



Resilience to climate change in theory and in practice

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Conserving
changing
on buildin

www.defra.gov.uk

England Biodivers
Towards adaptatio

Final Report to Defra for co
May 2007

HM Government

England Biodiversity Strategy

Climate Change Adaptation
Principles

Conserving biodiversity in a changing climate

**Resilience is a 'good thing'
but
what is it?**

Making Space for Nature:
A review of England's Wildlife Sites and Ecological
Network

Chaired by Professor Sir John Lawton CBE FRS

Submitted to the Secretary of State, the Department for Environment,
Affairs on 16 September 2010

Strategic Direction
2008 – 2013

..... and how do we increase it?

- S:
- A: Vision
- B: Coalition Priorities
- C: Structural Reform Plan

defra
Department for Environment,
Affairs

Structure



- Definitions of resilience
- Resilience vs. accommodation
- What promotes resilient populations and communities?
- Preparing for an uncertain future
- Conclusions

Definitions of Resilience 1



- IPCC (WG2)
- *the ability of a social or ecological system to absorb disturbances while retaining the same basic structure and ways of functioning, the capacity for self-organisation, and the capacity to adapt to stress and change.*

Definitions of Resilience 2



- Ecology Text Book
- *the speed with which a community returns to its former state after it has been disturbed*
- c.f. '**resistance**' - *the ability of a community to avoid displacement from its present state by a disturbance*
- Begon, Harper and Townsend, 1996

Definitions of Resilience 3



- Making Space for Nature (Lawton et al. 2010)
- Resilient ecological network:
capable of absorbing, resisting or recovering from disturbances and damage caused by natural perturbations and human activities (including climate change) while continuing to meet its overall objectives of supporting biodiversity and providing ecosystem services.

Resilience in practice



- Can't impose single vocabulary
- Can be clear what we mean

Rest of talk:

- Will deal with 'resistance' and resilience

Resilience and accommodation



Resilience vs. Accommodation

Enable persistence

Accept change

- Two broad approaches to adaptation
- Not a hard and fast distinction
- Matter of perspective and attitude

Resilience and accommodation



Change in species → habitat resilience?

Resilience and accommodation: Porlock



Resilience of what? At what scale?

- Species populations
- Biological communities
- Ecosystems
 - Processes
 - Services
- Landscapes
- Geodiversity

Change in one attribute may confer resilience in another

Resilience in practice



- Need clarity on resilience of what?

Rest of talk:

- Biological communities and populations

Resilience or accommodation?



Changing approach as the climate changes

1°C > 2°C > 3°C > 4°C

resilience

accommodation

enable persistence -----> accept change



Still here - but see poster by Crick *et al.*

What promotes resilient populations and communities?



- Landscape scale heterogeneity
- Large patch size
- Landscape connectivity
- Species attributes
- Resilient Management

