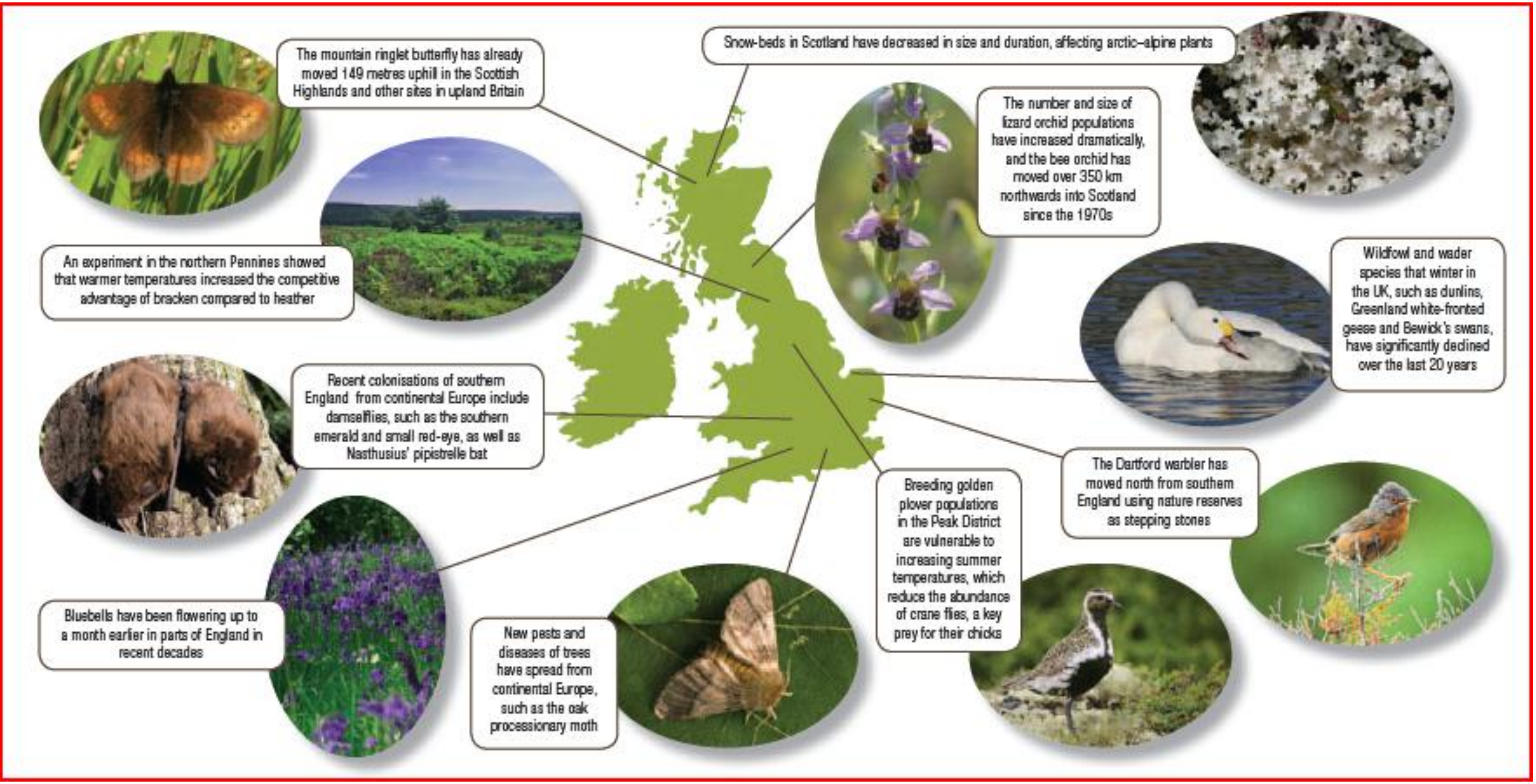
Integration of climate change adaptation : site and landscape responses

