Habitat quality on its own is not enough*. Existing AECS options should be linked to predator control measures
- Needs to be accompanied by more flexible predator control and build capacity to *manage predators at landscape scale*.

Katrin Prager, Freddy van Hulst, Laure Kuhfuss

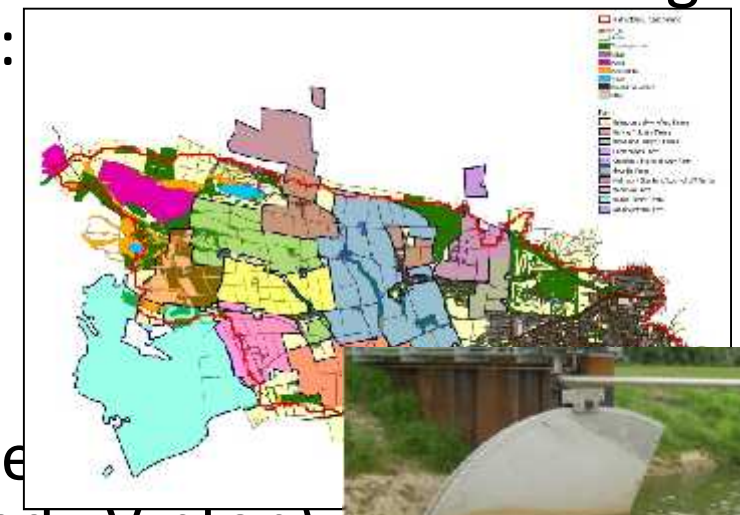
Co-operation/co-ordination

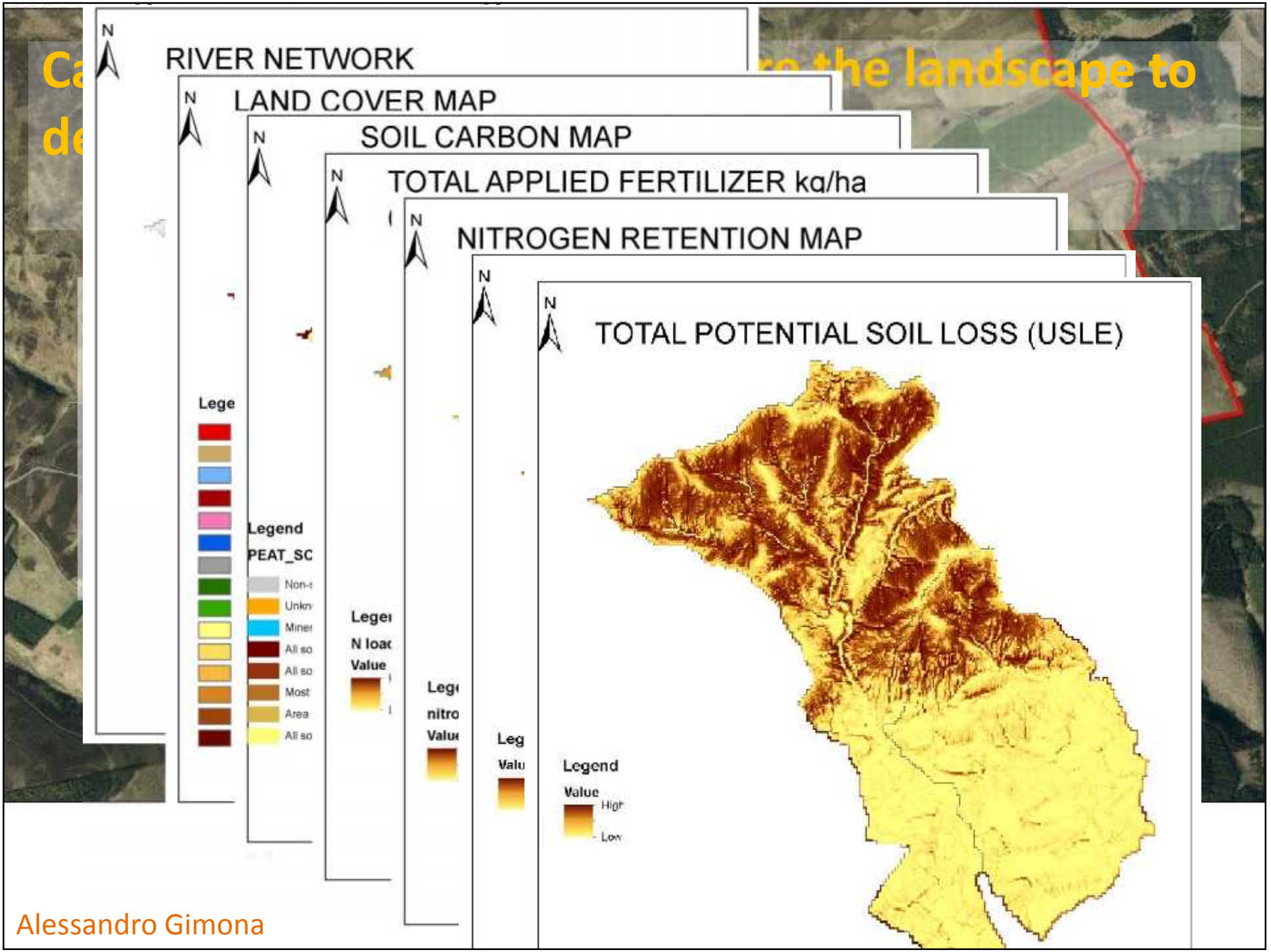
ECAF: not aware of any plans to replace

- Evaluate opportunities for catchment scale land reconfiguration using Agri-Environment schemes
- and working with local farmers and land managers in case study **catchments** :
  - upland

- arable: Balruddery

- linking water manageme
  and land use (Lunan, Andy Vinten)





Alessandro Gimona

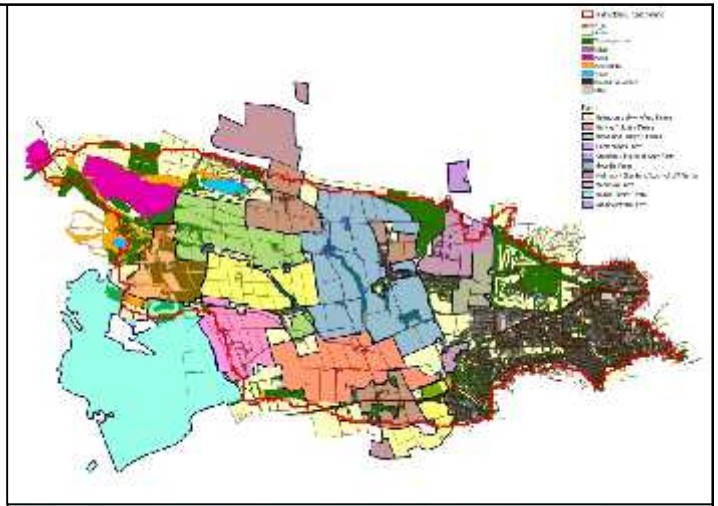
Balruddery Catchment

Linking scientific data with farmer knowledge for sustainable land use decision making.

- Building a local land manager network.
- Characterise catchment land-use.
- biodiversity and ecosystem services assessment.

Outcomes so far:

- Mapped land-use, crop, Ecological Focus Areas and other semi-natural habitats
- Baseline surveys of vegetation, pollinator activity and other invertebrates
- Catchment model of natural enemy populations developed



Graham Begg et al

Can SRDP be used to reconfigure the landscape to deliver wider benefits

Catchment maps for how current land use delivers ecosystem services - **next steps**:

- Create matrix : eligible option x ES benefit
- Map where options can be applied to achieve improvements (opportunity mapping)
- Evaluate new landscape with local land managers to identify the trade-offs or win-wins with production
- Evaluate land use using Natural Capital Accounting

Alessandro Gimona, Justin Irvine, Alistair McVittie

Example in practice: Integrated land management.
Water for all – Lunan Catchment

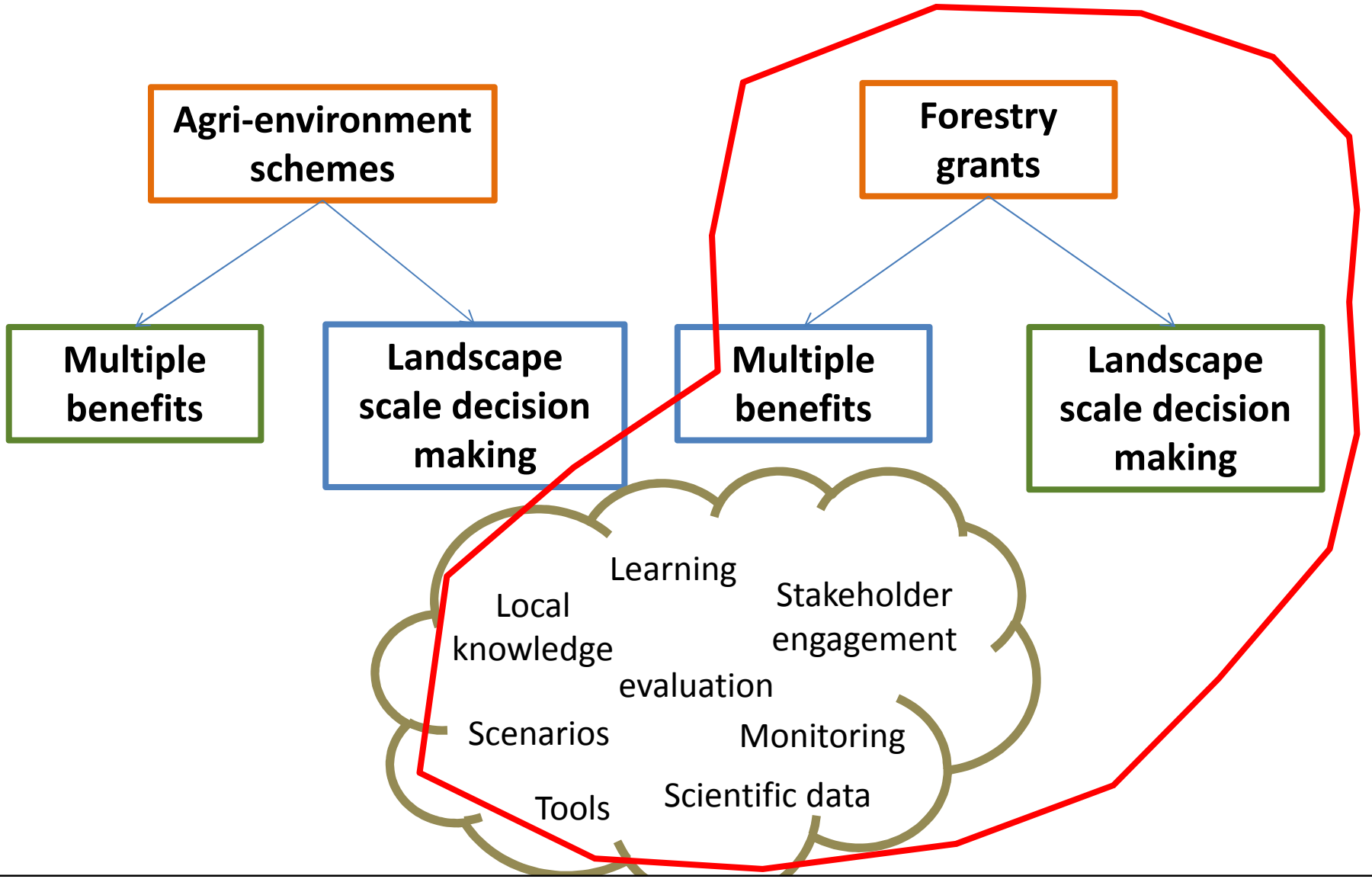
- Managing water **to improve ESs**? – maintaining wetlands, reducing flooding, improving water quality, enhancing fisheries
- **Adaptive management approach** to smart hydraulic controls (tilting weir)
- **New institutions:** who is responsible, how will it be funded and what evidence is used to make decisions?

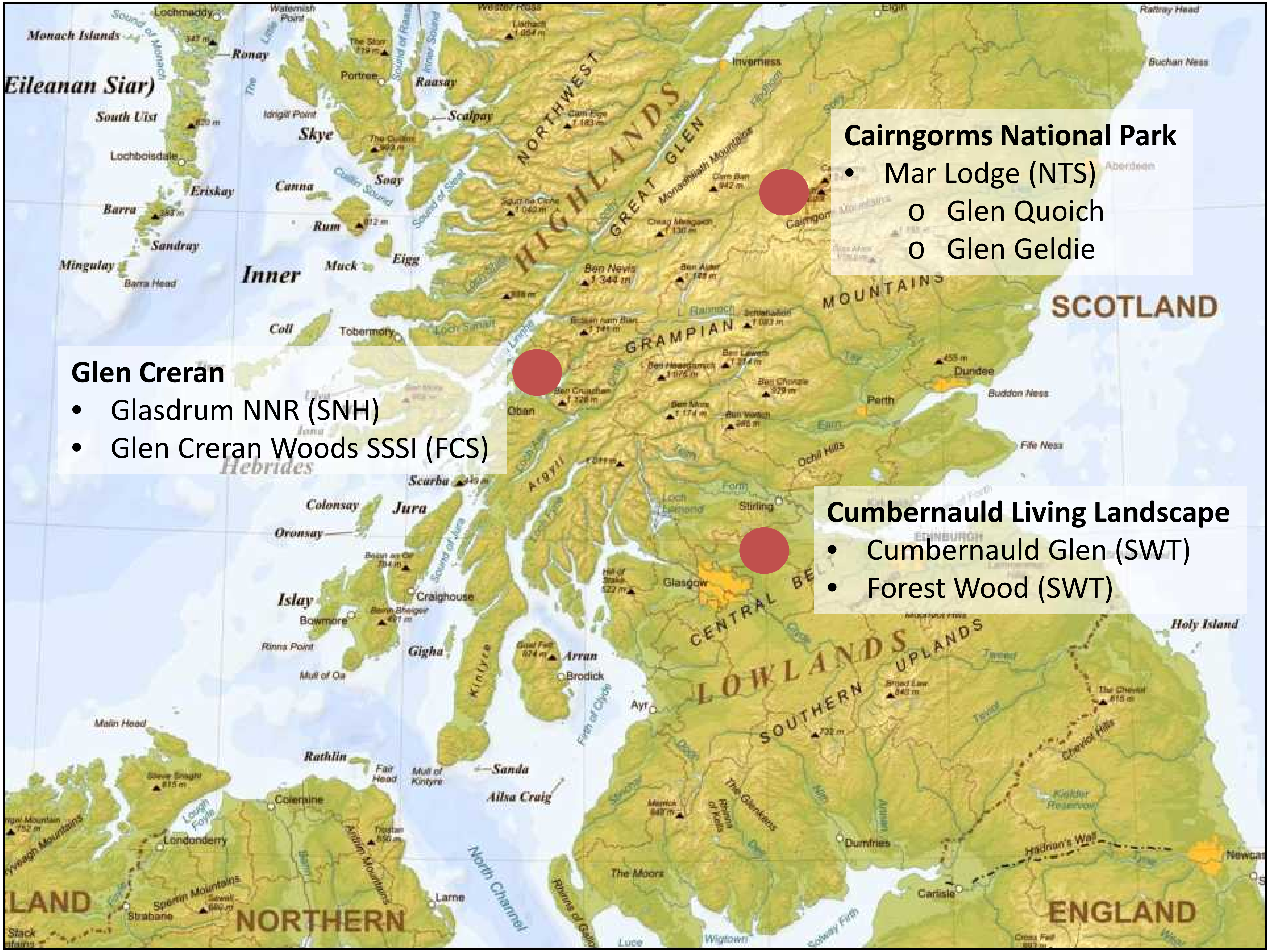
- http://www.hutton.ac.uk/research/projects/payments-ecosystem-services-lessons

Andy Vinten, Orla Shortall, Laure Kuhfuss




What are the wider benefits of current land use and how can these be enhanced?




