

PROGRAMME 3
ENVIRONMENT – LAND USE AND RURAL STEWARDSHIP

Conserving Natural Heritage

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Introduction

Scotland has a rich & diverse natural heritage:

From mountains, heath, forests & bogs...
... to cliffs & coastal sands

- shaped by complex interactions between natural & human influences
- geology, climate, pollution, land management...

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Management

Management of our natural heritage requires:

- predictive understanding of key processes involved (environmental, social, economic)
- analysis & resolution of conflicts & constraints
- > development of sustainable management practises to support Scotland's conservation policies & targets

This requires an integrated, interdisciplinary research approach to ensure:

- effective biodiversity management framework
- best use of new & existing knowledge (by researchers, practitioners, policy-makers) to provide required evidence-base

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Policy framework & key questions

Key questions:

- In what state is our current resource?
- How do different species/habitats/humans respond to policy & management changes?
- How will these responses be affected by environmental changes?
- > How will this affect policy/management success & what can we do about it?

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Current resource

- Distribution & abundance?
 - Biodiversity - National
 - International
- Importance?
 - Economic – farming
 - tourism
- Current condition?
 - Healthy - expanding
 - Stable
 - Degraded, declining...
 - Under threat
 - In danger of extinction
 -
- Invasive?
 - Spreading?
 - Control methods?

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Drivers of biodiversity change

Monitoring (Long-term) ← Manipulative experiments (Short-term) →

Correlative analyses ← Causal factors →

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Drivers of biodiversity change

Montane vegetation: 40y changes

Expt N addition:

Correlative analyses ← Causal factors →

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Engagement in policy

Successful policy development & implementation requires stakeholder engagement/participation – are we getting this right?

- **Traditional methods:**
 - Questionnaires
 - Public consultations
- **How well do they work?**
- **Digging deeper:**
 - Remove 'technical/jargon' barricades
 - Use non-verbal as well as verbal methods
 - Understand values/beliefs -> conflict resolution

-> improved policy design & public support

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Changing environment

Policy /management success in a changing environment


- Fragmentation & habitat loss
- Species adaptation
- Species shifts



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Fragmentation & habitat loss

Scotland's native woodland




- Current extent: ~4% land area of Scotland
- Estimated biophysical potential (current climate): ~50%
- International obligations to protect/expand – e.g. Caledonian pinewoods, upland birchwoods...
- New native woodlands: grant-aid
- **But: what have been the effects of the long-term fragmentation?**
- **And how will this affect biodiversity management success?**

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Fragmentation & habitat loss

Woodland protection/expansion:

- Fencing v grazing reduction/removal
- Wild v domestic grazers - different types/breeds
- Economics/grant-aid incentives






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Fragmentation & habitat loss

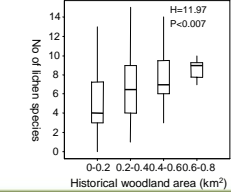
Effects of fragmentation & habitat loss?

- **Species diversity?**
LOSSES

Example: forest lichens

Lichen richness correlates with historical, NOT current, woodland area:



Historical woodland area (km²)	Min	Q1	Median	Q3	Max
0-0.2	3	4	5	6	10
0.2-0.4	4	5	6	7	11
0.4-0.6	5	6	7	8	12
0.6-0.8	6	7	8	9	13

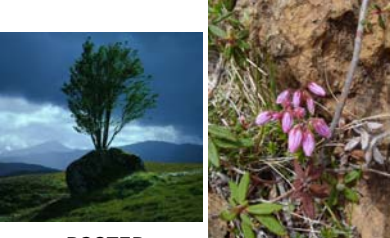
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Fragmentation & habitat loss

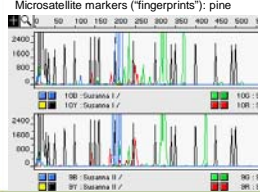
Effects of fragmentation & habitat loss?

- Species diversity?
- Genetic diversity?

SOME LOSSES



Microsatellite markers ("fingerprints"): pine



- POSTER:
- Important factors include:
 - degree of isolation
 - pollen/seed dispersal distances
 - generation times ...

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Fragmentation & habitat loss


Effects of fragmentation & habitat loss?

- Species diversity?
- Genetic diversity?

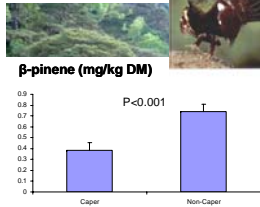
SOME LOSSES

Genetic diversity -> chemical diversity

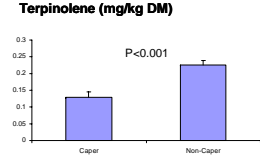
- Whole system diversity (above & below ground)
- Example: capercaillie avoid trees high in monoterpenes, but select trees high in magnesium
- Knock-on effects on habitat diversity & resistance/resilience to change



β-pinene (mg/kg DM)



Terpinolene (mg/kg DM)




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Adaptation....

Effects of fragmentation & habitat loss?

- Species diversity?
- Genetic diversity?
- Resistance/resilience to change?
- CLIMATE CHANGE:
 - adaptation in-situ?
 - Changes in budburst/flowering/seed timing?
 - Effects on/of pollinators/grazers??

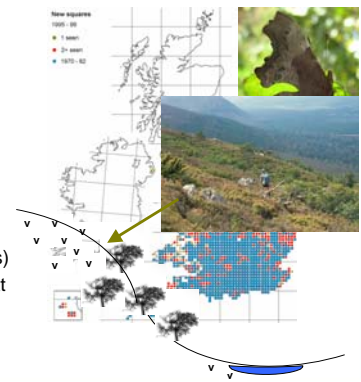


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Species shifts

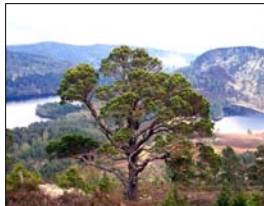
Species shifts in a changing climate....

- Species which can move fast/easily:
 - already seeing change
- Less mobile species – key issues:
 - seed dispersal ability (plants)
 - availability of suitable habitat close by
 - invasibility of neighbouring habitat



Key issues:

- State & condition of our biodiversity & natural heritage
- Resilience/resistance to change (envt., econ., social)
- Valuing our resource (central role)
- Economics & land-use balance
- Integrated management
- International -> National biodiversity targets
- Emerging issues:
 - Global change.....



THANK YOU