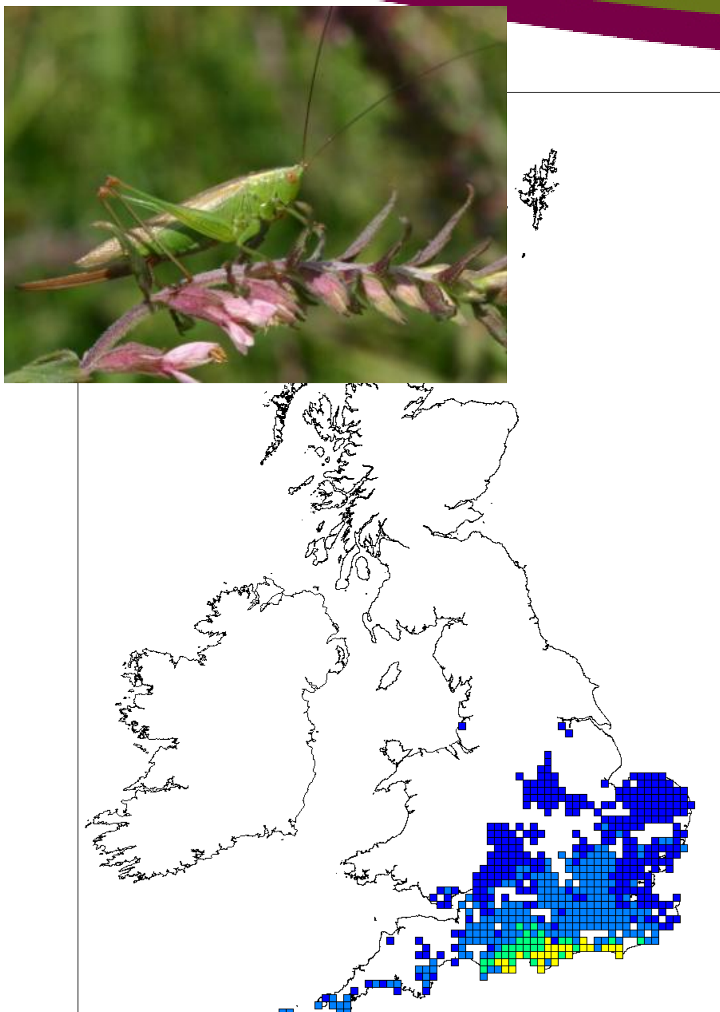
Simon Duffield
Natural England

Present more in detail the topics on which the Convention should work, explaining why it would be important to have it integrated in a new work plan, and highlighting both the added value of addressing such a topic and the implications/ challenges in terms of commitment by the Parties.

Climate Change - impacts

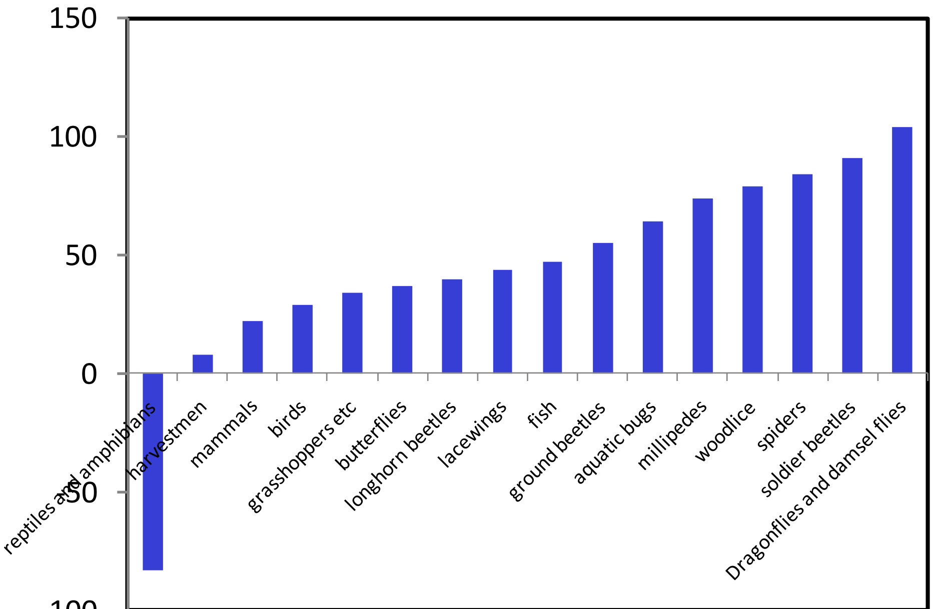


Species distributions are changing



Long-winged conehead
Conocephalus discolor

Shift north-wards (km)