Cairngorms National Park
• Mar Lodge (NTS)
o Glen Quoich
o Glen Geldie
Glen Creran
• Glasdrum NNR (SNH)
• Glen Creran Woods SSSI (FCS)
Cumbernauld Living Landscape
• Cumbernauld Glen (SWT)
• Forest Wood (SWT)
SCOTLAND
ENGLAND
NORTHERN
HIGHLANDS
NORTHWEST
GREAT GLEN
GRAMPIAN
MOUNTAINS
CENTRAL
LOWLANDS
SOUTHERN UPLANDS
Eileanan Siar)
Monach Islands
South Uist
Eriskay
Barra
Sandray
Mingulay
Inner
Hebrides
Skye
Canna
Rum
Muck
Eigg
Soay
Raasay
Scalpay
Rona
Coll
Colonsay
Oronsay
Jura
Scarba
Islay
Gigha
Arran
Kintyre
Rathlin
Sanda
Ailsa Craig
Holy Island
Inverness
Oban
Perth
Dundee
Stirling
Glasgow
Ayr
Dumfries
Carlisle
Brodick
Bowmore
Craighouse
Portree
Tobermory
Lochboisdale
Lochmaddy
Coleraine
Londonderry
Strabane
Larne
Ben Nevis
Argyll
Ochil Hills
Buddon Ness
Fife Ness
Buchan Ness
Rattray Head
Cheviot Hills
Hadrian's Wall
North Channel
The Moors
Malin Head
Rinns Point
Mull of Oa
Sperrin Mountains
Antrim Mountains

Woodland Grants: delivering multiple benefits

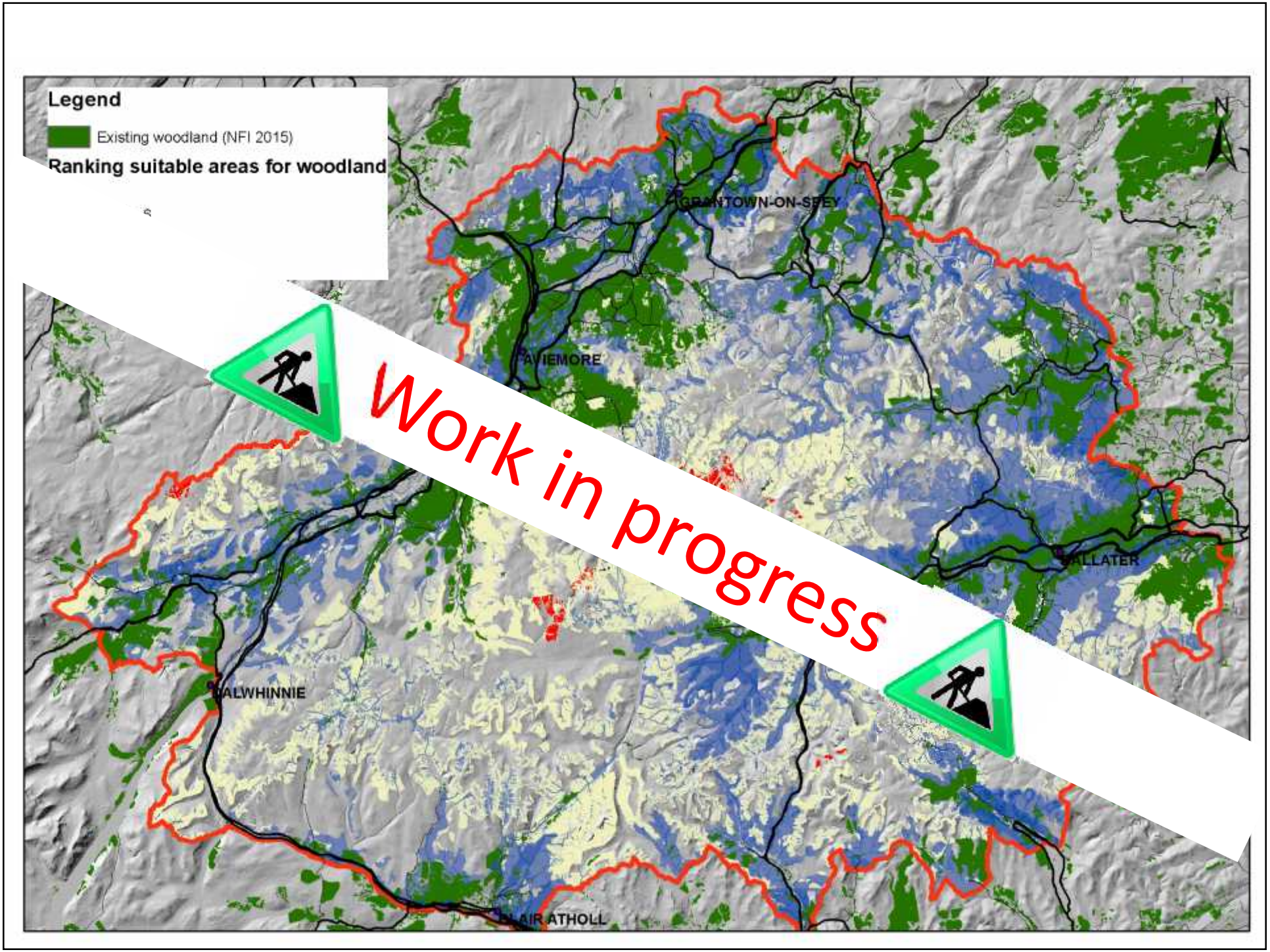
1. How can multiple benefits be considered in targeting Forestry grants?
2. What are the consequences for the values communities hold of different woodland expansion scenarios?
3. How do decision makers learn and integrate knowledge?

Opportunity mapping for woodland expansion: strategic planning for multiple benefits: Informing the CNPA draft forest strategy

Work in progress: exploring criteria to support the CNPA draft Forest Strategy

CNPA Locational premium if applications cover areas designated for connectivity and capercaillie

Can we improve targeting within preferred areas to deliver wider benefits?


Legend
Existing woodland (NFI 2015)
Ranking suitable areas for woodland
N
GRANTOWN-ON-SPEY
AVIEMORE
KINGUSSIE
DALWHINNIE
BLAIR ATHOLL
Work in progress

opportunity mapping for woodland expansion:
multi-criteria tools for strategic planning

reuse these weights later (click on 'Average' in the top menu).

If you want to store one final combination of weights permanently, press "Save perm". Use this button only when you have made up your mind. The weights will be used to compare to other users.

Positive Criteria

river50

0 — 1

fr_net_1k

0 — 1

sp_w_pos

0 — 1

Negative Criteria

lca_pres

0 — 0.21 — 1

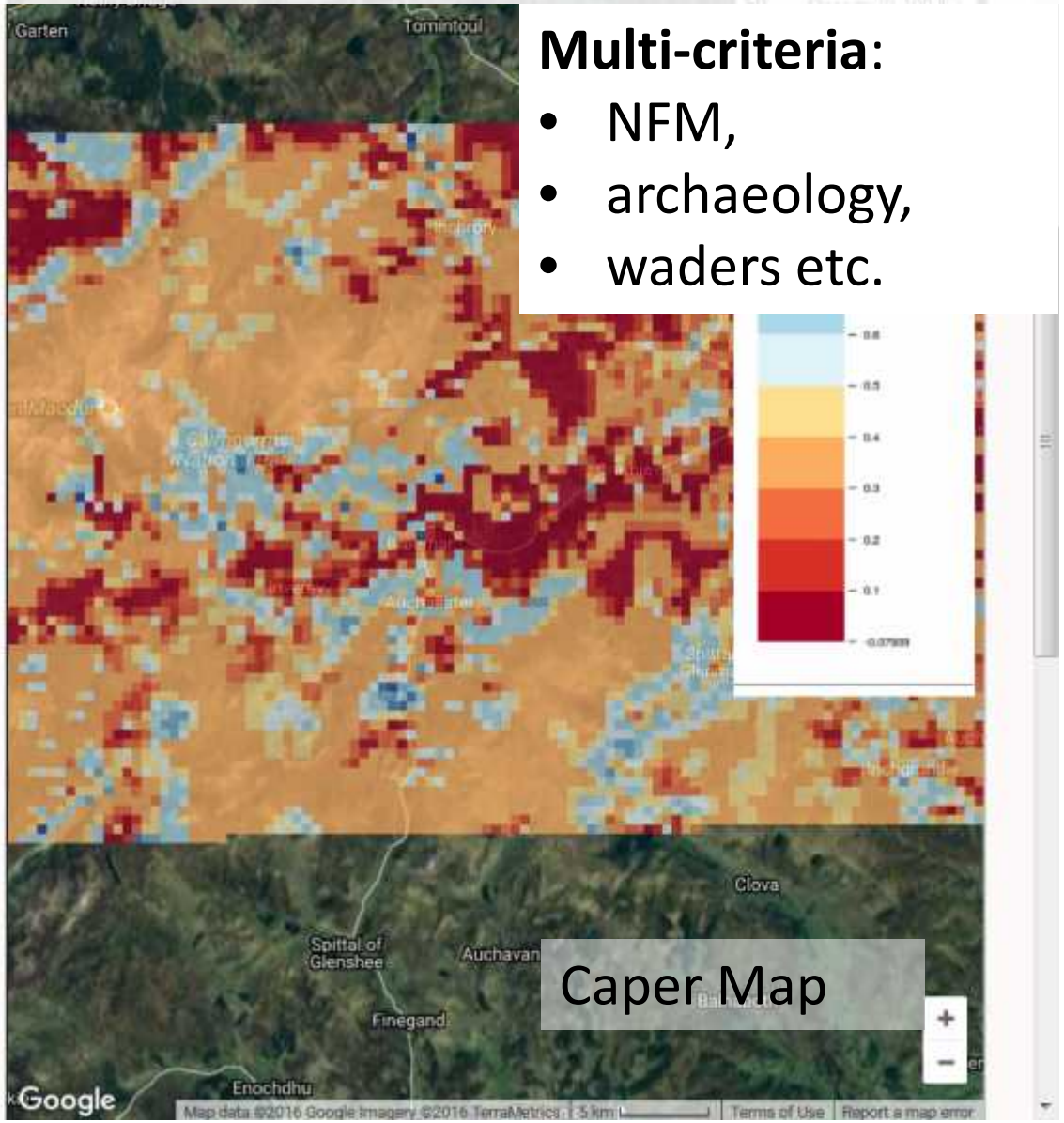
lcf_good

0 — 1

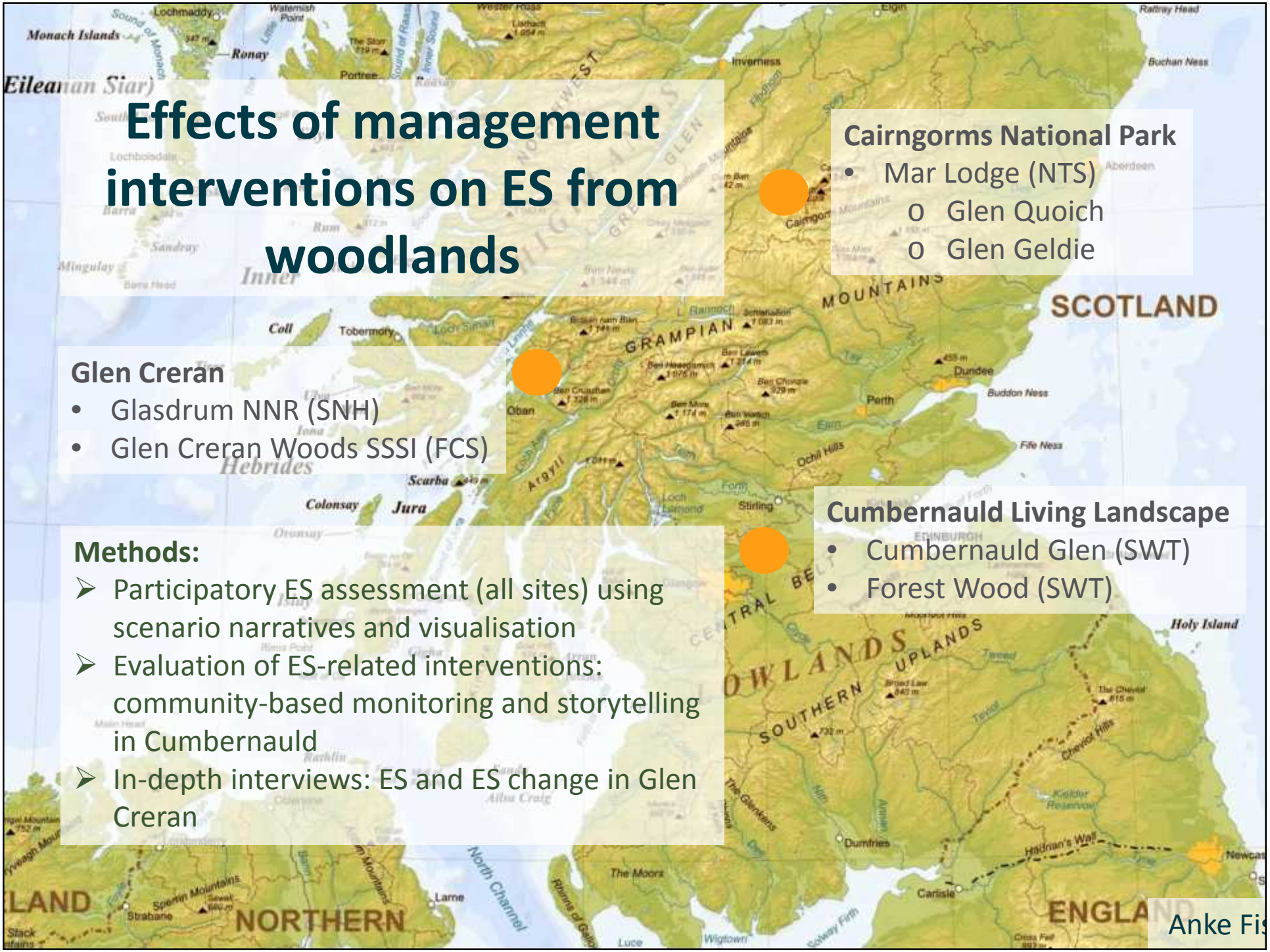
Method selection

Multi-criteria:

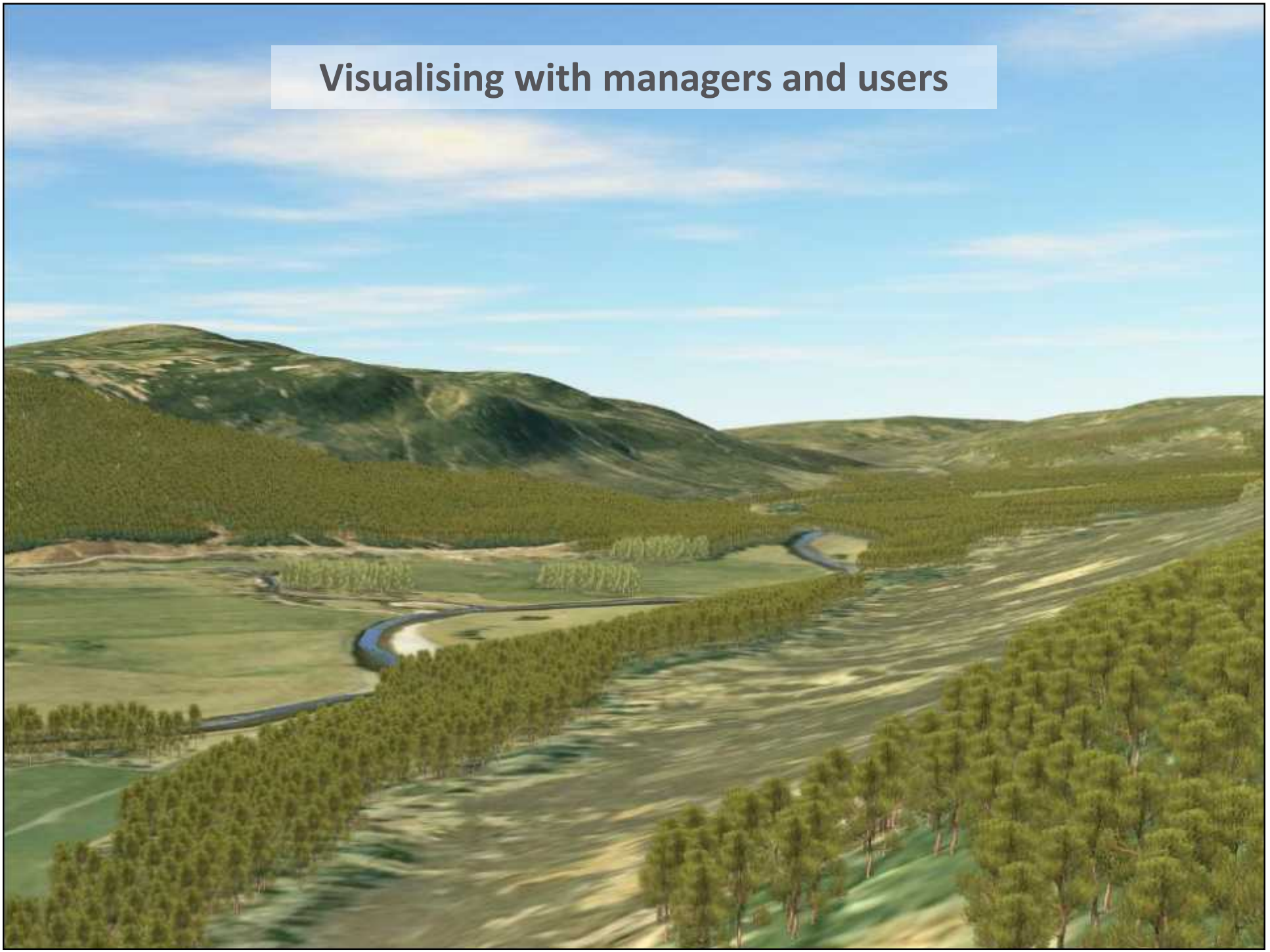
- NFM,
- archaeology,
- waders etc.



Alessandro Gimona, Justin Irvine & Mark Wilkinson


Effects of management interventions on ES from woodlands
Cairngorms National Park
• Mar Lodge (NTS)
o Glen Quoich
o Glen Geldie
Glen Creran
• Glasdrum NNR (SNH)
• Glen Creran Woods SSSI (FCS)
Cumbernauld Living Landscape
• Cumbernauld Glen (SWT)
• Forest Wood (SWT)
Methods:
➢ Participatory ES assessment (all sites) using scenario narratives and visualisation
➢ Evaluation of ES-related interventions: community-based monitoring and storytelling in Cumbernauld
➢ In-depth interviews: ES and ES change in Glen Creran
SCOTLAND
GRAMPIAN MOUNTAINS
Hebrides
Inverness
Dundee
Perth
Stirling
Oban
Coll
Tobermory
Colonsay
Jura
Scarba
Argyll
Ochil Hills
Fife Ness
Buddon Ness
Holy Island
SOUTHERN UPLANDS
Dumfries
Carlisle
Strabane
Larne
The Moors
North Channel
NORTHERN
ENGLAND
Anke Fi

Visualising with managers and users



How do decision makers learn and integrate knowledge?

Focus on social learning, collaboration & management across landscapes

- Collaborative arrangements: How do they work (or don't)?
- Interviews and social network maps with land managers

Potential findings:

- Collaboration may be limited by differences between actors in management philosophy and knowledge base.

- Ongoing: **Social network analysis**: circulation and translation of knowledge and how it influences management decisions
- Next: Use **digital storymapping** to draw out how experience sharing changes knowledges, narratives and management decisions

Katrina Brown, Antonia Eastwood et al

Integrated land management?

