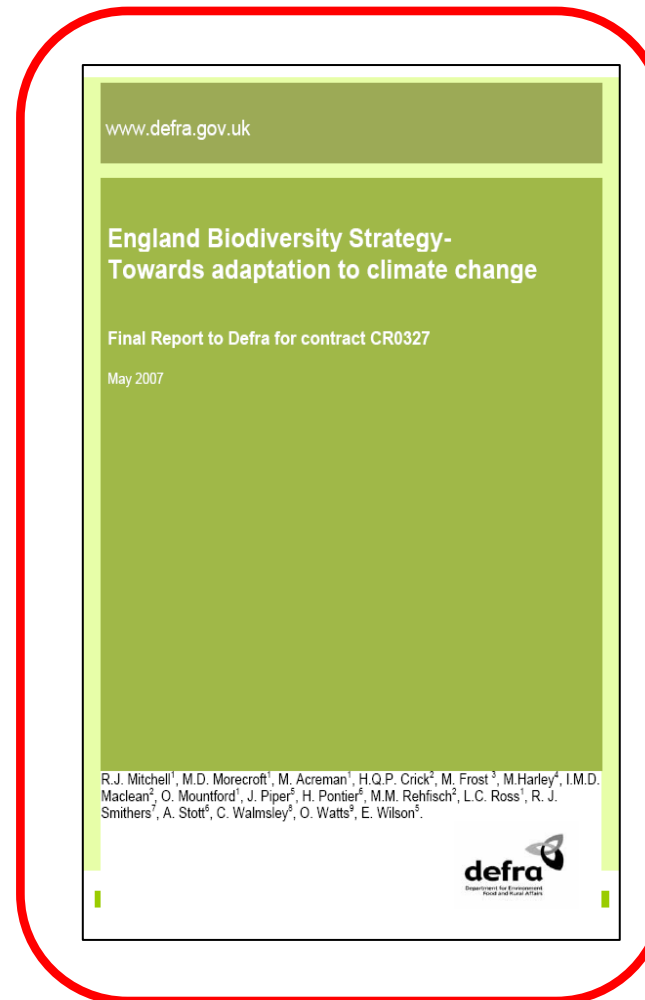
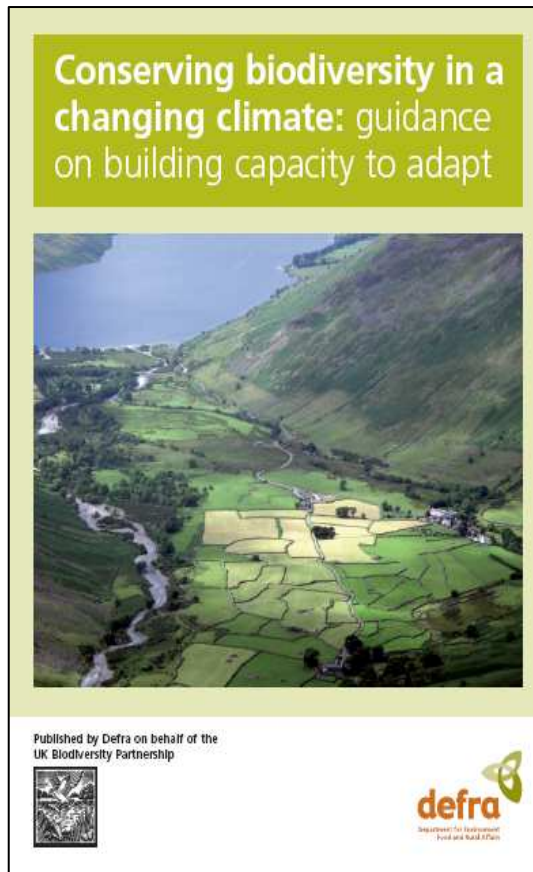




Adapting biodiversity conservation to climate change

Mike Morecroft
CEH Wallingford

Reports and Guidance 2007



+ various others

Practical considerations

- Accept uncertainty
(climate x ecology x interactions)
- Adaptive management – learning from experience
- No regrets
- Win-Wins



Mitchell *et al.*, 2007. *England Biodiversity Strategy: towards climate change adaptation*. Defra.

Principles for adaptation

- Reduce direct impacts
 - direct management response (e.g. Control invasive species)
- Reduce indirect impacts
 - Effects on biodiversity of other changes (e.g. new crops + many others)
 - Integrate mitigation and adaptation
- Increase resilience
 - Increase habitat area and heterogeneity
 - Enable ecosystem function
 - Reduce other pressures
- Accommodate change
 - Landscape permeability to facilitate dispersal

But will they work? Is there any evidence?