Hickling et al. 2006

Many species are occurring further north and at higher altitudes

Mountain Ringlet

Moved 130 – 150m uphill

Scotch Argus

¾ extinctions due to attributed to climate change

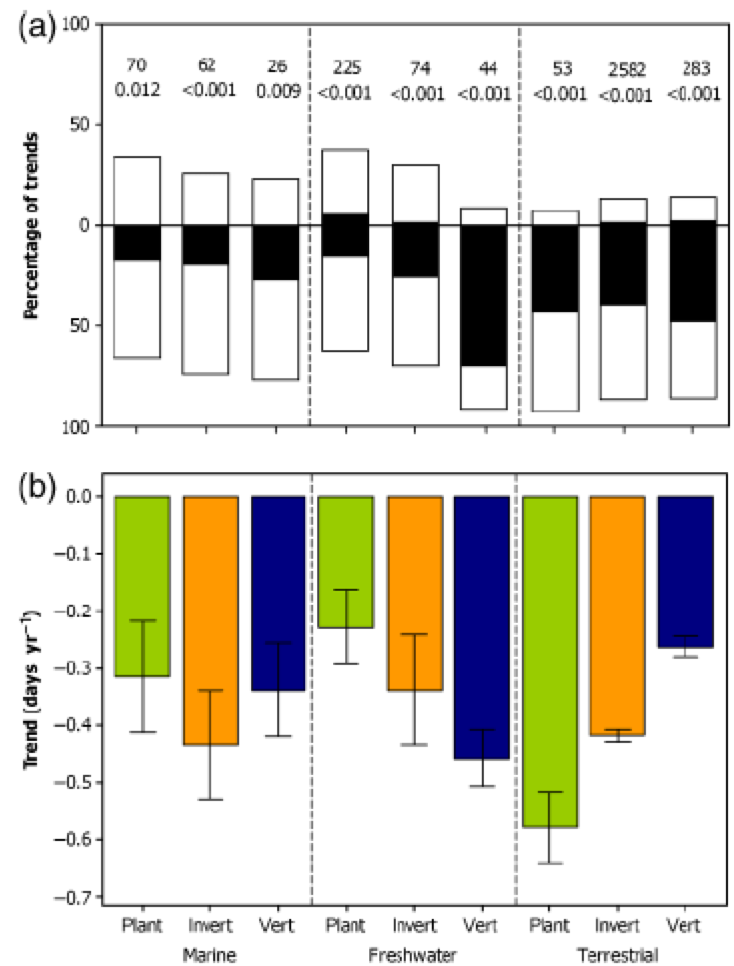
Franco et al. (2006) *Global Change Biology*