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- Continue to integrate agriculture and farming with environment (take a wider view of production?)
- Land use *produces*: clean water, vegetation, food crops, meat, pollinators, landscape, well-being
- Land use *reduces*: flooding, sediment and nutrient export, pests and disease, carbon loss.
- Requires a better understanding of how to make cooperation work

Thank you

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The work presented here is supported by the Scottish Government's Rural and Environment Science Analytical Services Division

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Natural Capital Accounts

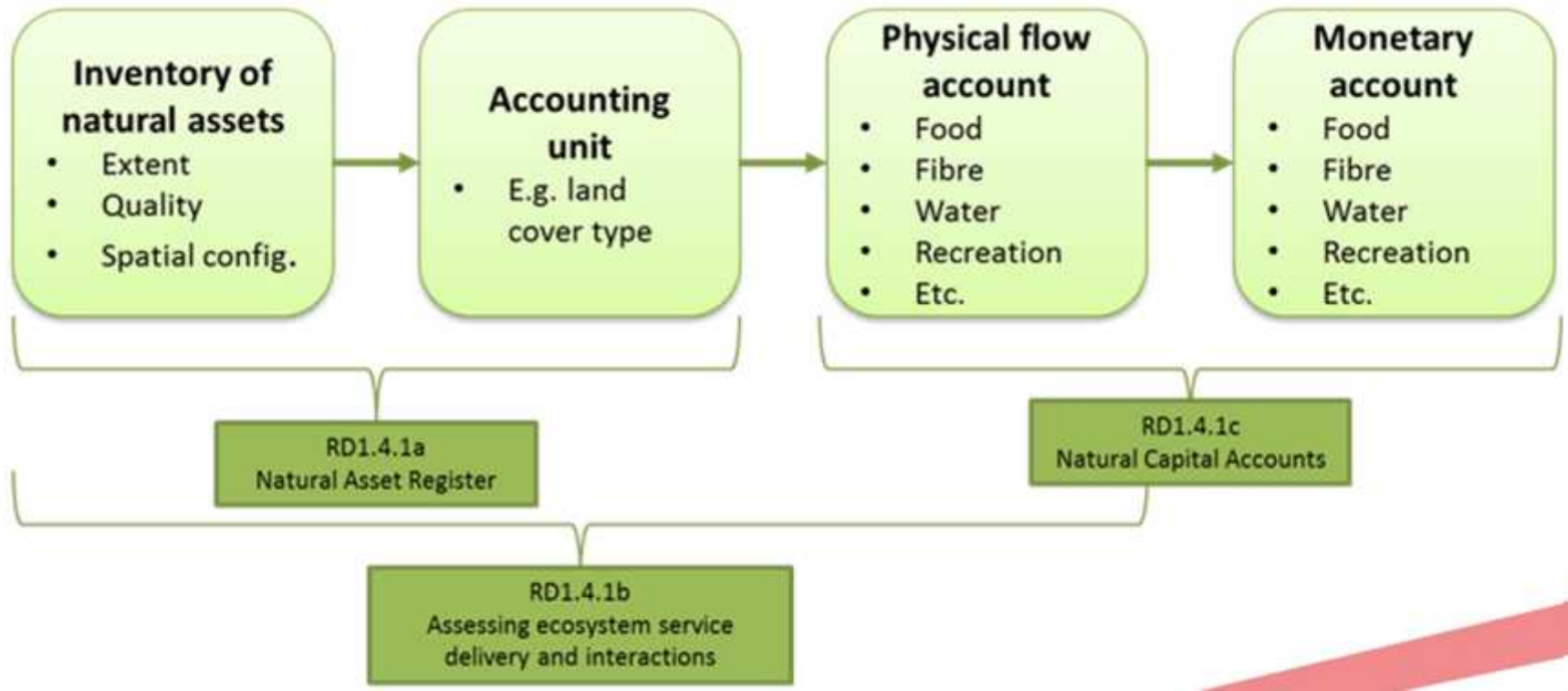
Agriculture and Forestry accounts

Alistair McVittie

Michela Faccioli

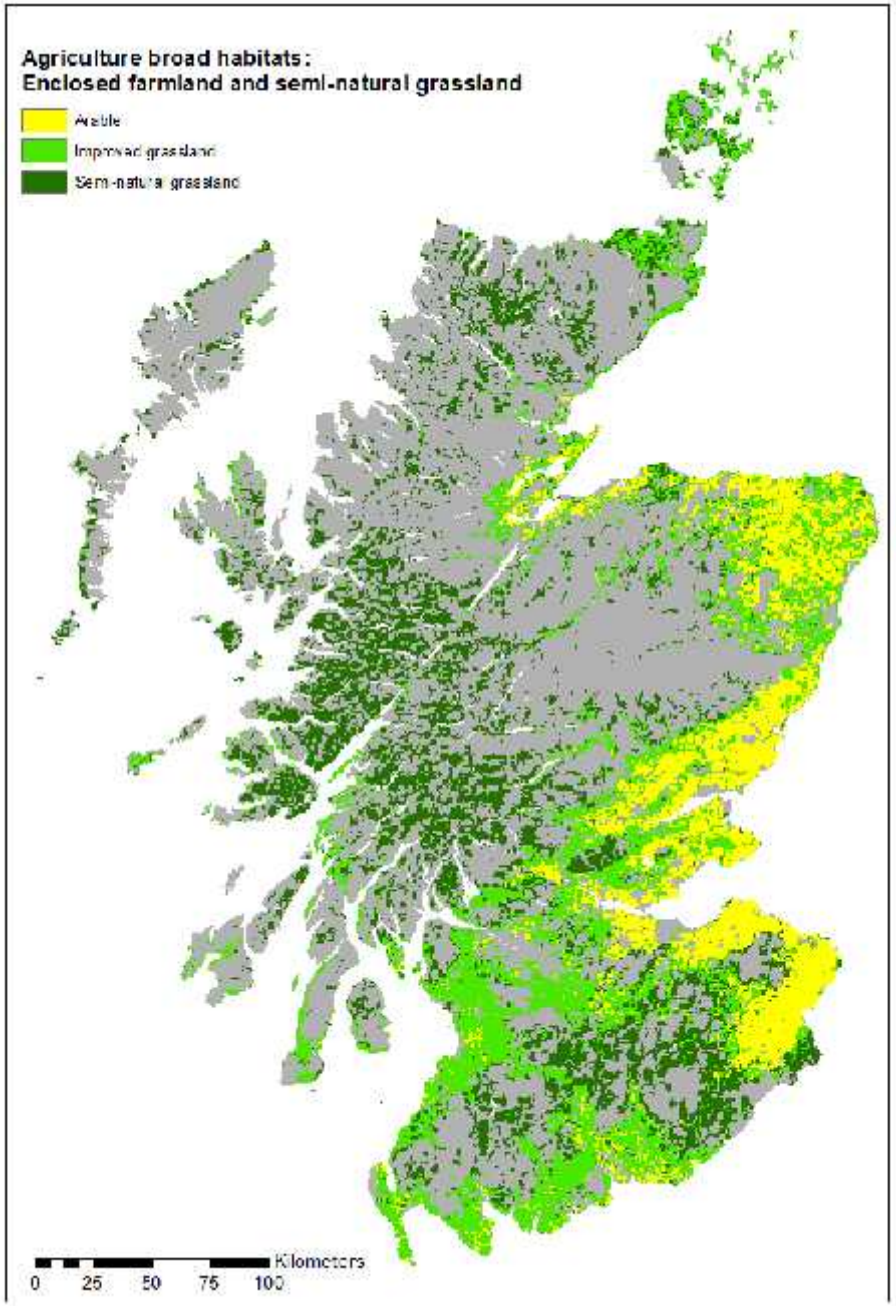
Klaus Glenk

How does the RD1.4.1 fit with an accounting framework?



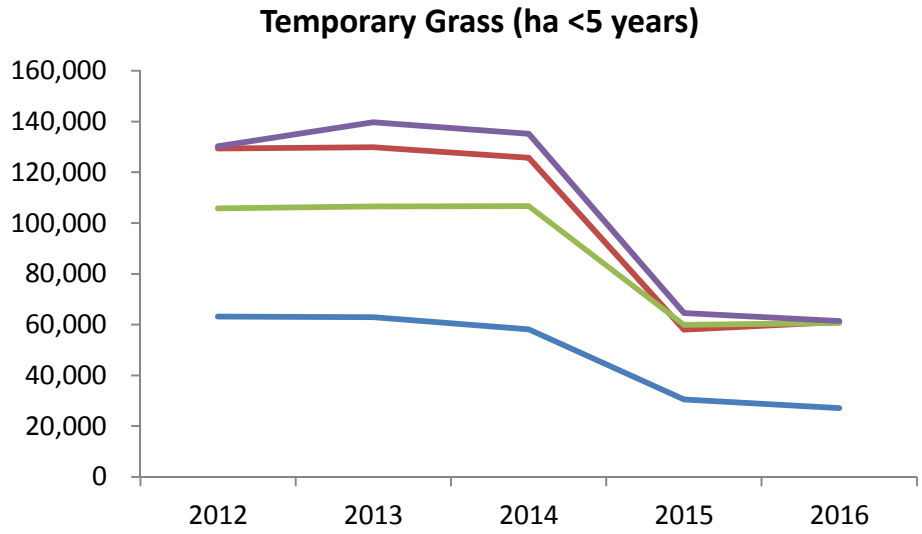
Agriculture in Scotland

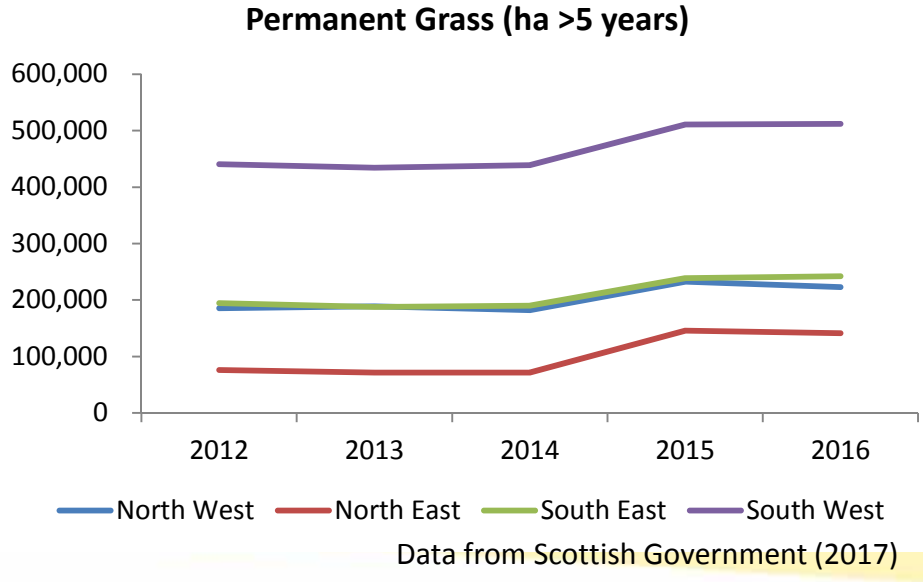
- ONS uses broad habitats
- Enclosed farmland includes arable and improved grassland
- Semi-natural includes rough grazing
- BUT
  - Improved grassland includes both temporary (rotational) and permanent grassland
  - Rough grazing also included in mountains, moors and heaths
  - Not all semi-natural is agricultural



Agriculture in Scotland

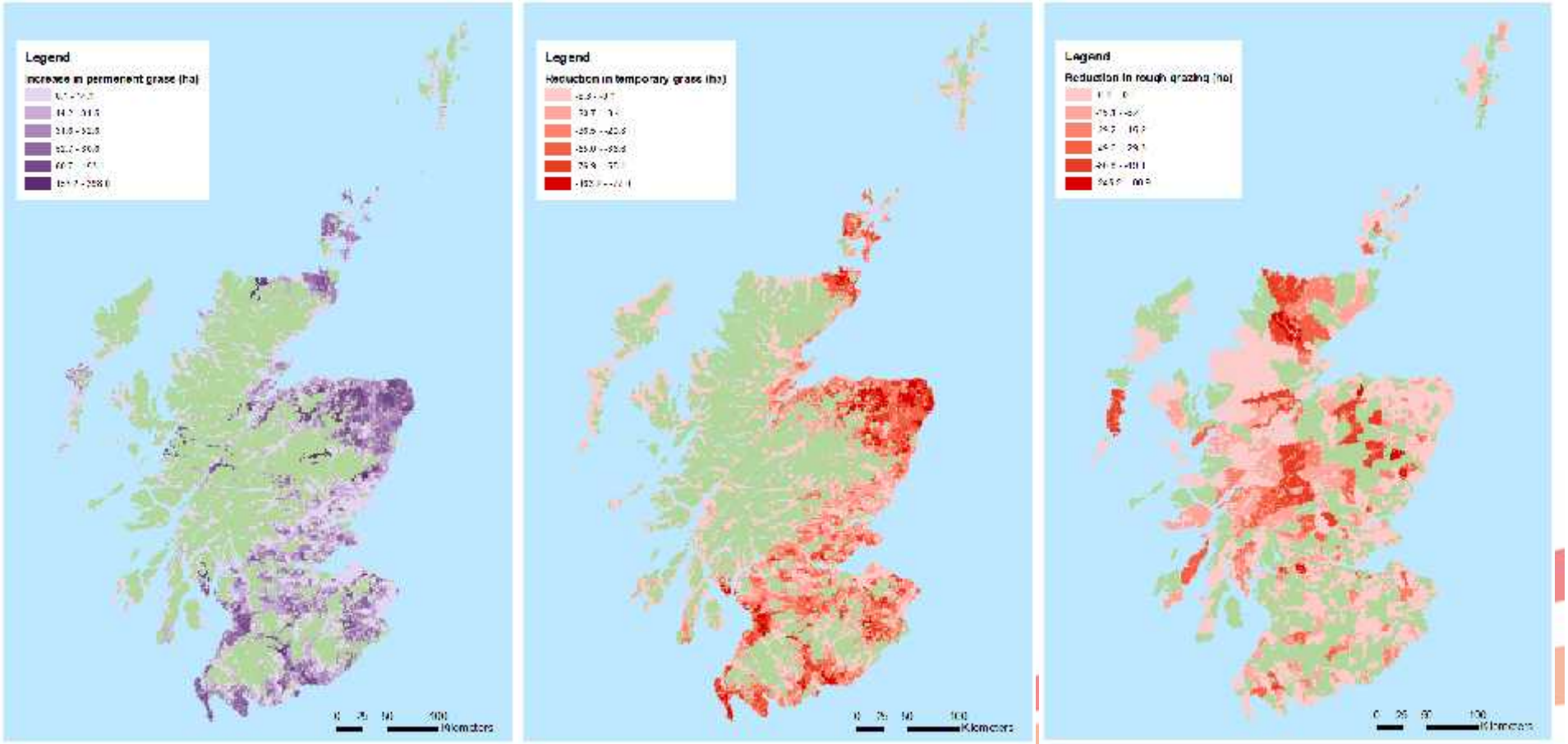
- Regional variations
- Responses to policy changes?
- Are these long or short-term?
- Impacts on condition
- Impacts on ecosystem service flow





Data from Scottish Government (2017)

Changes in grassland 2014-15



Agriculture: valuing water quality and biodiversity

- Choice experiment – changing farm management to improve water quality and increase farmland birds

	Programme A	*Programme B*	*Business as usual* **No additional effort**
Water condition			
Farmland bird species	 25 bird species	 15 bird species	 15 bird species
Increase in council tax	£ 75/year	£ 5/year	£ 0/year
I choose	☐	☐	☐

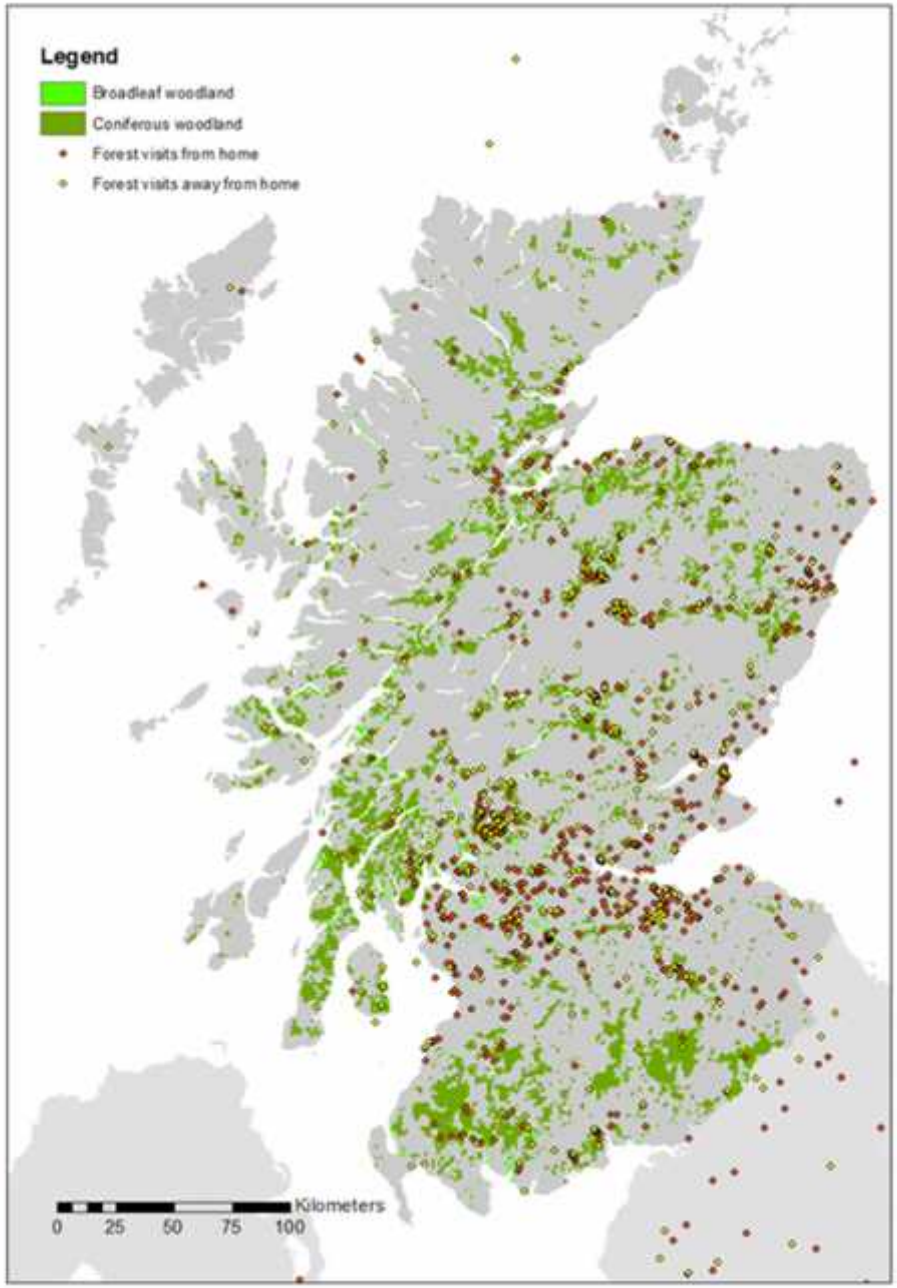
Agriculture: valuing water quality and biodiversity