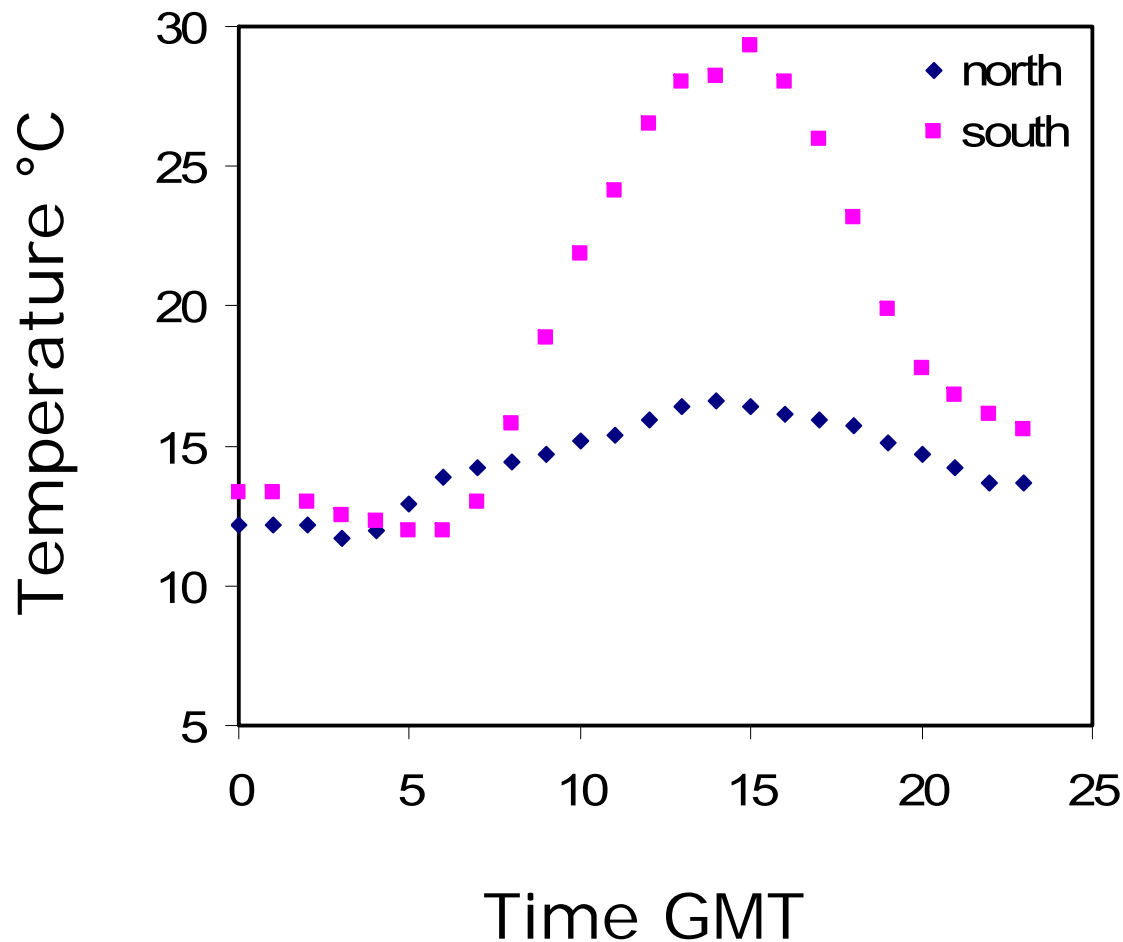
What promotes resilient populations and communities: **landscape heterogeneity**



- Microclimate variation with aspect, altitude
- Soil variation – wet and dry
- Structural complexity e.g. trees in grassland, different height swards