Seasonal timing (phenology) is changing

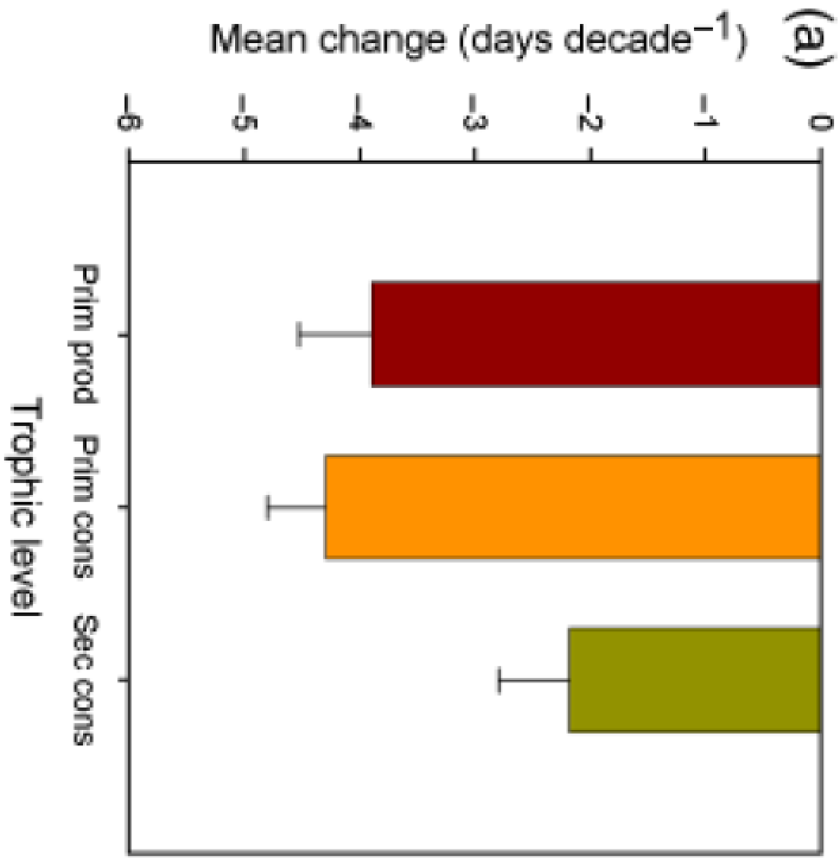
Spring is coming earlier

- Mean change 11.7 days (1976 – 2005)
- 725 taxa across different groups
- 83.8% of trends were advance

Thackeray et al. (2010)