Change from this situation		*to achieve this situation*	*Median WTP [a] (95% confidence interval)*	*Median WTP [b] (95% confidence interval)*
	⇨		£ 46.89 (£ 31.73 - £ 68.11) per person/year	£ 17.17 (£ 11.85 - £ 23.83) per person/ year
	⇨		£ 104.43 (£ 76.92 - £ 142.38) per person/year	£ 41.55 (£ 30.81 - £ 55.05) per person/ year
 15 bird species	⇨	 20 bird species	£ 21.37 (£ 9.11 - £ 36.97) per person/year	£ 8.74 (£ 4.18 – £ 13.93) per person/ year
 15 bird species	⇨	 25 bird species	£ 44.83 (£ 27.76 - £ 66.22) per person/year	£ 14.24 (£ 8.68 - £ 21.05) Per person/ year

[a] lognormal distribution for the cost coefficient
[b] normal distribution for the cost coefficient

Forest recreation valuation

- Choice experiment considered:
  - Species mix
  - Tree height
  - Age structure
  - Deadwood (biodiversity)
  - Visitor facilities (picnic sites and trails)
- People most want :
  - Mature, multi-species broadleaved forest with high biodiversity and visitor facilities
- Implications for planting and management



Summary

- Extent accounts
  - Readily available but may be dynamic within broad habitats
- Condition accounts
  - Will reflect changes in management and policy
  - Mismatch with extent information
- Ecosystem service flows
  - Spatial distribution of benefits
  - Spatial configuration of habitat patches
  - Time lags linked to extent and condition

Thank you

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- Rural & Environment Science & Analytical Services Division of the Scottish Government
- EU H2020 project PROVIDE http://www.provide-project.eu/ (grant agreement No 633838)

- alistair.mcvittie@sruc.ac.uk

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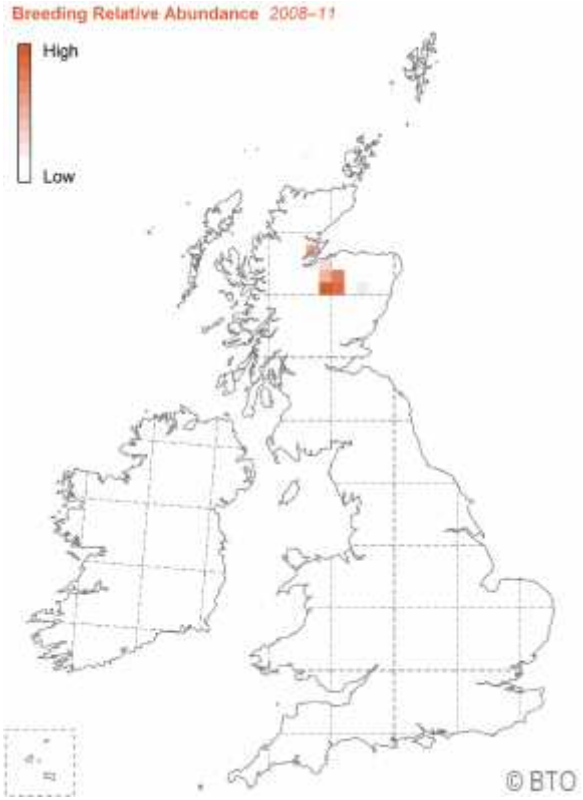
CaperMap:
Facilitating stakeholder dialogue to promote capercaillie conservation

Scott Newey

James Hutton Institute, Aberdeen

Capercaillie

- Critically endangered
- 1,114 individuals in 2017



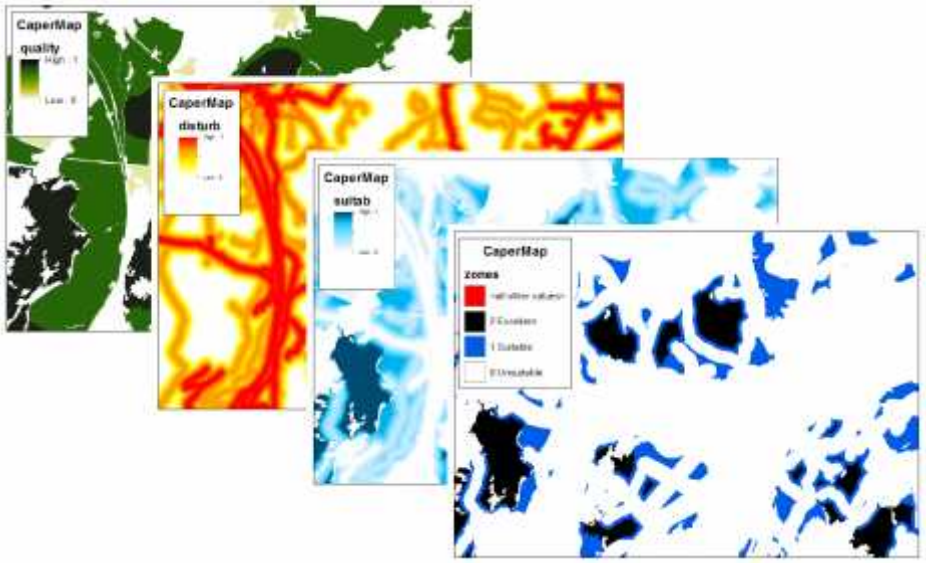
Confined to old growth Scots pine forest

- 80% in Cairngorm NP
- 70% in Strathspey

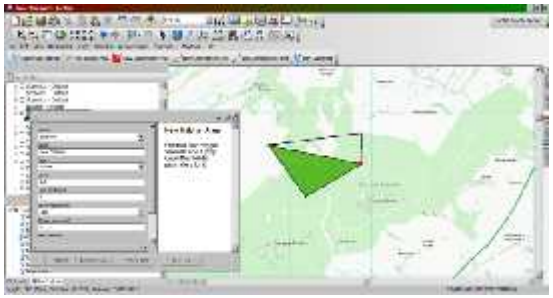
CaperMap

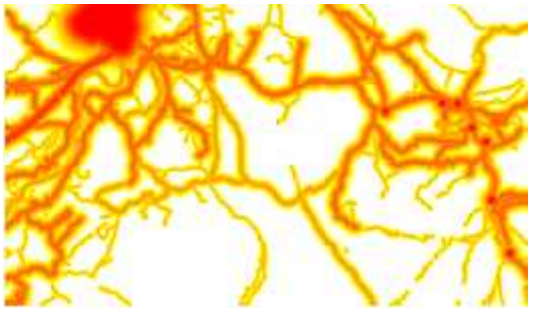
- **Communication and engagement tool**
- Promote capercaillie conservation and support the Capercaillie Framework
- Assess the effects of different scenarios on the resilience of capercaillie in Scotland

Interactively and visually explore complex spatial information and compare outcomes of different assumptions and scenarios



CaperMap: Scenarios





Habitat Quality + Features = Habitat Suitability

Parameters under user control

Acknowledgements

- Jim McLeod, Justin Irvine and Katrina Brown (James Hutton Institute)
- Sue Haysom (SNH), Justin Prigmore (CNPA), Gareth Marshal (RSPB)
- Capercaillie Framework, Capercaillie BAP Group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Afternoon Introduction

Kirsty Blackstock

Ecosystems and Land Use
Stakeholder Engagement Group
20th November 2017

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Agenda

13:30 **Introduction to the afternoon session – *Kirsty Blackstock (JHI)***

Spotlight presentations - how our science can help:

***Ruth Mitchell (JHI)* - Understanding changes in Scotland's plant communities – uses of long-term resurvey data**

***Alessandro Gimona (JHI)* - Simulating land use change**

***Anke Fischer (JHI)* – Scenario-based evaluation of policy options and their implications**

***Graham Begg (JHI)* - Sustainable agriculture options for the future**

***Jessica Maxwell (JHI)* - Coordinating policy instruments that influence soil, water, and biodiversity in Scotland**

Break out discussions:

- **What evidence do stakeholders use?**
- **What information might stakeholders need?**
- **Are there gaps that the Work Packages might address?**

Report back and full group discussion

15:15 Wrap up and next steps

15:30 Close

The gauntlet

- Omission of ‘Brexit’ and its implications raised at last ELSEG meeting
- Challenged to show what we were doing to inform the debate

- This is our response…

Purpose of Plenary

- This session will not:
  - Attempt to predict the future
  - Debate what, when, how or if we should leave the EU
  - Set out a vision for a post-EU agricultural, land-use or environmental strategy

- Why not?

Future predictions

- Other institutions deliver these aspects:
  - Various briefings on the future exist e.g.
    - RESAS (2017) *Brexit and Scottish Agriculture*
    - Davis et al. (2017) *Impacts of Alternative Post-Brexit Trade Agreements on UK Agriculture: Sector Analyses using the FAPRI-UK Model*
    - Mitchell (2017) *The Implications of Brexit for UK, EU and Global Agricultural Reform in the Next Decade.* Chatham House Briefing.
  - Influence the decision space for governance of Scottish ecosystems and land use

Post-EU futures?

		Bespoke Free Trade Agreement with the EU	WTO Default	Unilateral Trade Liberalisation
Commodity				
Beef:	Price	+3%	+17%	-45%
	Production	0%	+10%	-10%
	Output Value	+3%	+29%	-50%
Sheep:	Price	-1%	-30%	-29%
	Production	0%	-11%	-11%
	Output Value	-1%	-38%	-36%
Pigs:	Price	0%	+18%	-12%
	Production	+1%	+22%	-6%
	Output Value	+1%	+44%	-17%
Poultry:	Price	0%	+15%	-9%
	Production	0%	+11%	-3%
	Output Value	0%	+28%	-12%
Milk & Dairy:	Price	+1%	+30%	-10%
	Production	0%	+7%	-2%
	Output Value	+2%	+37%	-12%
Wheat:	Price	-1%	-4%	-5%
	Production	0%	-1%	-1%
	Output Value	-1%	-4%	-6%
Barley:	Price	-1%	-5%	-7%
	Production	0%		
	Output Value	-2%		

Davis et al. (2017) FABRI Report
All other factors held constant except trade agreements
No environmental impacts considered

Mitchell (2017) Chatham House Briefing:
Assumes env. regulations and standards retained
Four models of agricultural support – recommends 'market' model

Future Arrangements

- Other institutions deliver these aspects:
  - Many political, legal and market experts as well as UK and Scottish Parliaments and their Governments working on EU withdrawal
    - Confusing pronouncements – ‘hard’ Brexit for CAP in 2019 or budget ring-fenced until 2022?
    - Devolved powers debates
    - Legal procedures for continuity post 2019 of transposed EU legislation

Burns et al. (2016) The EU Referendum and the UK Environment: the Future under ‘Hard and ‘Soft’ Brexit

Future Visions

- Other institutions deliver these aspects:
  - Visions for future e.g.
    - Land Use Strategy (2016-2021); RAFE outcomes
    - Agricultural Strategy (2018) via Agricultural Champions; also Agricultural Review Group and National Council of Rural Advisors
    - Strategic approach to environmental policy (2018)
    - Scottish Environment LINK's (2017) Future of Farming and Rural Land Use

Purpose of Plenary

- This session will:
  - Ask not what Brexit will do for us … but what we can do for Brexit (analysts)
  - Focus on areas of research and expertise that can be drawn upon to help others
  - Policy support for those making policy
  - Contribute to public debate through providing information, sources and expertise

What we can do

- Planning the future for ecosystems and land use will need:
  - Evidence about quantity and quality of natural assets, ecosystem services and benefits provided
  - Evidence about public and stakeholder narratives, preferences and constraints to change
  - Methods that help us evaluate the past and appraise the future
  - A community with knowledge of, and interest in, Scotland as part of a global network

What we can do

- Spotlight talks – range of approaches & scale
  - Understand current trends
  - Consider potential future trajectories
  - Evaluate our options and understand preferences
  - Design new interventions at field scale
  - Modify policy instruments and approaches

- Other research is also relevant (see briefing)

  e.g. Resilience, Environmental Health Indicators, Supply chains, Monitoring, Adaptive Management…

What's next?

- Spotlight talks (5 x 5 minutes)
- Straight to breakout sessions
- Work with the speaker of interest to you
- Discuss topic including: (30 minutes)
  - What evidence do stakeholders use?
  - What information might stakeholders need?
  - Are there gaps that the Work Packages might address?

Breakout Locations

Topic & Speaker	Location
Trends – Ruth Mitchell & Glenn Iason	Main Room
Simulations – Alessandro Gimona & Rob Brooker	Main Room
Scenarios – Anke Fischer & Justin Irvine	??
Management – Graham Begg & Robin Pakeman	??
Policy instruments – Jessica Maxwell & Kirsty Blackstock	??

Plenary

- Breakout feedback
  - Headline points from 5 groups
  - Questions and clarifications

- Closing discussion
  - What other topics are of interest to those planning for Brexit?
  - Any other comments?

Understanding changes in Scotland's plant communities – uses of long-term resurvey data

Ruth Mitchell

Andrea Britton, Alison Hester, Robin Pakeman and many others

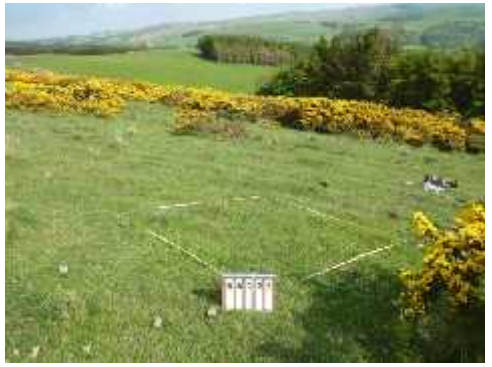
Birse and Robertson vegetation data for Scotland

- Unique collection of historical information on the status of Scottish plant communities,
- Eric Birse and Jim Robertson surveyed Scottish vegetation between 1945 and 1985,
- 7000 records of vegetation composition,
- All major Scottish vegetation types, throughout Scotland.
- Published as ‘Plant communities of Scotland’ in 1980.

Resurvey

- Increasing awareness of, and interest in, the long term impacts of human activities on plant community composition.
- Between 2004 and 2014 approximately 1500 of the original survey locations were re-visited.

3 examples of uses of this data



Climate change impacts

Northern and alpine specialists declined while lowland generalists increased

Britton et al. 2009 Biological Conservation 142, 1728-1739

Recovery from sulphur pollution

- Peak of 3200 Gg-S in 1970 decreased to 203 Gg-S in 2010.
- Wet deposition decreased by 70%.
- Sulphur impacts = decreased species richness and increased grass cover

Changes in Grasslands 1973-2013

- Increases in mosses, sedges and forbs
- Decline in grasses

} Decrease in Sulphur

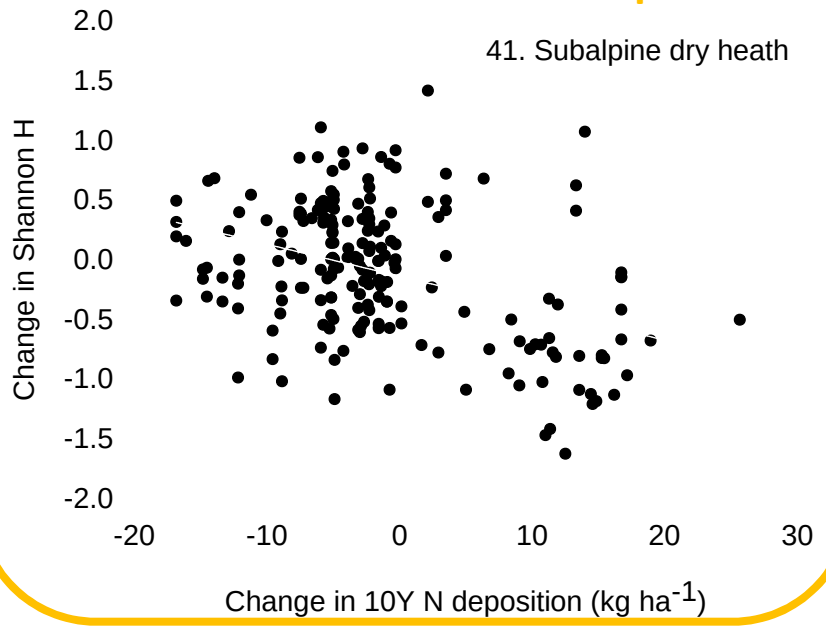
First indications of an impact of reduced SO_x deposition




Mitchell et al. 2017 Biological Conservation 212, 327-336

Testing N impacts

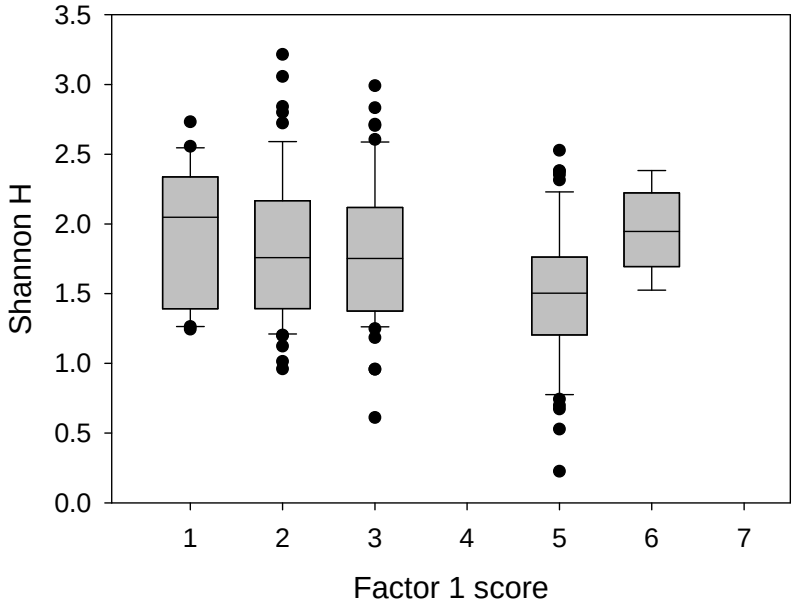
Scotland scale: relationship



JNCC
Joint Nature Conservation Committee

Developing a decision framework to attribute atmospheric nitrogen deposition as a threat to or cause of unfavourable habitat condition on protected sites

Testing the framework



Factor 1 score/Exceedance Score:

- N deposition at the site,
- critical load range for that habitat

Site level: no relationship

Britton et al. 2017 Report to SNH

The value of long-term surveys

- Birse and Robertson just one of many long-term datasets
- Using data to answer questions for which it was not actually collected
- Lots of versatility
- Identifying drivers of change and their relative importance
- Impacts of changes in policy
- Predicting future changes

Thanks to

All the surveyors: Richard Hewison, Rob Brooker, Roger Cummins, Debbie Fielding, Julia Fisher, Diana Gilbert, Sonja Hurskainen, David Riach

E.L. Birse and J.S. Robertson for baseline data

Landowners for access to the survey sites.