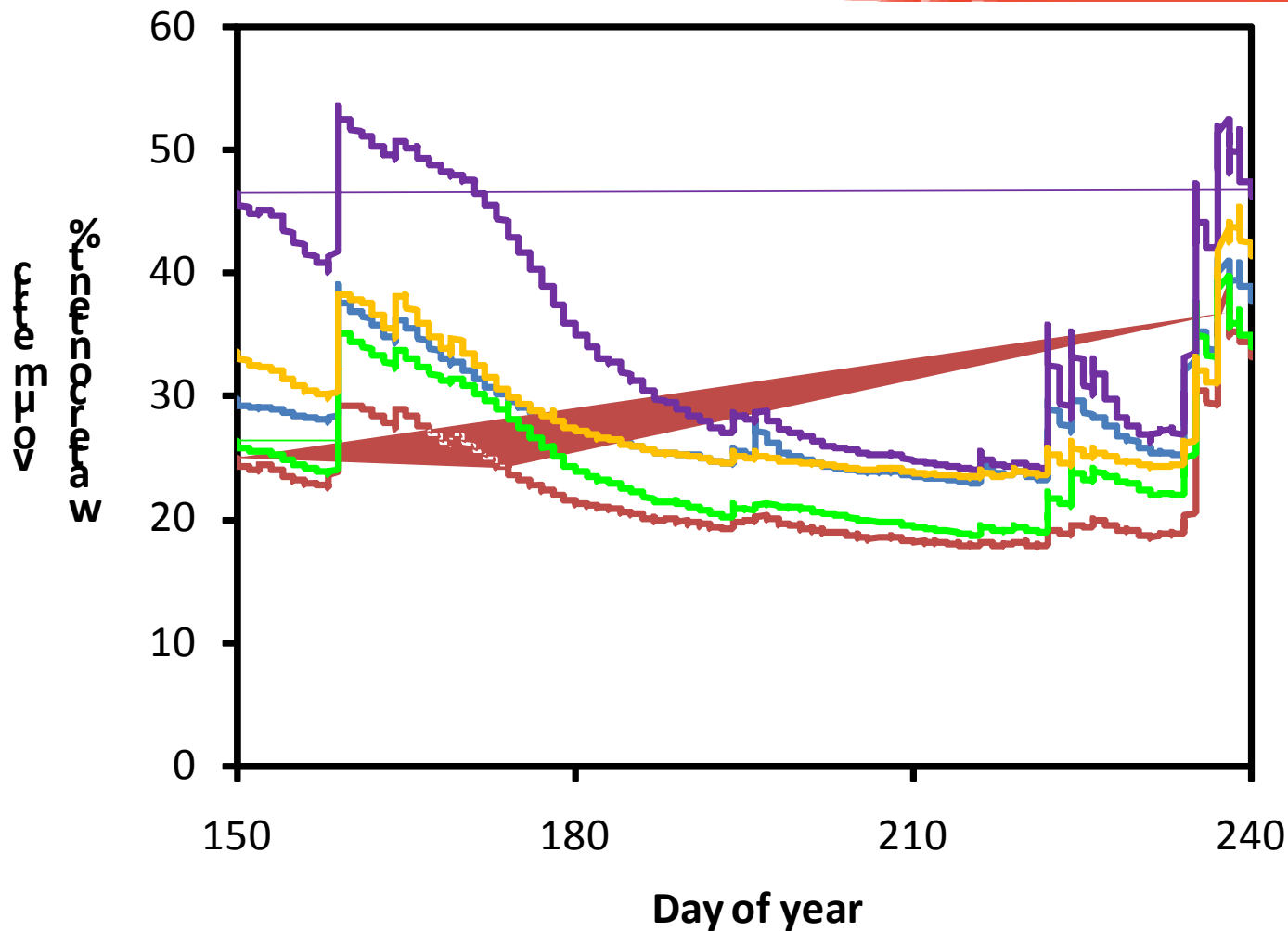
- NB Talk by Tom Oliver

Grass temperatures on sunny day; southern and northern aspects (Ben Lawers)



Mean N-S difference
Sunniest week: 4.3 °C
Overall : 0.7 °C

Soil water content at 5 locations within 100 m Summer 2010 (Wytham Woods)