- Too early to test outcomes
- Can test processes and principles
- Some examples for plants



Mitchell *et al.*, 2007. *England Biodiversity Strategy towards climate change adaptation*

Principles for adaptation

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(1) Increase Resilience

Can species survive under a changed climate?

Are climatic limits influenced by other factors?

How important is microclimate?



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

A mountain plant with clear altitudinal and latitudinal limits



Transplanted to 845m
At natural limit

Limited by
climate - competition - soil interaction



Transplanted to 480m
3°C warmer
Doesn't occur naturally

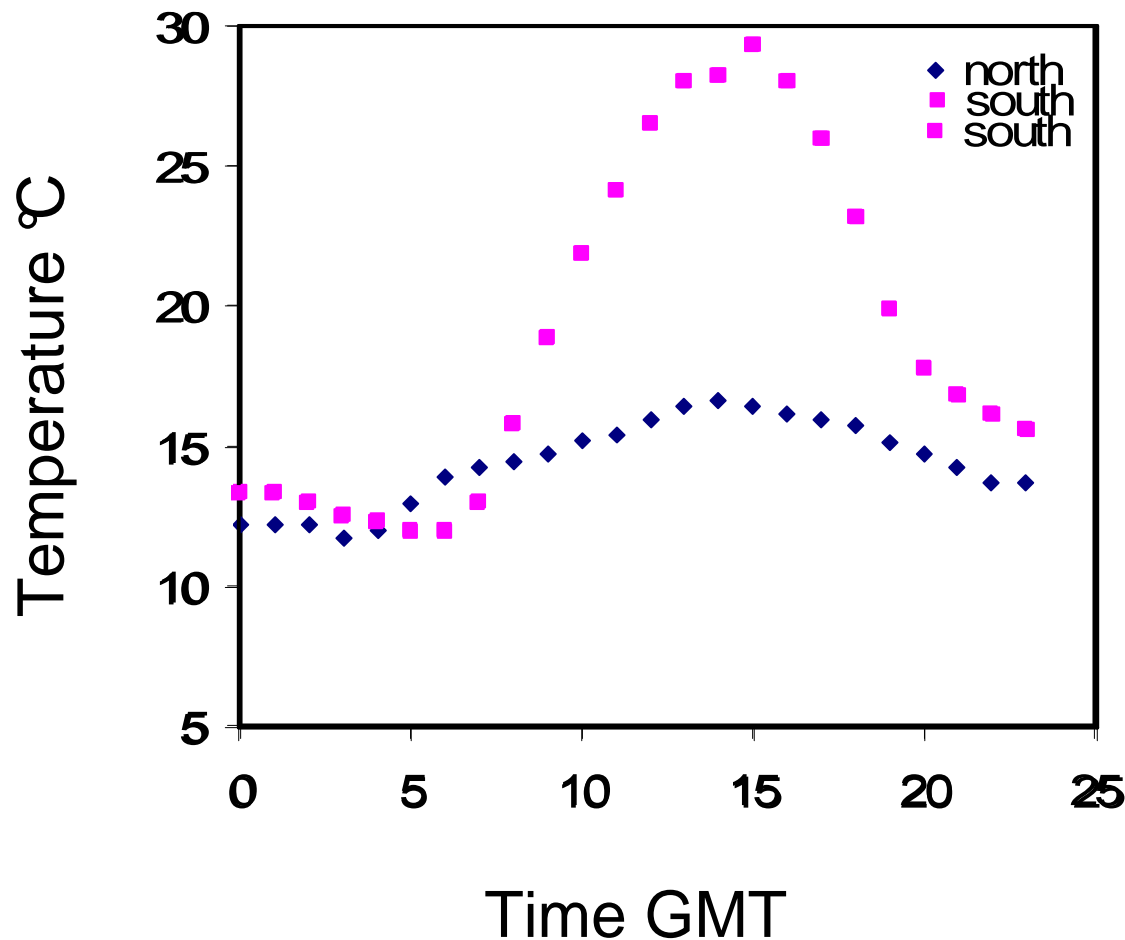


Microclimates on Ben Lawers

How much colder are plants on north facing slopes?

M. Trivedi (2007) PhD thesis

Ben Lawers: temperatures at 5mm under short grass on sunny day; southern aspect and northern