Funded by Strategic Research Programme of the Scottish Government's Rural and Environment Science and Analytical Services Division: 2016-2021, 2011–2016 and 2009-2011

Land Use Change and its Simulation

ELSEG 20th Nov 2017

Alessandro Gimona

Andrea Baggio, Marie Castellazzi, Jim McLeod, Laura Poggio , Rebekka Artz, Richard Hewitt, Dave Miller, Douglas Wardell Johnson, Keith Matthews

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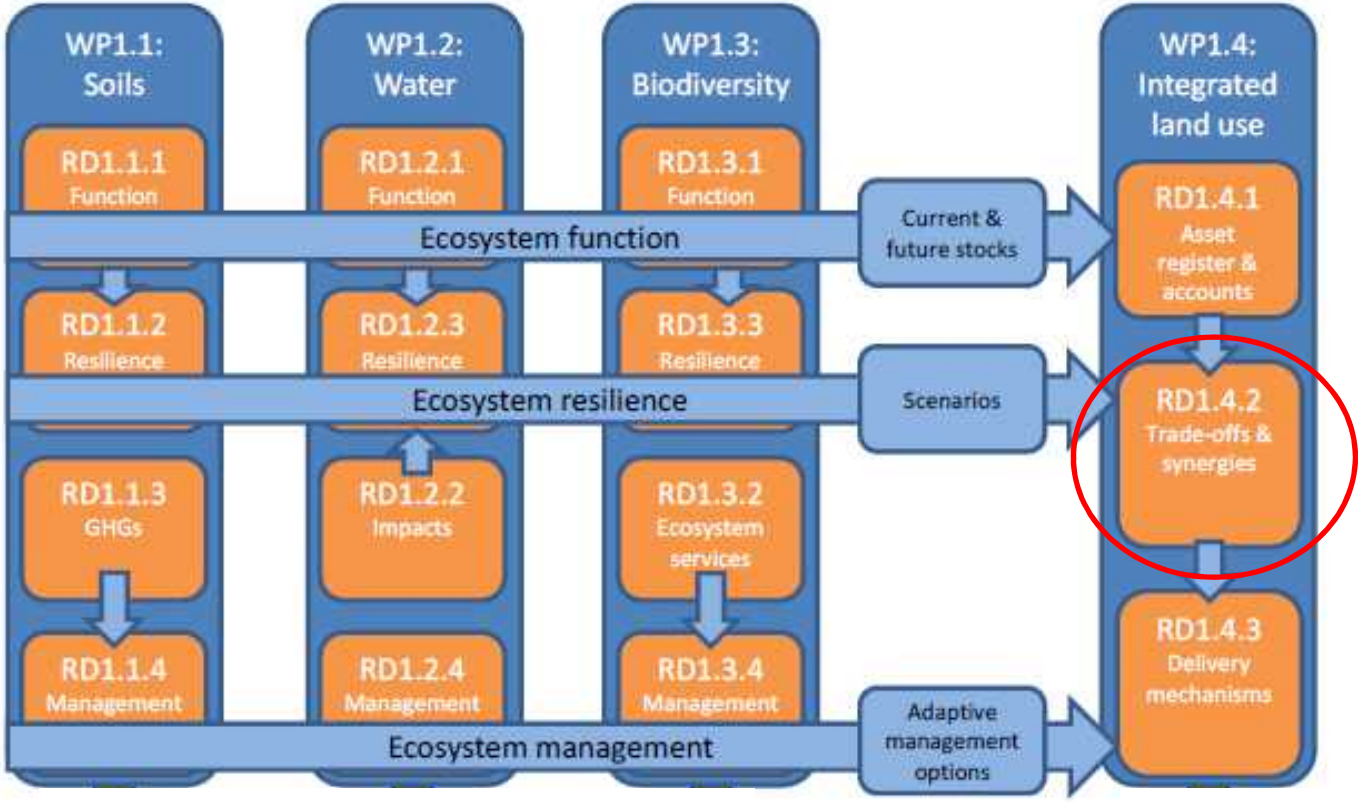

WP1.1: Soils
WP1.2: Water
WP1.3: Biodiversity
WP1.4: Integrated land use
RD1.1.1 Function
RD1.2.1 Function
RD1.3.1 Function
RD1.1.2 Resilience
RD1.2.3 Resilience
RD1.3.3 Resilience
RD1.1.3 GHGs
RD1.2.2 Impacts
RD1.3.2 Ecosystem services
RD1.1.4 Management
RD1.2.4 Management
RD1.3.4 Management
Ecosystem function
Ecosystem resilience
Ecosystem management
Current & future stocks
Scenarios
Adaptive management options
RD1.4.1 Asset register & accounts
RD1.4.2 Trade-offs & synergies
RD1.4.3 Delivery mechanisms

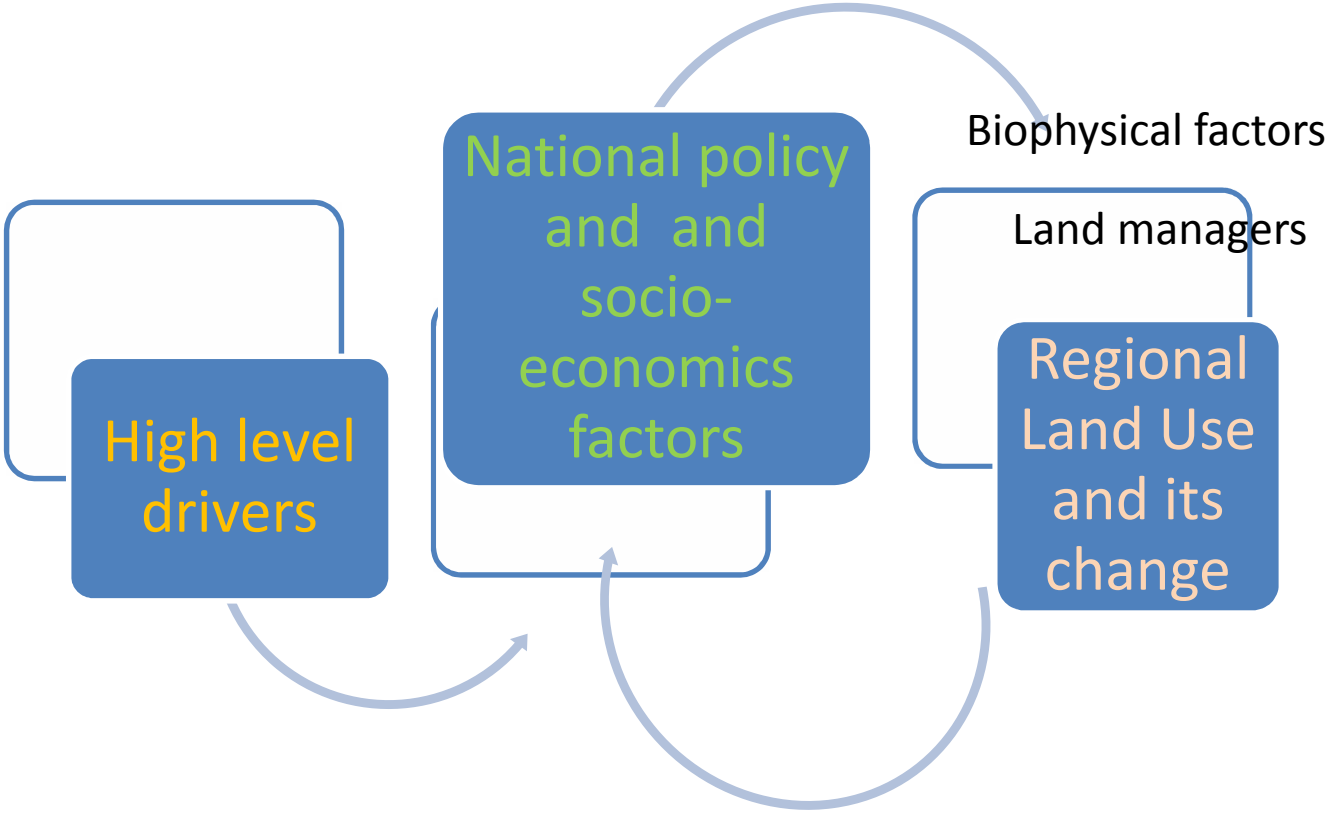
Indicator of resilience: landscape multifunctionality

Multifunctional:
A range of ESS and benefits

Loss of biodiversity, resilience and ultimately, of well-being

Fewer ESS and benefits

Overview

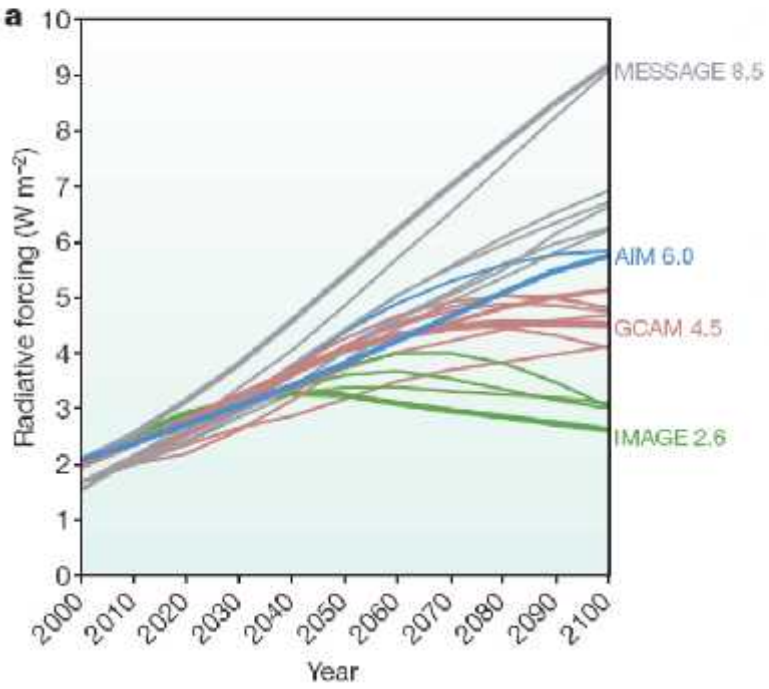

National policy and and socio-economics factors
Biophysical factors
Land managers
High level drivers
Regional Land Use and its change

High level drivers

IPCC's Representative concentration pathways:
Climate change, markets, population, energy consumption

Radiative Forcings

The graph below shows radiative forcing trajectories for the four RCPs, the other candidate scenarios that informed the final versions, and the modelling group associated with each.



+4.5 degrees C

+3.0 degrees C

+2.4 degrees C

+1.5 degrees C

Bundles of drivers associated to each RCPs scenario

National Scale
Implications for LUC

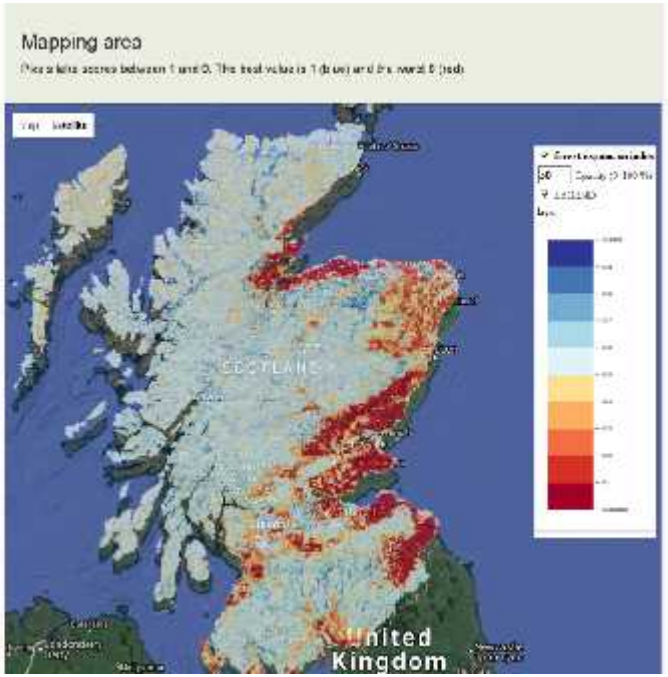
Drawing from scenarios work in **NEA, Land Use Futures, DURESS..**

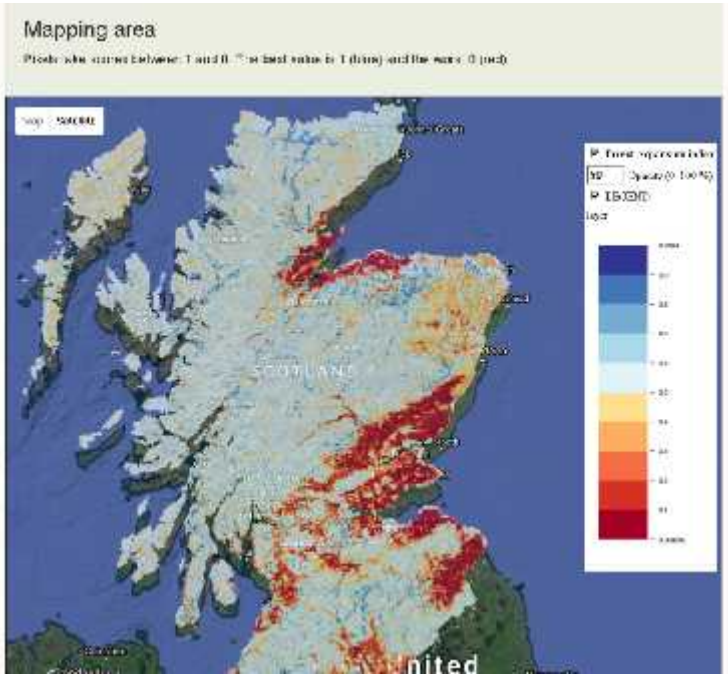
Story lines for Scotland

Impacts on:

i) Impacts on agricultural capability
ii) water resources management (e.g. quantity & quality)
iii) Impacts on semi-natural forests and landscape connectivity;
iv) Impacts on Carbon stocks

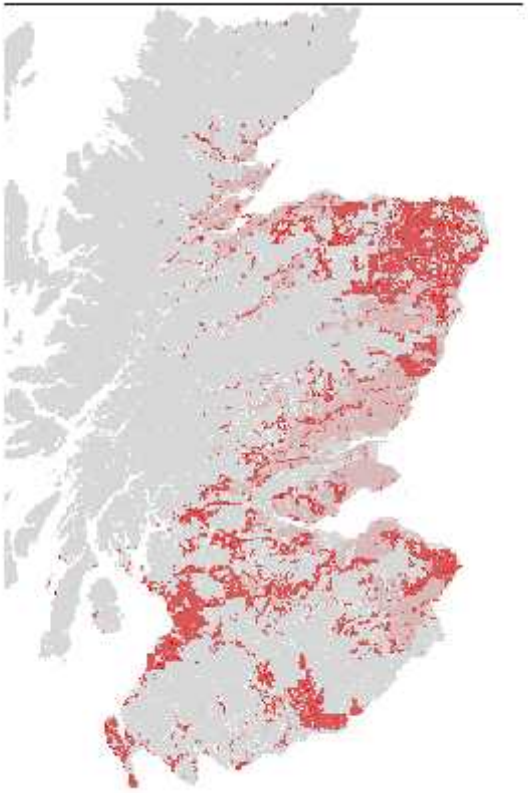
Forests and Peatlands





Forest suitability according to the importance of multiple criteria

Agriculture



Land
Capability
Agriculture
2050

High resolution soil properties modelled
Climate downscaling –method developed

ScenInVEST model (from LUC scenarios to ESS)

status 16/11/17

ScenInVEST model

Land use scenarios descriptions

Climate change scenarios

LandSFACTS model

Spatio-temporal land use scenarios (maps)

Data pre-processing (Python, ArcGIS)

InVEST models

Nutrient

Sediment

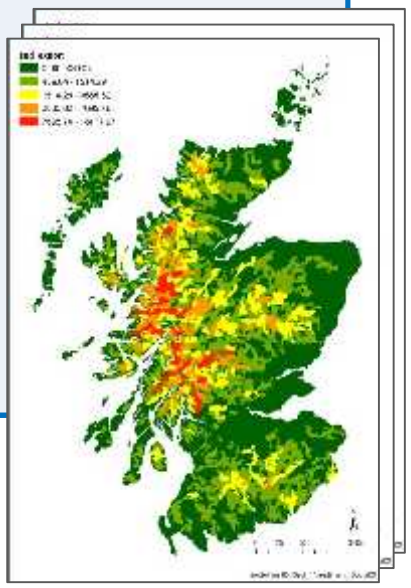
assessments

Stat. Metamodels (R)

BBNs

(in progress);

faster assessments

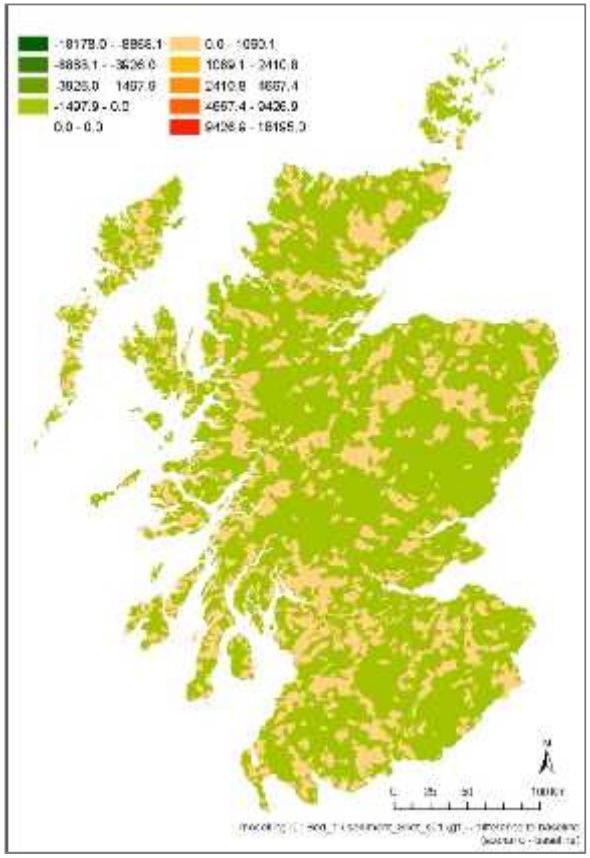


Integration of Carbon assessment is in progress

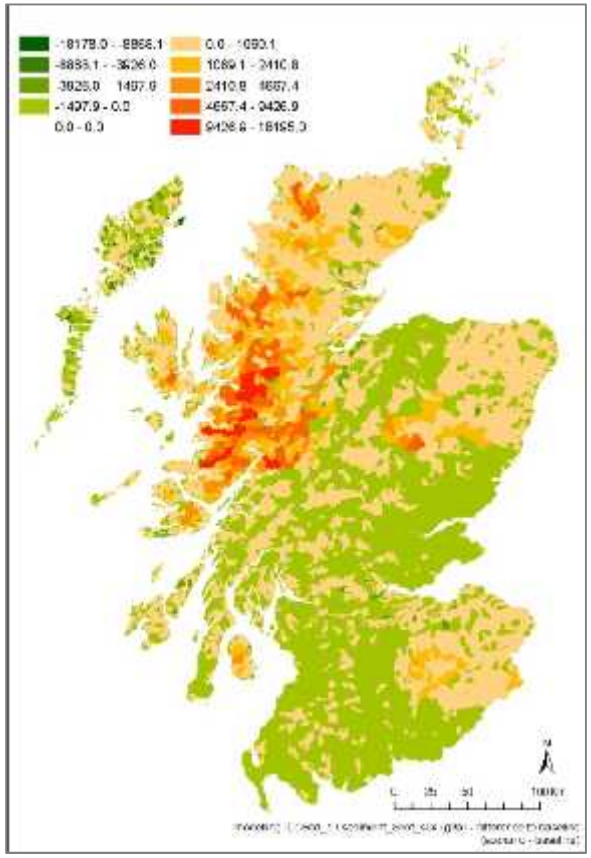
The addition of Shetland is currently running