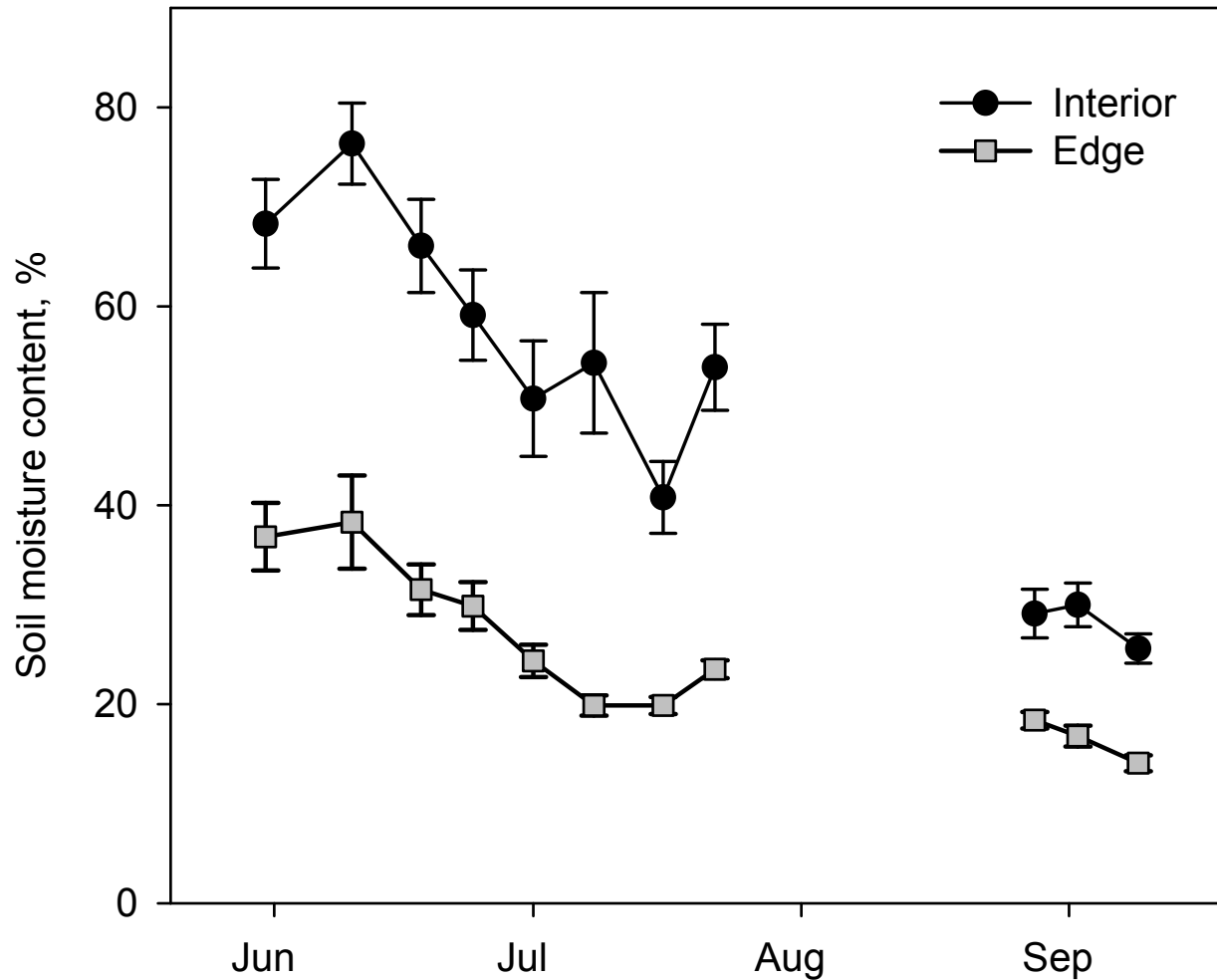
C. George (CEH) / M. Morecroft

What promotes resilient populations and communities: **Large patch size**



- Larger populations
 - more robust to extinction
 - increased propagule pressure
- Reduced edge effects

Soil water content at the woodland edge



What promotes resilient populations and communities: **connectivity**



- Higher connectivity facilitates dispersal (but n.b. interspecific differences)
- Enables metapopulation dynamics to function
- Increases chance of occupying new climate (or microclimate) space
- Allows recolonisation after local extinction

What promotes resilient populations and communities: **species attributes**



- **Intervention may not be possible but understanding should inform strategy**
- Mobile, high reproduction (r-selected)
 - dispersal, rapid recovery
- Longevity, stress tolerance (K-selected)
 - survive *in situ*
- Diversity (species and intraspecific)
 - autonomous adaptation
- From a site perspective: not at range margin

An example of potential for resistance to change



***Alchemilla alpina* (Alpine ladies mantle)**



Transplanted to 845m
(natural limit)



Transplanted to 480m
3°C warmer

Limited by climate - competition - soil interaction

What promotes resilient populations and communities: **Resilient management**



Appropriate management → good habitat

- Local skills and knowledge
- Accessible specialist expertise
- Flexibility to respond to events
- Willingness to consider change
- Resources
- Integration of conservation with other objectives

What promotes resilient populations and communities: **Resilient management**



What promotes resilient populations and communities?



- Landscape scale heterogeneity
- Large patch size
- Landscape connectivity
- Species attributes
- Resilient Management

Priority evidence needs:

- Empirical data especially beyond birds / butterflies
- Relative importance / cost / practicalities

Theory into practice: Natural England's approach



- Vulnerability assessment at multiple scales
- Embedding adaptation in all we do
- Developing the evidence base
- Partnership

- See posters!

Second week of December at Moor House NNR 1997 - 2010



An aerial photograph of a vast, snow-covered landscape under a cloudy sky. In the center, a small cluster of buildings is visible. The terrain is uneven with some tracks or paths in the snow. The overall color palette is dominated by blues and whites.

We need **resilience to a range of possibilities**
not plans for particular scenarios

Conclusions



- Resilience has different meanings: need clarity and specificity
- Good reason to believe we can enhance resilience
- Need more evidence on most effective measures
- Plan for uncertainty
- Will need to shift towards accommodating change as climate changes more

Acknowledgements



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