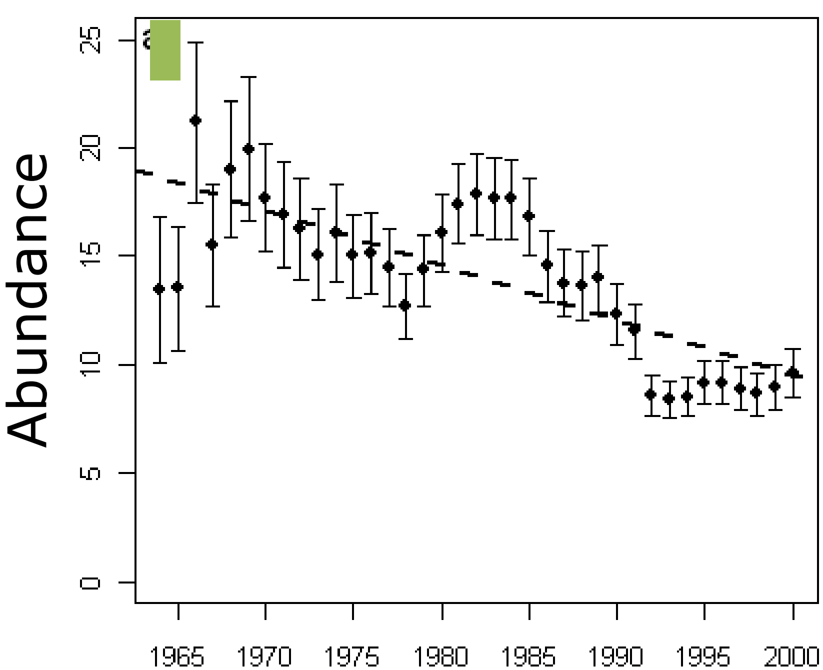
Community interactions are changing



Communities are changing

NATURAL ENGLAND

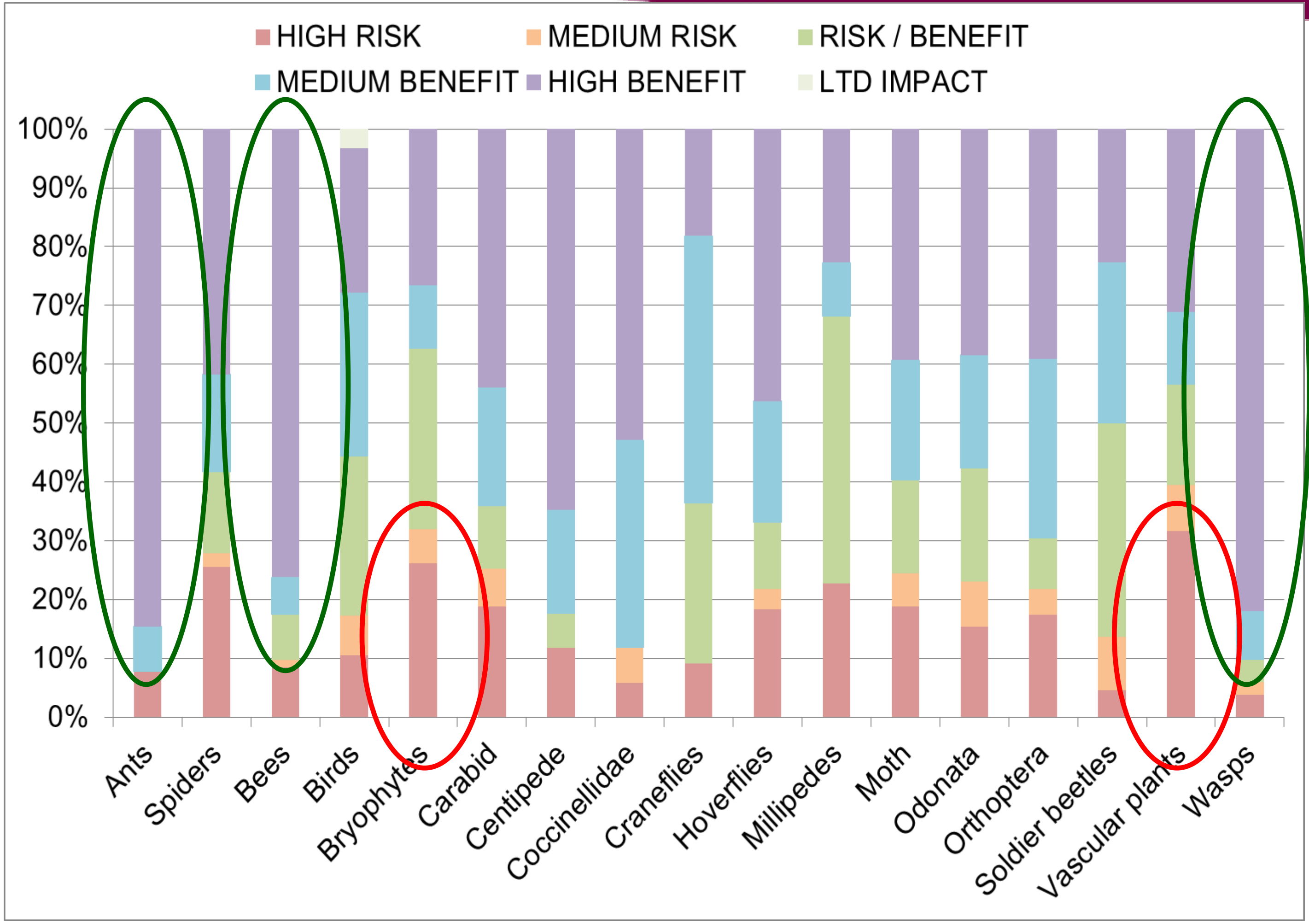
Cold adapted bird species have declined in the UK



Some habitats are particularly vulnerable to climate change

We expect there to be regional differences in the impact of climate change on biodiversity,