LUC & soil loss to water courses

Scenario g1 minus Baseline



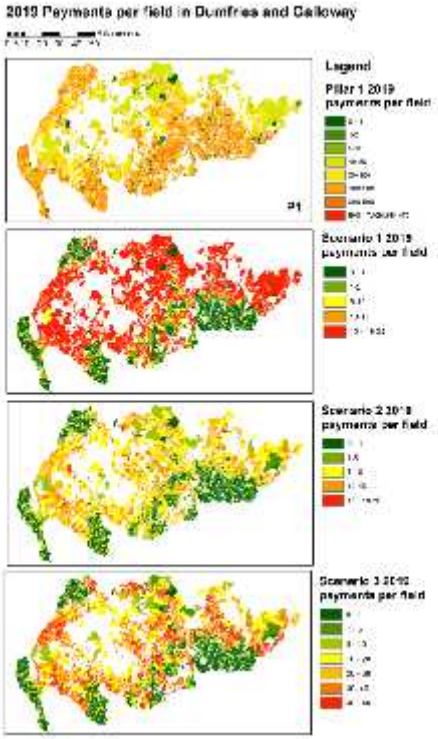
Scenario g3a minus Baseline



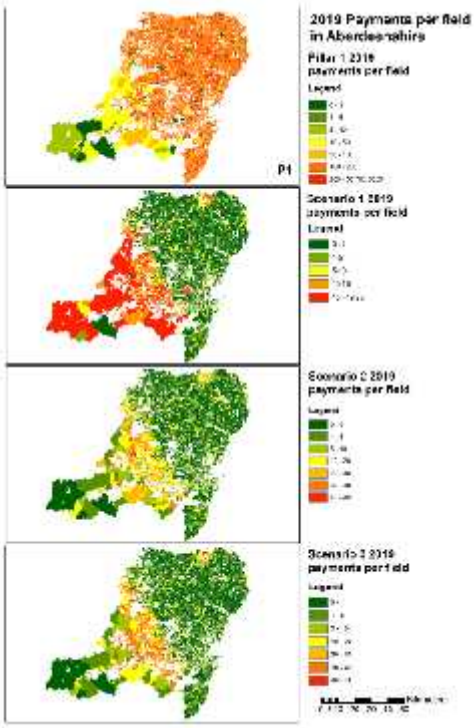
Nutrient and Sediment input/output analysis by land use and projected SRDP payments in three Scottish regions

Payment structure (red = high, green = low)

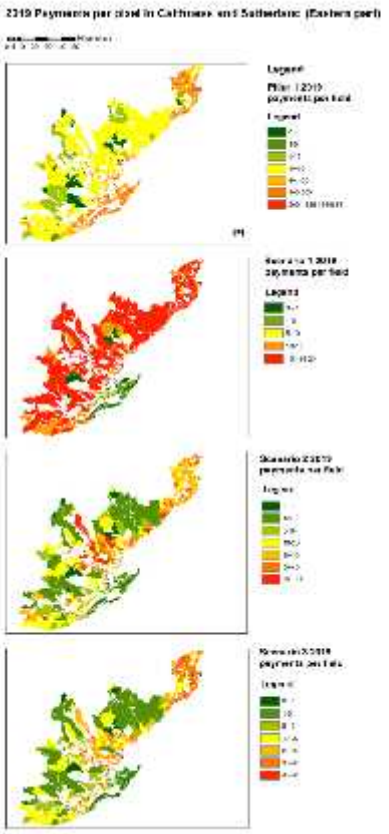
Dumfries and Galloway



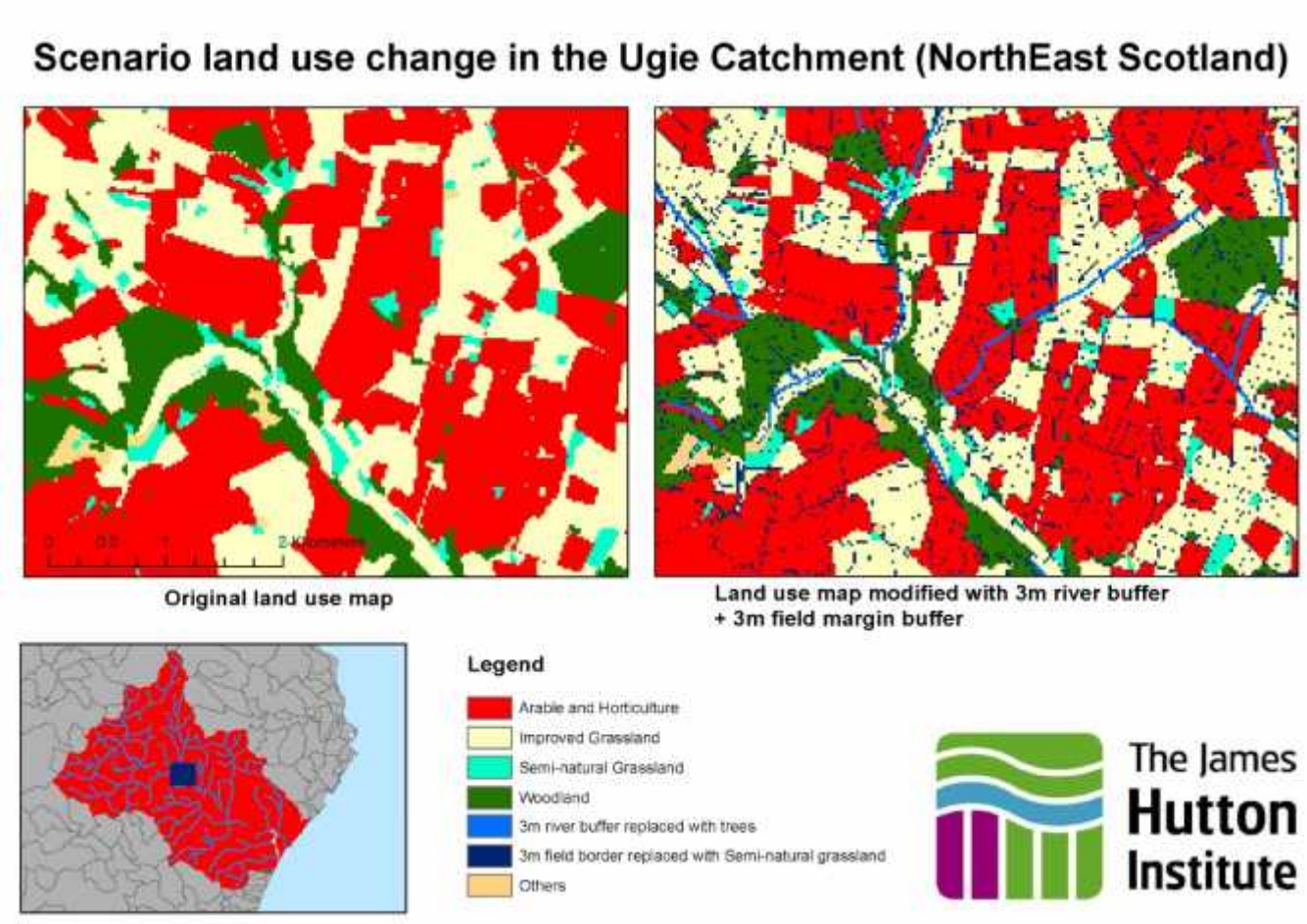
Aberdeenshire



Caithness/Sutherland (eastern part)



LUC & N export

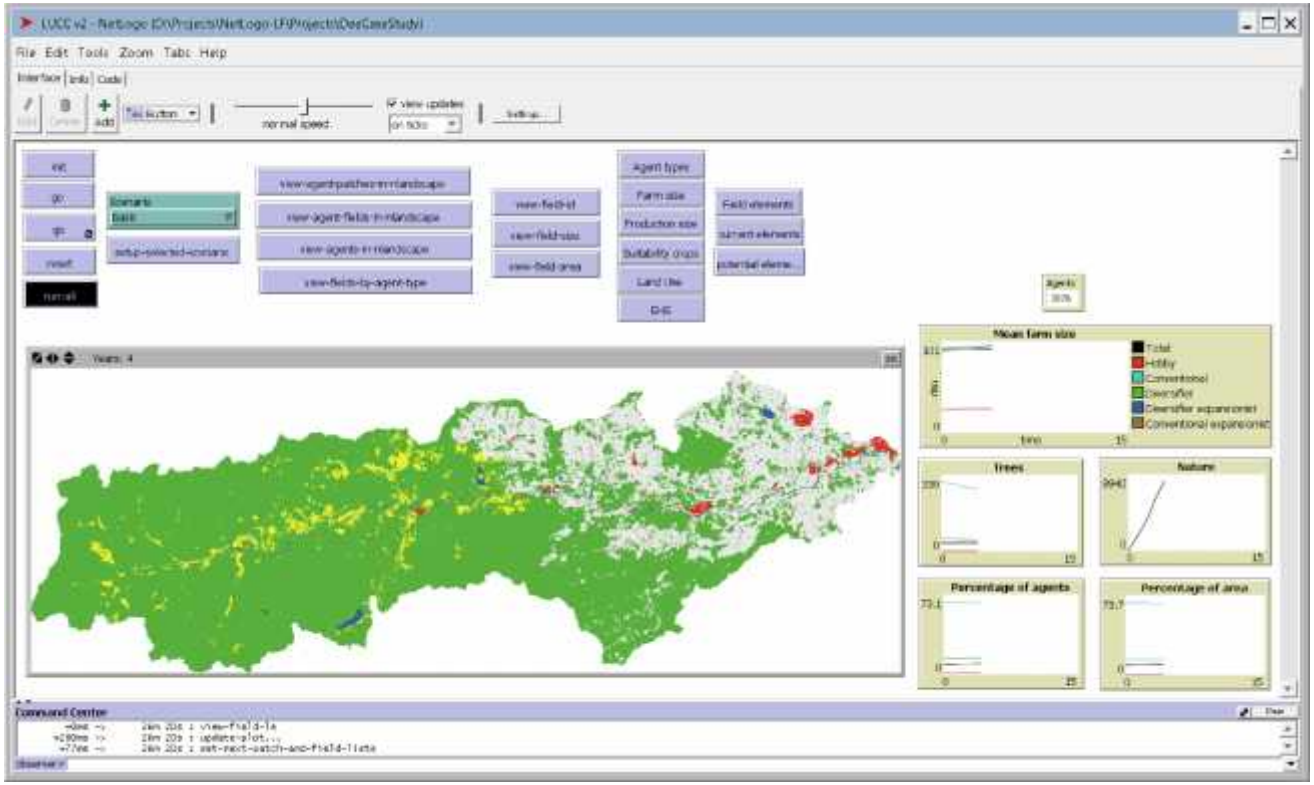


Modelling result

Buffer strips need to be at least **20 m wide**
and **widespread**
to obtains ca 20% reduction in N export.
3m-wide buffers strips: 1-3% reduction in N export

The Role of Land Managers

Agent Based Model

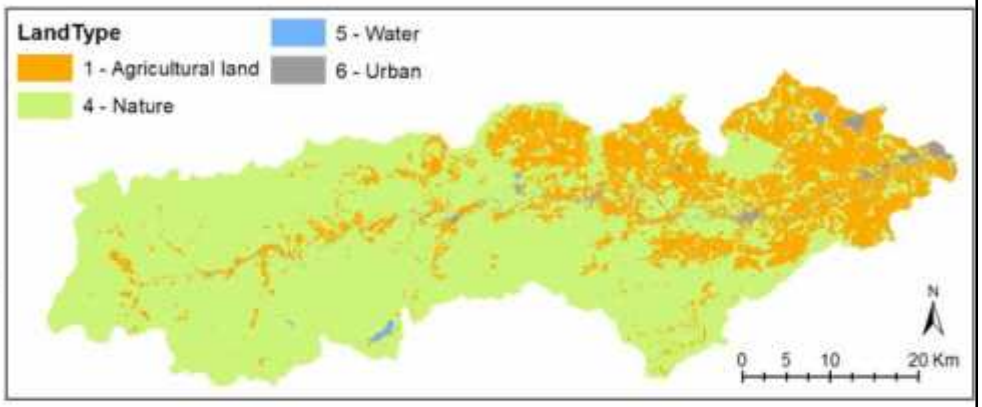


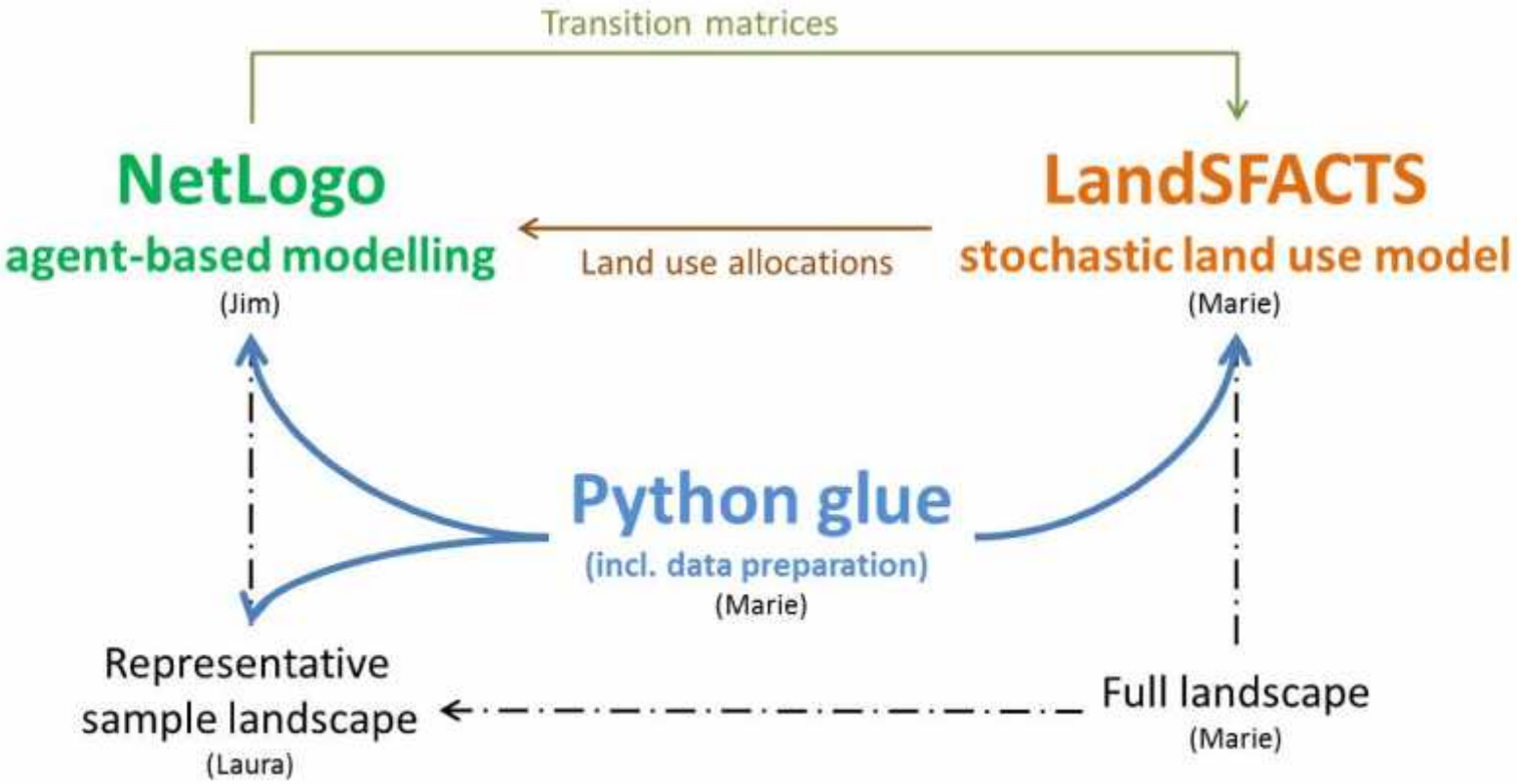
NetLogo-LandSFACTS integration

15/11/17

Modelling land use change at national scale by considering land owners preferences.