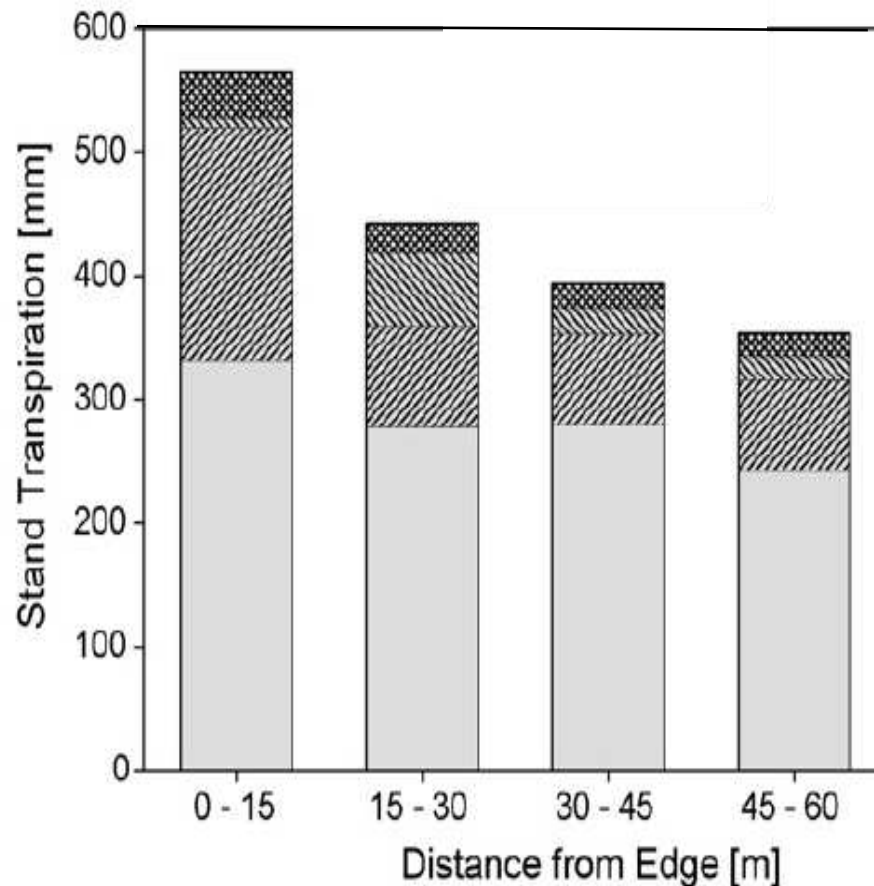


Mean N-S difference
Sunniest week: 4.3 °C
Overall : 0.7 °C

Woodland fragmentation & microclimate

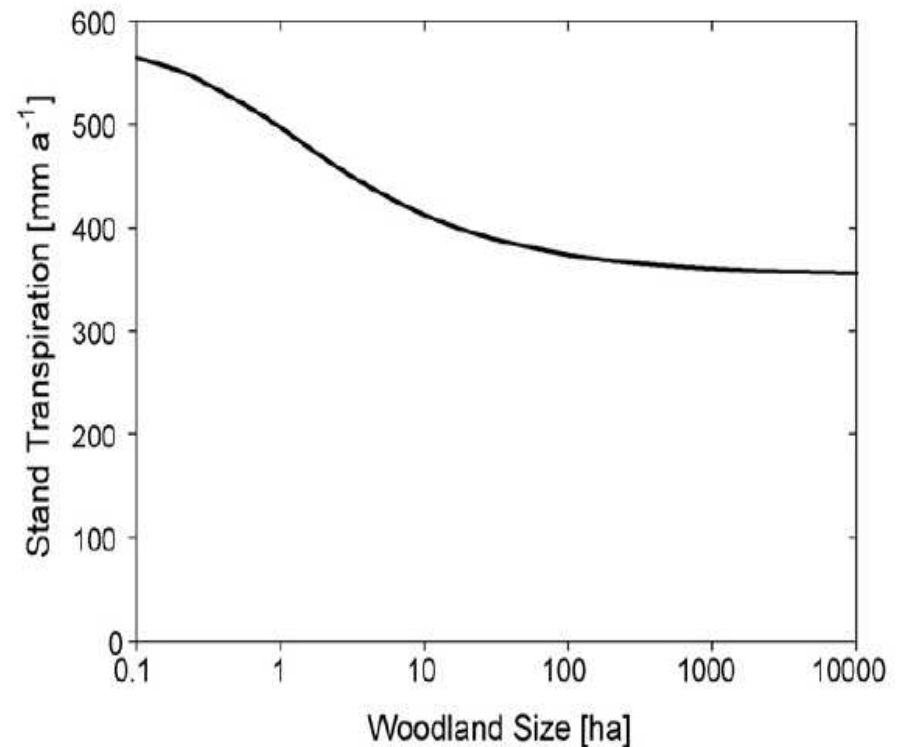


Water loss is higher at forest edges



Herbst *et al.*, (2007) *Forest Ecology and Management* 250: 176–186

- Small fragmented woodlands more prone to drought
- ⇒ Plant bigger woodlands?
- Also larger populations and buffer against pollution