Climate change presents both risks & opportunities for species

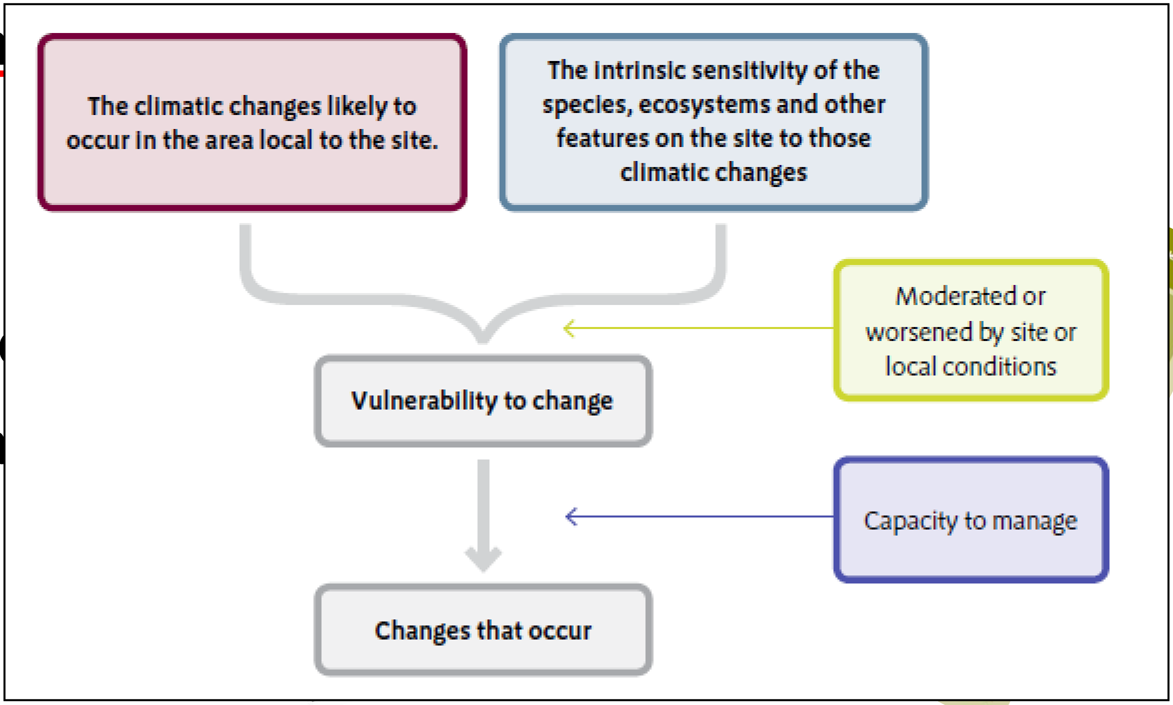


Adaptation for the natural environment

1 Increase connectivity
2 Integrate climate change into planning exercises
3 Mitigate other threats
4 Study response of species to climate change
Practice intensive management to secure populations
Translocate species
5 Increase number of reserves (sites)
6 Address scale problems match modeling,management and experimental scales for improved predictive capacity
Improve inter-agency, regional coordination
7 Increase and maintain basic monitoring programs
Practice adaptive management
Protect large areas, increase reserve size
8 Create and manage buffer zones around reserves
9 Create ecological reserve networks large reserves, connected by small reserves, stepping stones
Develop improved modeling and analysis capacity i.e. more effective software, integration with GIS, integrate greater complexity
Do integrated study of multiple global change drivers
Improve techniques for and do more restoration wetlands, rivers, matrix
Increase interdisciplinary collaboration
Promote conservation policies that engage local users and promote healthy human communities
Protect full range of bioclimatic variation
Soften landuse practices in the matrix
10 Adopt long-term and regional perspective in planning, modeling, and management
Re-assess conservation goals (i.e. Move away from concepts of natural, embrace processes over patterns
Study species dispersal across landuse boundaries, gene flow, migration rates, historic flux
Study species distributions current and historic
11 Broaden genetic and species diversity in restoration and forestry
Develop adaptation strategies now; early adaptation is encouraged
Do not implement CO2 emission mitigation projects that negatively impact biodiversity
Manage for flexibility, use of portfolio of approaches, maintain options
Validate model results with empirical data
12 Do regional impact assessments
Identify indicator species
Initiate long-term studies of species responses to climate
Model species ranges in the future
Protect refugia current and predicted future
Study adaptive genetic variation
13 Leadership by those with power senior management, government agencies
Limit CO2 emissions
Predict effects of directional climate change on ecosystems, communities, populations
Preserve genetic diversity in populations
Represent each species in more than one reserve
14 Create culturally appropriate adaptation/management options
Create education programs for public about landuse practices and effects on and with climate
Develop best management practices for climate change scenarios
Institute flexible zoning around reserves
Increase investment in climate related research
Increase communication of knowledge about climate change impacts to policymakers and stakeholders
Initiate dialogue among stakeholders
Institute government reform (i.e. adaptive governance)
Locate reserves in areas of high heterogeneity, endemism
Maintain natural disturbance dynamics of ecosystems
Practice proactive management of habitat to mitigate warming
Secure boundaries of existing preserves
Start strategic zoning of landuse to minimize climate related impacts
Study and monitor ecotones and gradients
Study effectiveness of corridors
Use predictive models to make decisions on where to situate new reserves
15 Anticipate surprises and threshold effects i.e. major extinctions or invasions
Design biological preserves for complex changes in time, not just directional change
Locate reserves at northern boundary of species' ranges
Manage the matrix
Practice proactive research on climate change
Protect many small reserves rather than single large one
Provide education opportunities and summaries of primary literature for staff to learn and network about climate chang
Study and protect metapopulations
Study processes of change at multiple spatial and temporal scales
Use GIS to study species distributions and landscape patterns
16 Action plans must be time-bound and measurable
Adjust park boundaries to capture anticipated movement of critical habitats
Create institutional flexibility
Create linear reserves oriented longitudinally
Establish cross-national collaboration
Establish neo-native forest plant species where they were in the past, but are not found currently
Experiment with refugia
Focus protection on sensitive biomes
Focus on annual plants rather than perennials near climate boundaries
Increase wetland protection
Institutional capacity enhancement to address climate change
Institute reform to improve support for interdisciplinary, multiinstitutional research
Locate reserves so major vegetation transitions are in core
Locate reserves at core of ranges
Manage for landscape asynchrony
Manage human-wildlife conflict as change occurs
Manage populations to reduce temporal fluctuations in population sizes
Develop guidelines for climate sensitive restoration and infrastructure development
Need to increase social acceptance of shared resilience goals
Promote personal action plans among employees to reduce emissions
Protect endangered species ex situ
Protect functional groups and keystone species
Protect mountains
Protect primary forests
Protect urban green space
Quantify environmental susceptibility versus adaptive capacity to inform conservation planning
Schedule dam releases to protect stream temperatures
Study changes in populations at rear of range rather than only range fronts
Study response of undisturbed areas to climate change
Study social agency and human decision making
Study time-series data on species dynamics
Substitute space for time to study the responses of species to climate change
Train more taxonomists
Use caution in predictive modeling because the responses of some species are not well predicted