<u>status</u>: fine tuning the integration of the data between the 2 models, using Dee catchment dataset





Expected Outcome (Y4-5)

- Assessing the joint effect of multiple drivers on biodiversity and ecosystem services

- New tools to link landscape and land use change to BD & ESS (e.g. assisting the design and targeting of incentives)

- (with other RDs) Identification of barriers, opportunities and trade-offs in land use policy and decision-making


Thanks for your attention
Any Questions?
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Scenario-based evaluation of policy options and their implications

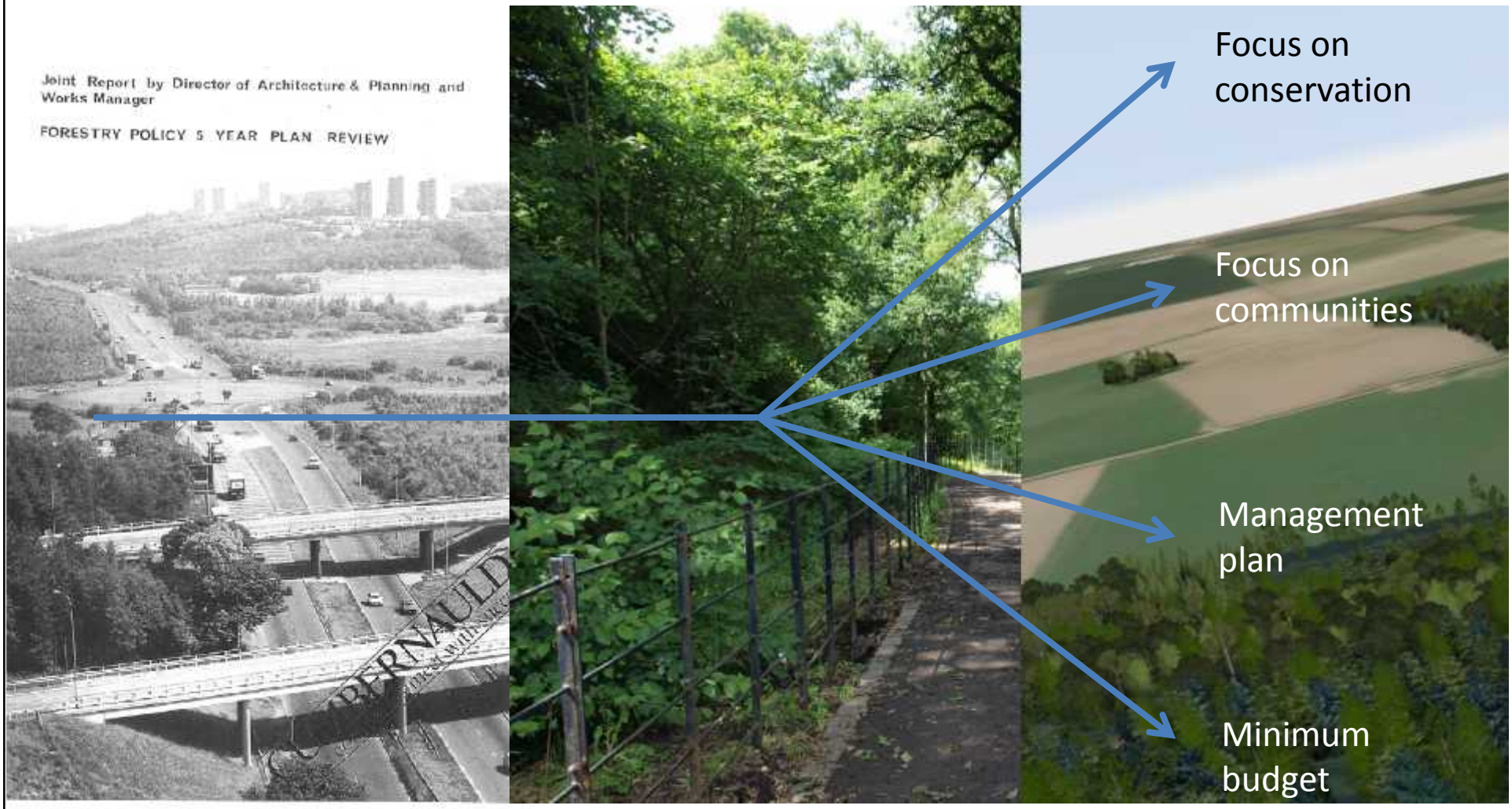
Scenario-based evaluation of policy options

- Evaluation of future policy options?
  - Lack of data
  - Lack of models, complex contexts
- Using scenarios for expert/stakeholder-based evaluation
  - Scenarios that describe external factors or drivers of change (e.g., climate, global economy)
  - Ideal scenarios, visions
  - **Scenarios that explore implications of (policy) choices**
- Have used all of these in previous research – EPIC Centre for Expertise, Regional Land Use Pilots, etc.

Participatory Impact Assessment

- Stakeholder-based assessment of alternative land use scenarios (Morris et al. 2011, König et al. 2013):
  1. Development of scenario narratives
  2. Specification of the context (Land Use Functions → indicators)
  3. Assessment of scenario impacts and analysis of trade-offs
- Allows for structured consideration of a range of implications of options for change
- Currently used to assess impacts of woodland management on ecosystem services
- Can also be applied to explore impacts of large-scale policy choices

Participatory Ecosystem Service Assessment

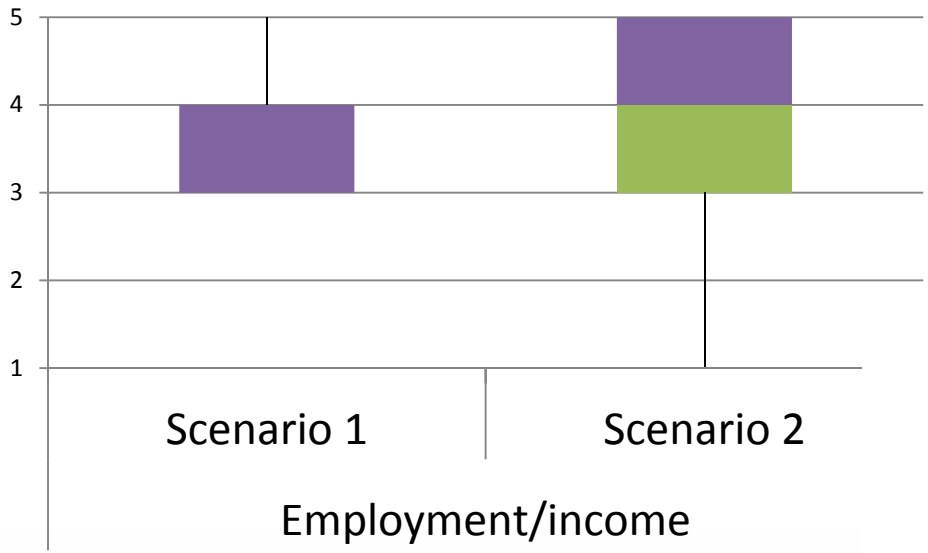


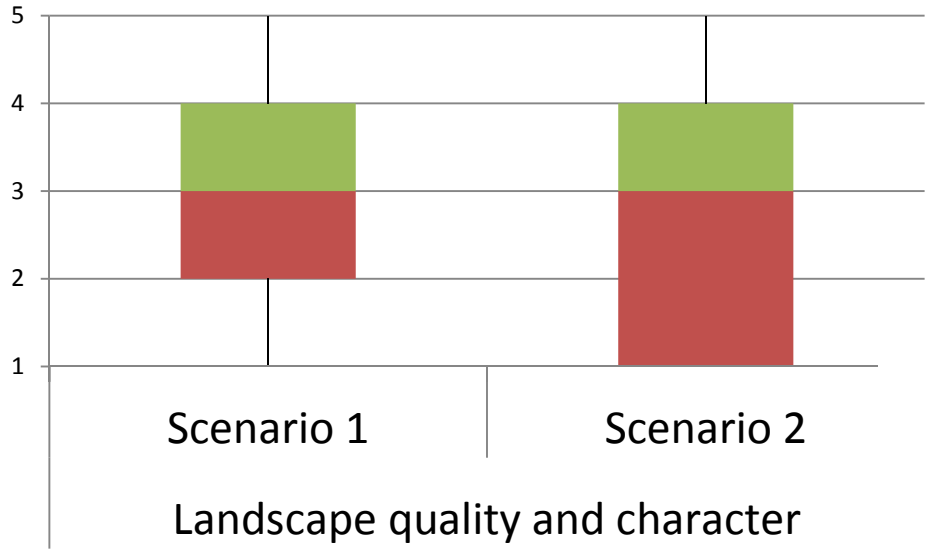
Past: late 1980s/ early 1990s

Present: 2016

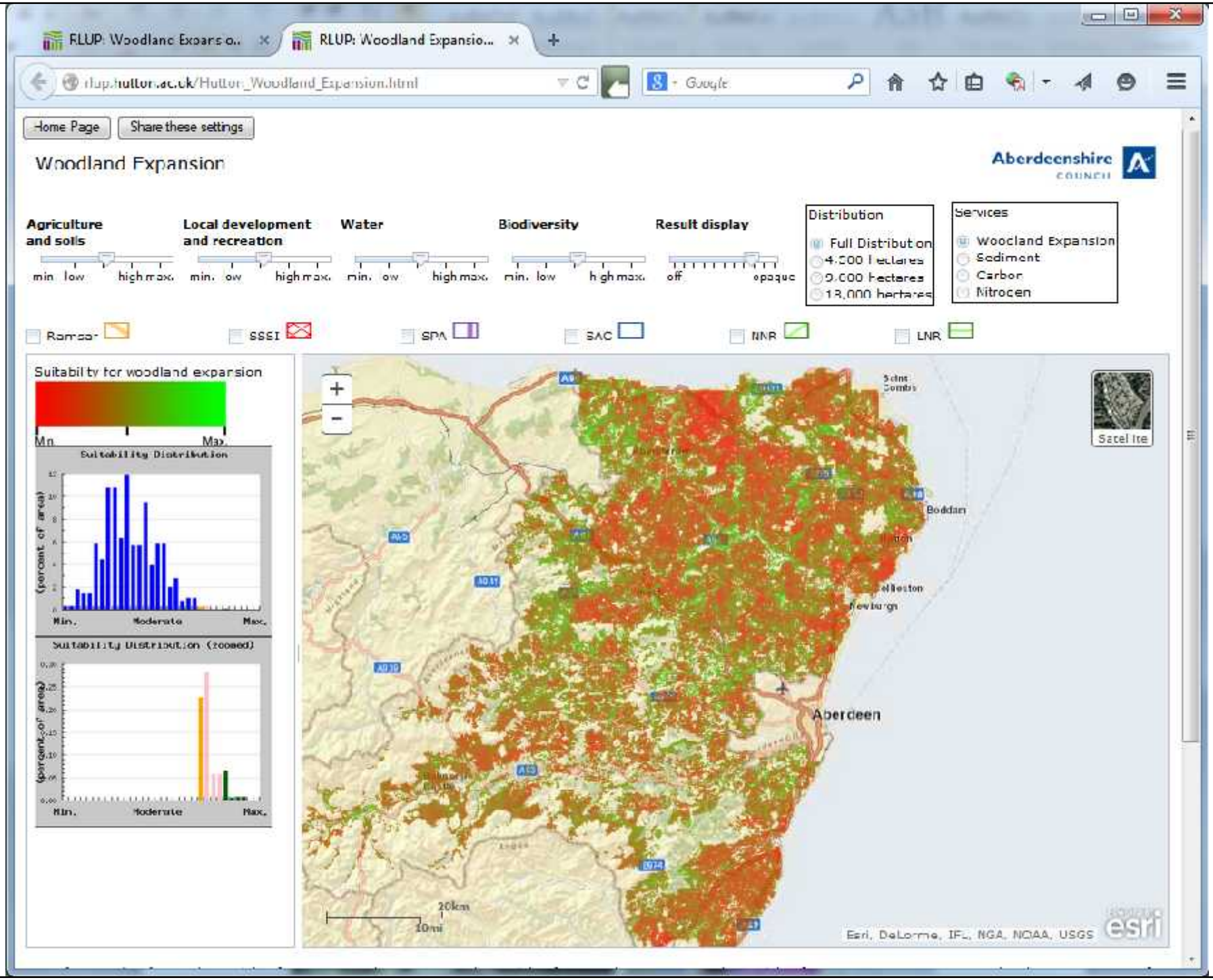
Future: 2030s

Participatory Ecosystem Service Assessment





- Scores can be used as such, or in a Delphi-type process


RLUP: Woodland Expans o..
RLUP: Woodland Expansio...
rlup.hutton.ac.uk/Hutton_Woodland_Expansion.html
Google
Home Page
Share these settings
Woodland Expansion
Aberdeenshire COUNCIL
Agriculture and soils
Local development and recreation
Water
Biodiversity
Result display
min. low high max.
off opaque
Distribution
Full Distribution
4,000 hectares
9,000 hectares
13,000 hectares
Services
Woodland Expansion
Sediment
Carbon
Nitrogen
Ramsar
SSSI
SPA
SAC
NNR
LNR
Suitability for woodland expansion
Min.
Max.
Suitability Distribution
(percent of area)
Min.
Moderate
Max.
Suitability Distribution (zoomed)
(percent of area)
Min.
Moderate
Max.
Satellite
Aberdeen
Peterhead
Fraserburgh
Banff
Macduff
Inverurie
Ellon
Newburgh
Stonehaven
20km
10mi
Esri, DeLorme, IPC, NGA, NOAA, USGS
esri

Participatory Policy Impact Assessment?

- Select environmental, economic and social criteria that fit the question
- Evaluation process, trade-offs identified *and* scores: input into decision making
- Can be complemented by modelling and mapping approaches
- Might provide a fuzzy but more integrated picture than focused models

Managing agro-ecosystems post Brexit

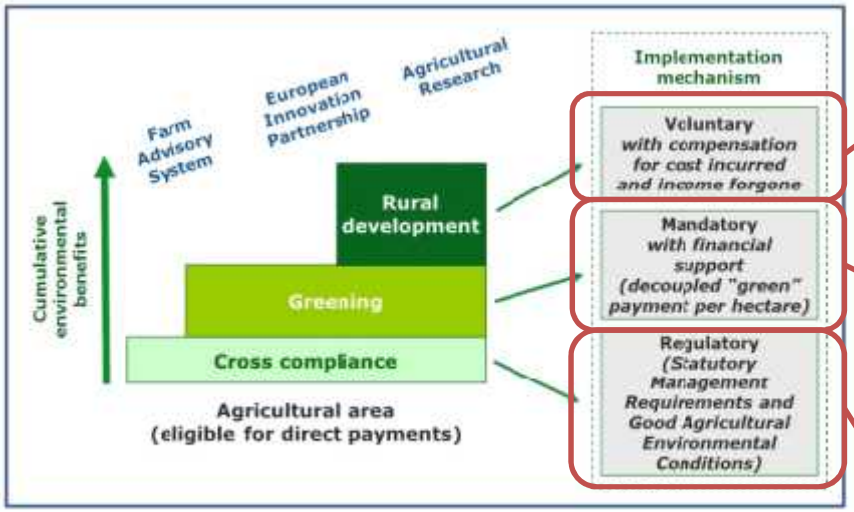
Graham Begg
Head of Agroecology
The James Hutton Institute

Brexit and EU regulations

- EU Common Agricultural Policy (EU Regulations)
- EU Sustainable use of pesticides Directive (Directive 2009/128/EC)
- EU Water Framework Directive (Directive 2000/60/EC)

CAP & the environment

Greening architecture



Source: DG Agriculture and Rural Development.

Rural Development Programme
- >€30% to AECS
- Voluntary and devolved
- 64 options in total
- 30+ for arable-grass

Green Direct Payment
- Compulsory
- permanent grassland
- ecological focus areas
- crop diversification

Cross-compliance
- Compulsory
- 7 x GAECs
- 13 x SMRs
- 10 x agri-env/climate

Other legislation

- EU Sustainable use of pesticides Directive "…**reducing the risks and impacts** of **pesticide use** on human health and the **environment** and promoting the use of **Integrated Pest Management** (IPM)

- EU Water Framework Directive "… **waters** must achieve good **ecological and chemical status**, to protect human health, water supply, natural **ecosystems and biodiversity**

- **EU Birds Directive** "…conservation of the species of **wild birds** naturally occurring in the European territory**"**

- **EU Habitats Directive** "…promote the maintenance of **biodiversity** by requiring Member States to take measures to maintain or restore **natural habitats and wild species**"

- **Other policy instruments (EU biodiversity strategy, EU Environmental Action Plan)**

Brexit and the CAP

- “UK is seeking to leave the EU Common Agricultural Policy in March 2019”

- CAP level subsidy promised by UK Government to 2020

Brexit is an opportunity to design something better

Post-Brexit possibilities

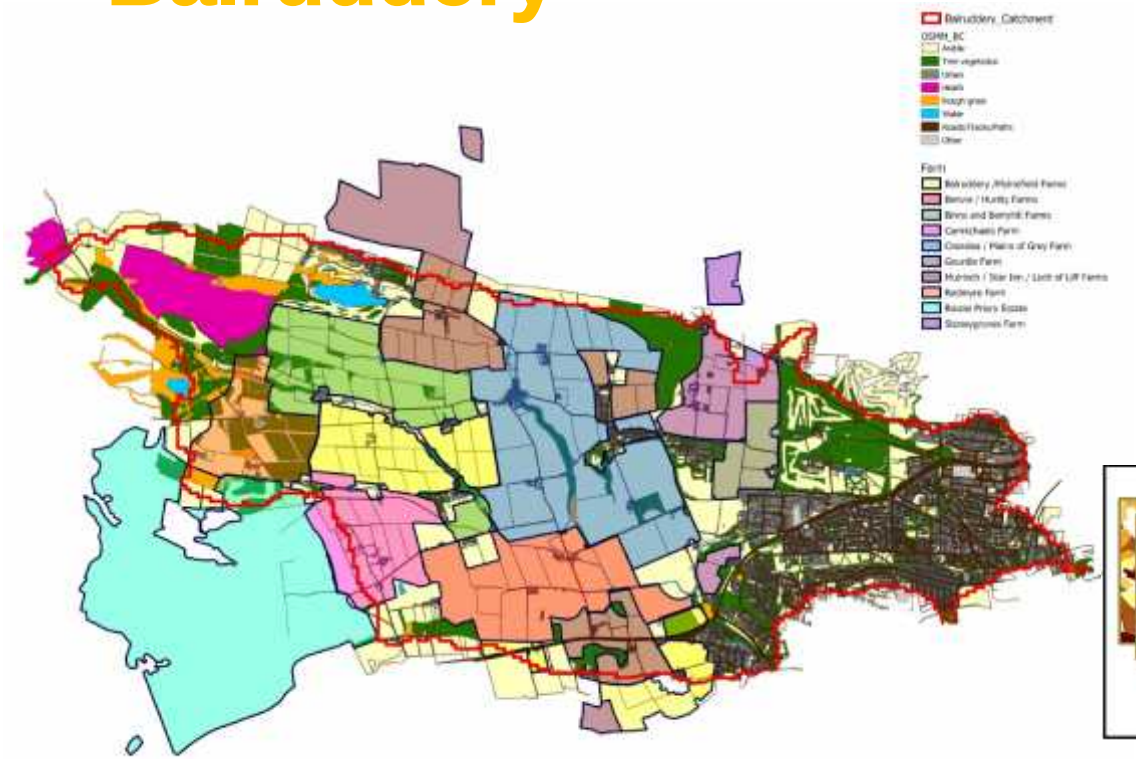
- Payment for public goods
- Landscape scale
- Evidence based
- Payment by results
- Knowledge support for farmers

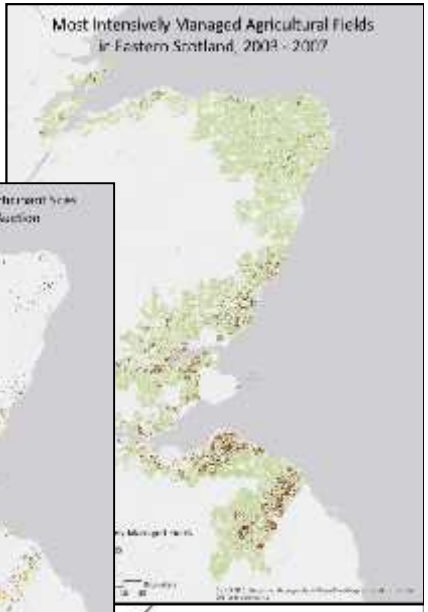
INTEGRATION!