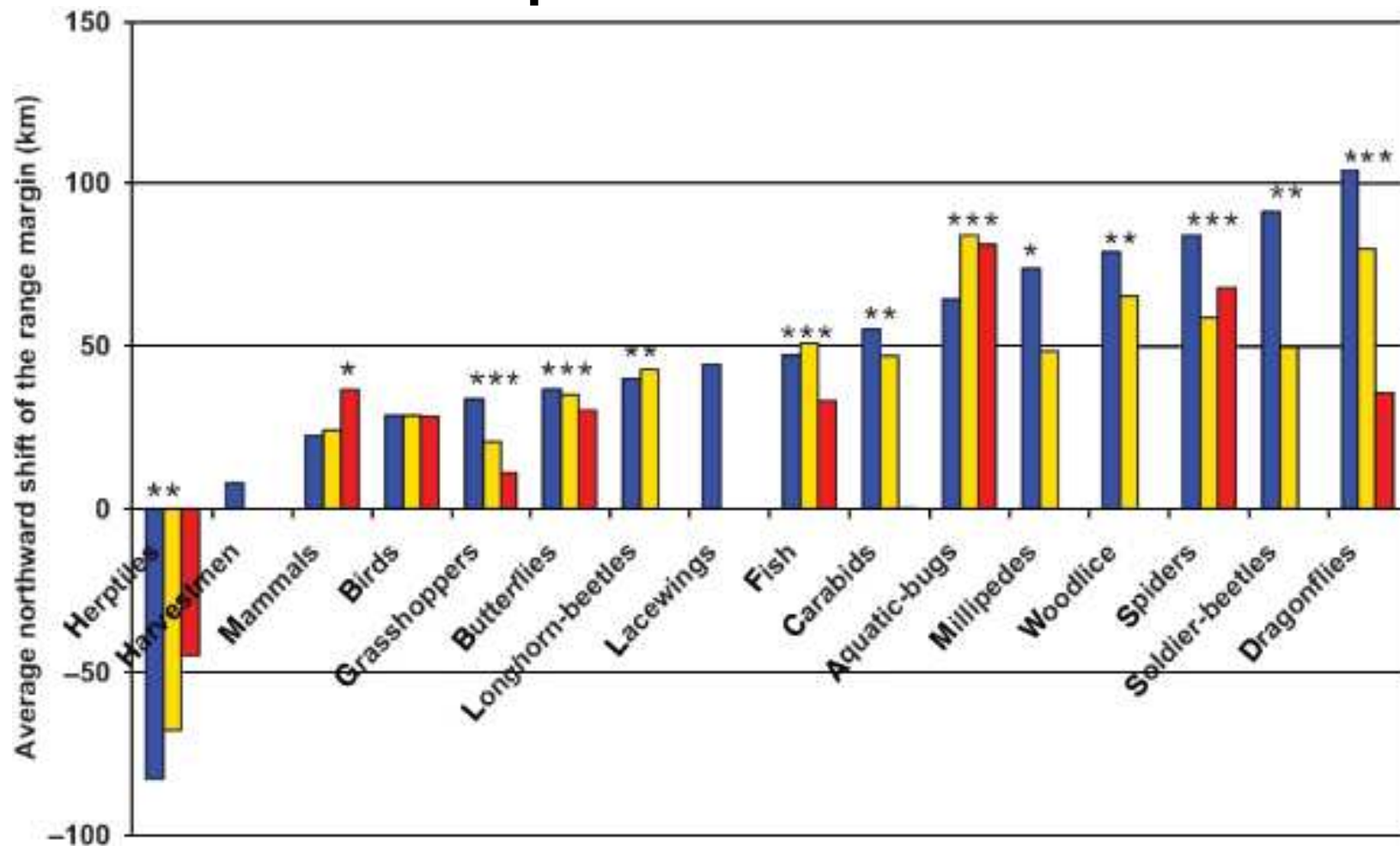
(1) Increase Resilience

- Can species survive in the same place under a changed climate?
- Yes - climate limits moderated by other factors
 - microclimate varies greatly
- But - complex interactions
 - Differences between species

(2) Accommodate change - Facilitate dispersal -

- Can species disperse?
- Can we create appropriate conditions?

Change in northern margin of species in UK



Hickling et al. (2006) *Global Change Biology*

But not everything is mobile...



(2) Accommodate change - Facilitate dispersal -

- Can species disperse?
- Can we create appropriate conditions?

- Yes and yes: some are dispersing already
- But not all

- Mobile animals vs. non-mobile plants
→ potential for dangerous mismatches?

Conclusions

- Don't give up on species and sites – increased resilience is a realistic aim
- But change is inevitable
- Interspecific differences:
 - mobile species → accommodation
 - non-mobile species → resilience
- Need a vision for healthy, biodiverse ecosystems not just historic species assemblages
- Need to develop the evidence base for decision making

Acknowledgements

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