Adaptation for the natural environment

- Take practical action now
- **Maintain and increase ecological resilience**
- **Accommodate cha**
- Integrate action ac partners and secto
- Develop knowledge and plan strategica



What we know

NATURAL ENGLAND


COUNCIL OF EUROPE CONSEIL DE L'EUROPE

T-PVS/PA (2013) 07

Strasbourg, 23 August 2013
[pa07e_2013.doc]

CONVENTION ON THE CONSERVATION OF EUROPEAN WILDLIFE
AND NATURAL HABITATS

**Group of Experts on
Protected Areas and Ecological Networks**

5th meeting
18-19 September 2013
Council of Europe, Strasbourg, France

**DRAFT GUIDELINES ON THE MANAGEMENT
OF EMERALD SITES,
INCLUDING CLIMATE CHANGE
ADAPTATION AND MITIGATION**

SECOND DRAFT

*Document established
by the Directorate for Democratic Governance,
Lyudmila Dimitrova (Eko-Innovation)
and Dobromira Dimova (Vitosha Nature Park)*

*This document will not be distributed at the meeting. Please bring this copy.
Ce document ne sera plus distribué en réunion. Prière de vous munir de cet exemplaire*


European Commission

Technical Report - 2013 - 068

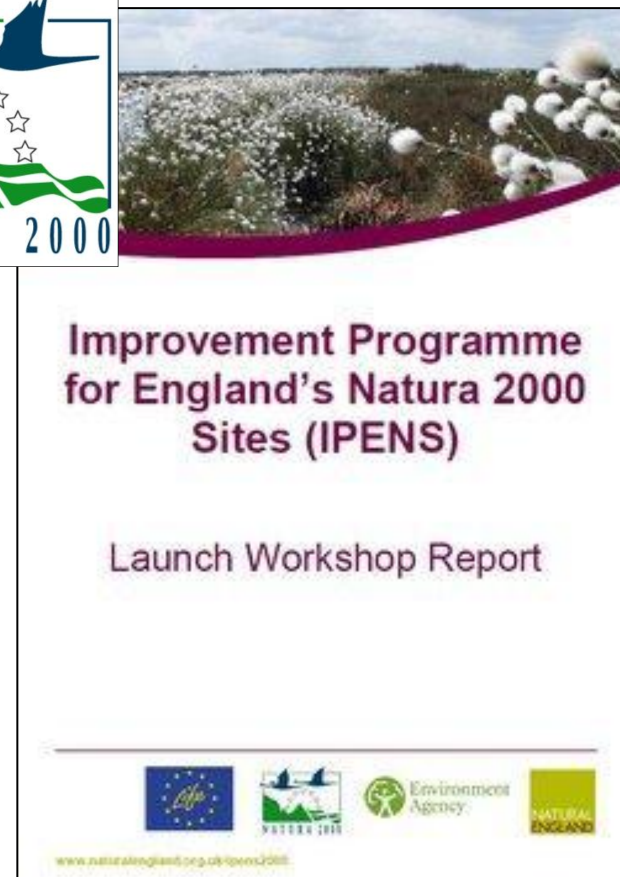
Guidelines on Climate Change and Natura 2000

Dealing with the impact of climate change
On the management of the Natura 2000 Network of areas of high biodiversity value