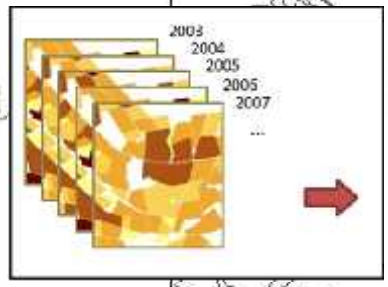
Challenges

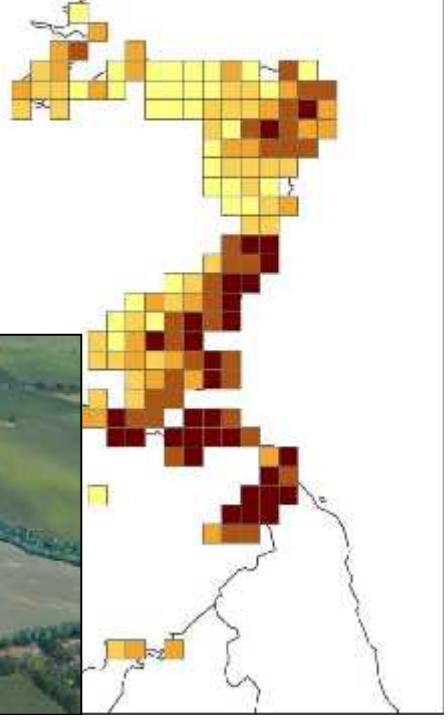
- Identify and prioritise ‘public goods’
- Design integrated strategy and management options to deliver goods
- Design payment scheme
- Design monitoring scheme
- Educate land managers and stakeholders

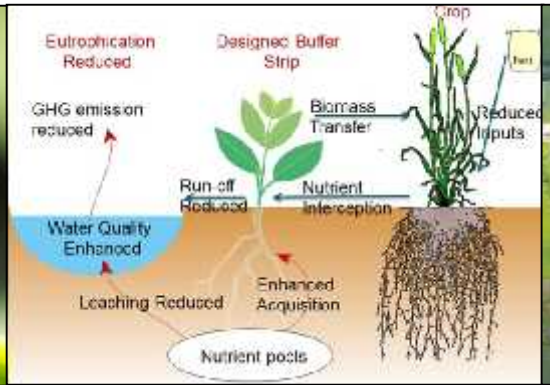
Agri-systems research: Balruddery





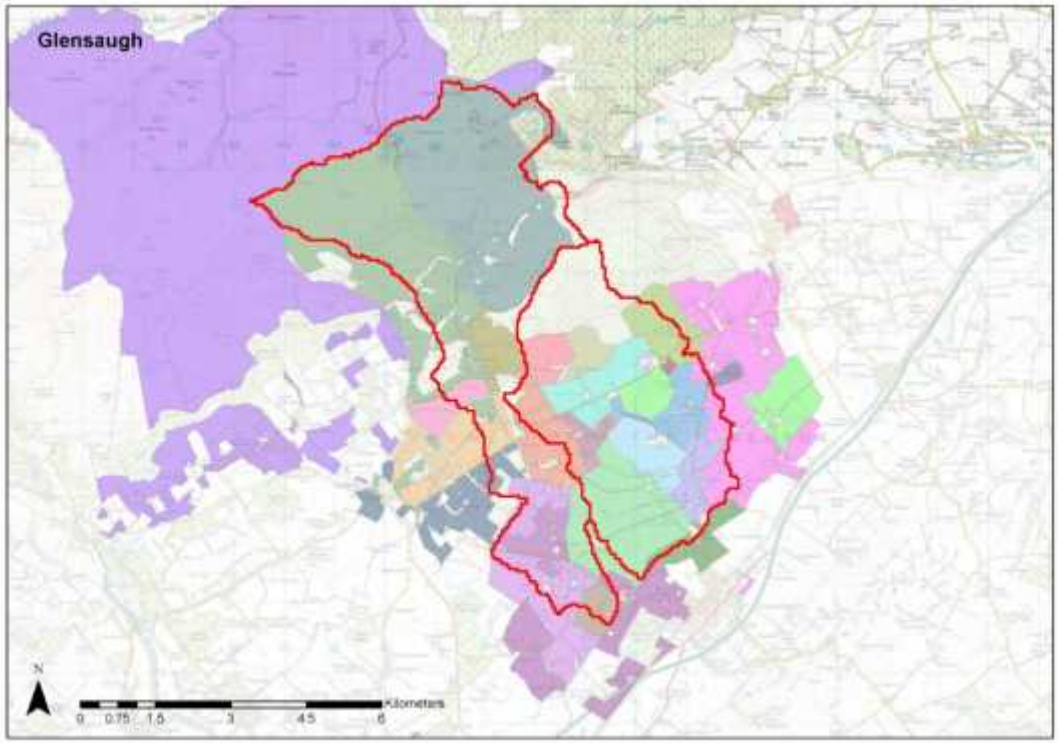






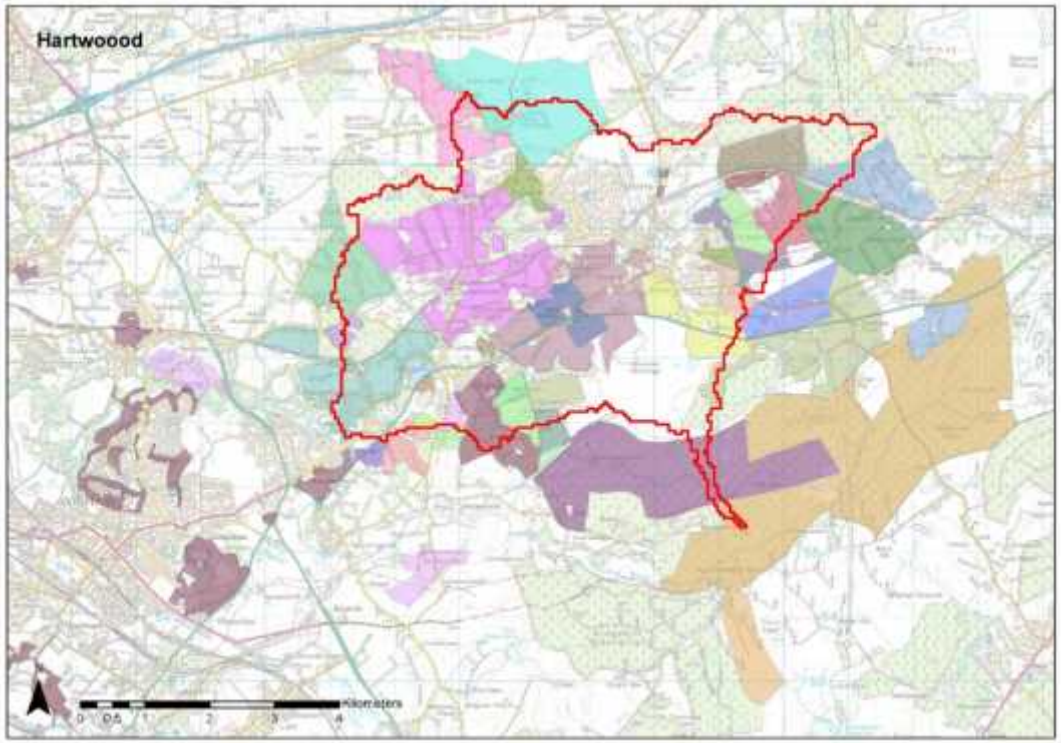
Agri-systems research: Glensaugh

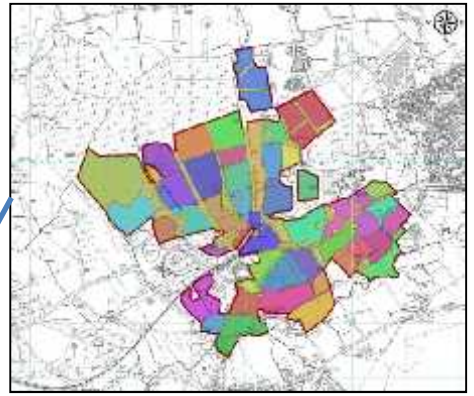
Glensaugh – upland grazing, moorland



Agri-systems research: Hartwood

Hartwood - rotational and permanent grassland, livestock production





Challenges

- Identify and prioritise ‘public goods’
- Design integrated strategy and management options to deliver goods
- Design payment scheme
- Design monitoring scheme
- Educate land managers and stakeholders

Thank you

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Coordinating policy instruments that influence soil, water, and biodiversity in Scotland

Jessica Maxwell, Alba Juarez Bourke, Kerry Waylen and Kirsty Blackstock

Purpose

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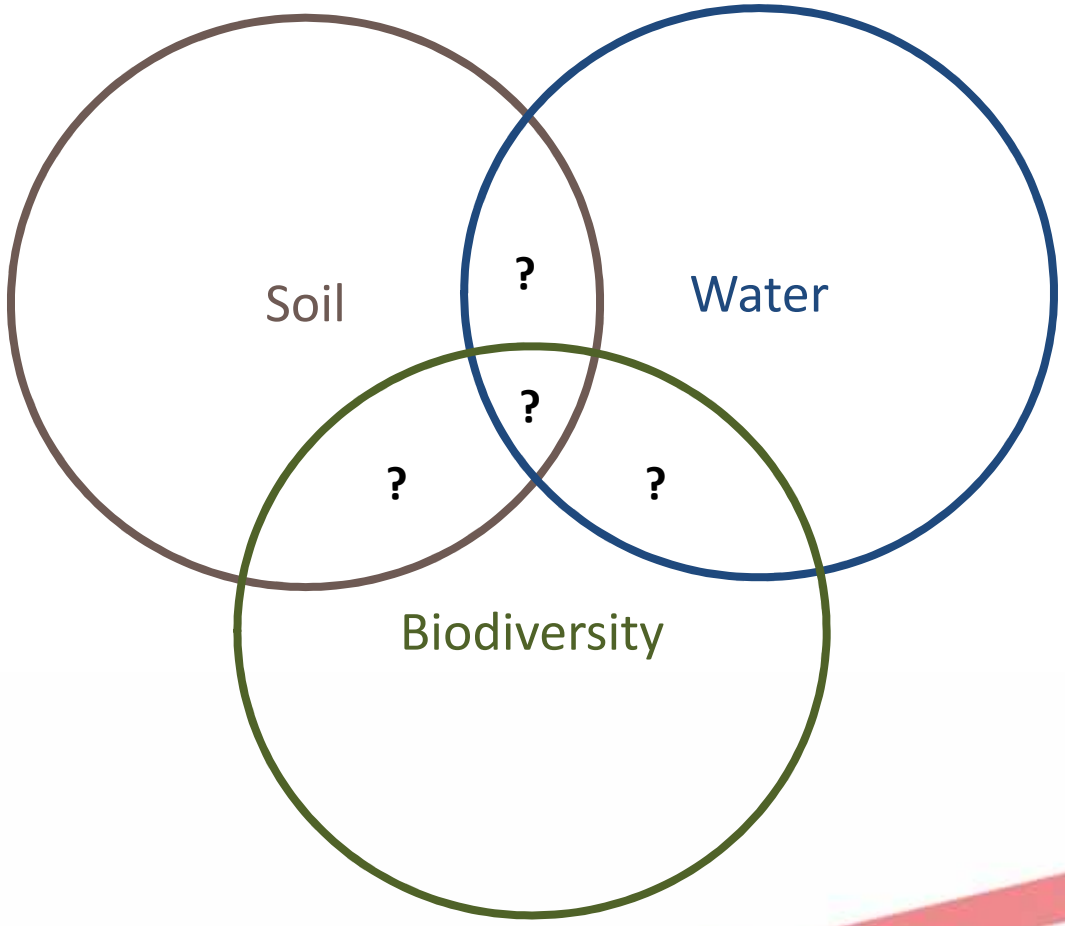

Process

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> 60

Scottish environmental policy instruments identified

10

Policy instruments selected for in-depth analysis

1

Workshop with cross-sectoral stakeholders

≈ 20

Interviews with the 'initiators' and 'owners' of the instruments

Next Steps

Results Spring 2018 followed by a workshop

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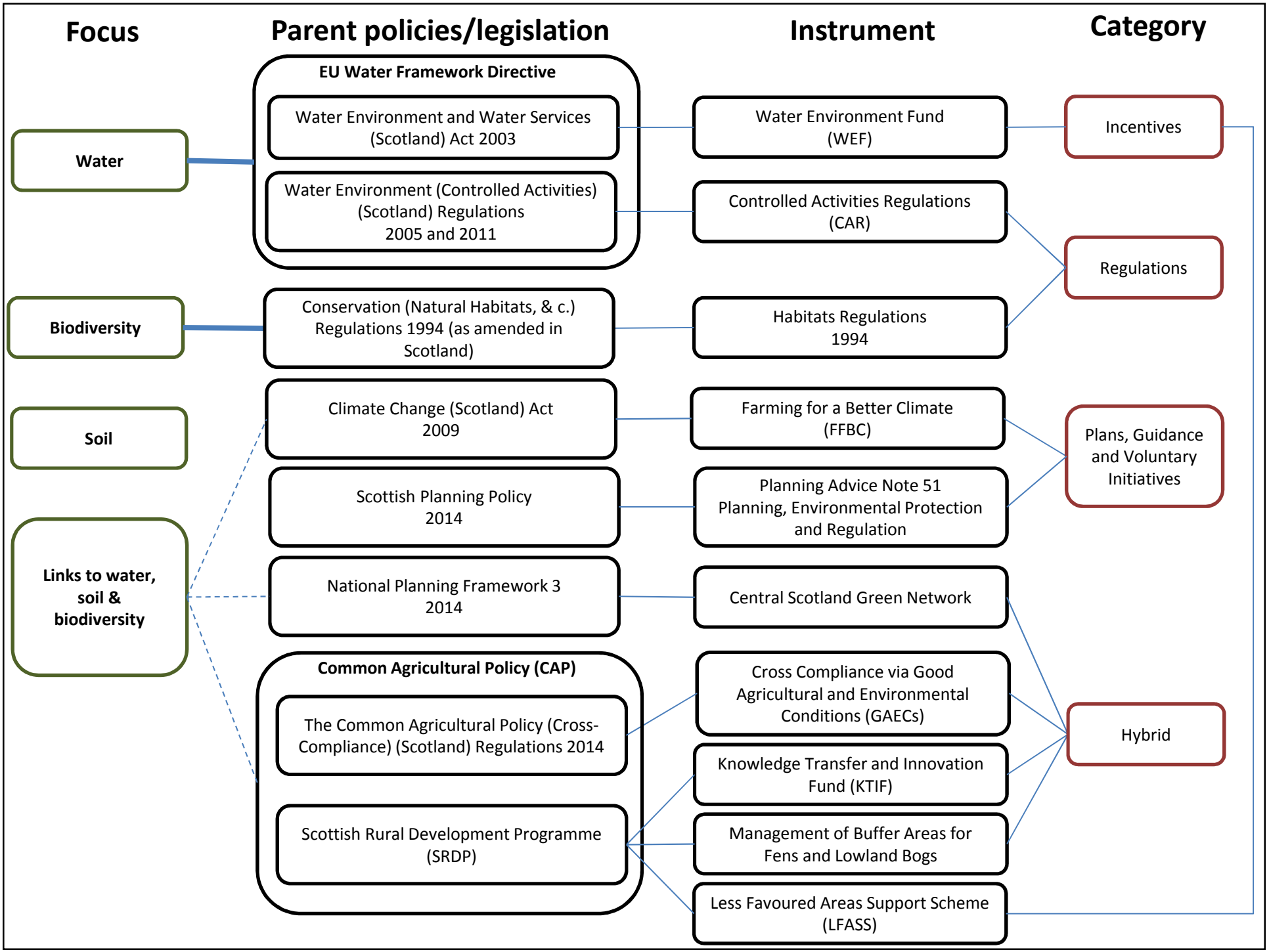
Interim Results


Focus
Parent policies/legislation
Instrument
Category
Water
Biodiversity
Soil
Links to water, soil & biodiversity
EU Water Framework Directive
Water Environment and Water Services (Scotland) Act 2003
Water Environment (Controlled Activities) (Scotland) Regulations 2005 and 2011
Conservation (Natural Habitats, & c.) Regulations 1994 (as amended in Scotland)
Climate Change (Scotland) Act 2009
Scottish Planning Policy 2014
National Planning Framework 3 2014
Common Agricultural Policy (CAP)
The Common Agricultural Policy (Cross-Compliance) (Scotland) Regulations 2014
Scottish Rural Development Programme (SRDP)
Water Environment Fund (WEF)
Controlled Activities Regulations (CAR)
Habitats Regulations 1994
Farming for a Better Climate (FFBC)
Planning Advice Note 51 Planning, Environmental Protection and Regulation
Central Scotland Green Network
Cross Compliance via Good Agricultural and Environmental Conditions (GAECs)
Knowledge Transfer and Innovation Fund (KTIF)
Management of Buffer Areas for Fens and Lowland Bogs
Less Favoured Areas Support Scheme (LFASS)
Incentives
Regulations
Plans, Guidance and Voluntary Initiatives
Hybrid

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