Approaches to assessing and responding to climate change

National Nature Reserves

1. Projected Climate Change
2. Impacts
3. Vulnerability Assessment
4. Responses



Improvement Programme for England's Natura 2000 Sites (IPENS)

Launch Workshop Report

Qualitative adaptation assessment

- Eight step adaptation assessment process
- Stakeholder workshop
- Four guiding / reporting tables
- Summary report structure

2°C and 4°C worlds as baselines

- Frames future climate in plain language
- Release from projected emissions scenarios, links to real world change
- Links to the climate mitigation world
- 2°C - practical planning
- 4°C - long term outlook, mitigation messages

Wild
Purbeck
NATURE IMPROVEMENT AREA

Conservation management of Purbeck's heathlands in the face of climate change

Dartford warbler, UK is likely to become more globally important for this species under climate change scenarios. Ben Hall (rspb-images.com).

A RICH HABITAT

Lowland Heathland is an extremely valuable and rare habitat, making the Dorset heathlands one of UK's most important wildlife areas – with much of it designated as Special Protection Areas or Special Areas of Conservation under European law. The total Heathland extent in Purbeck is around 3,607ha (7.84% of the NIA) of which around 1,365ha is wet Heathland. Within the Heathland complex there are important concentrations of other priority habitats including mires and fens, acid grassland, wood pasture and wet woodland. Valley mires are particularly well represented (around 325ha) and together with the New forest support the vast majority of remaining European habitat. Over the last 250 years 85% has been converted to agriculture, forestry or urban development but intensive conservation investment in the past 30 years has improved the status and quality of that which remains. A range of pressures continue to constrain the survival and future management of lowland Heathland areas including climate change and the impacts of this and other factors may not be readily separable.

LOWLAND HEATHLANDS – FIVE TOP 'NO REGRETS' ACTIONS

#1

Ensure that responding to climate change is well integrated into site management plans with the emphasis on monitoring change and flexible response

#2

Bigger sites are more robust – seek to attain larger sites, in the best possible condition and restored and linked up wherever possible

#3

Wet heaths are most vulnerable to changes in water availability – focus on reducing water loss and having the ability to respond to drought events

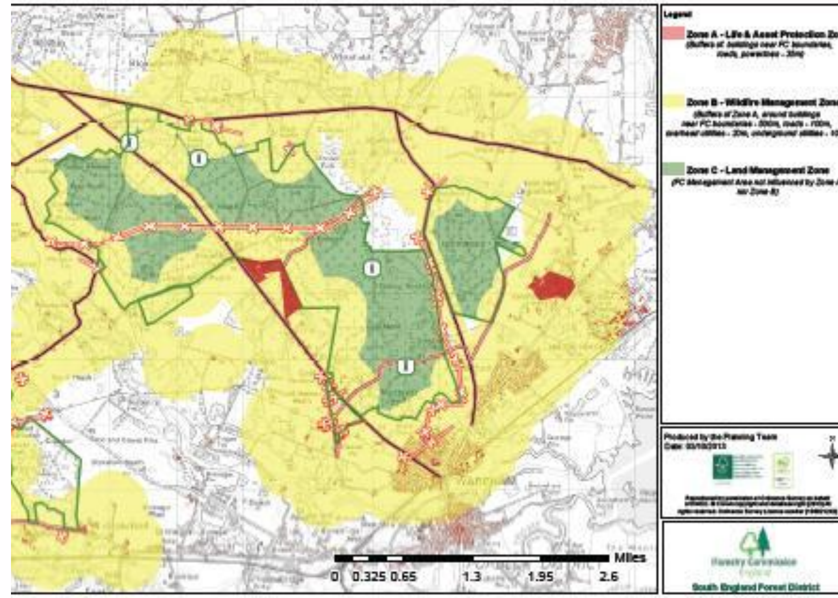
#4

Ensure good up to date fire management plans are in place which take a landscape scale approach

#5

Build public support for any changes that you need to make and engage people in monitoring the impact of and response to climate change

Wild
eck
EMENT AREA



fire management map from Wareham Forest. Forestry Commission.

Fire Management Zone

UDY

isk of wildfire caused ge as well as increased esents a threat to the NIA reas with fire susceptible heather, gorse and young e the Forestry Commission isk assessments for heathlands and defined ement Zones along with a management techniques, focusing on tree species selection and adaptive management. The lessons learnt from areas like Wareham Forest were then shared with the NIA partners, via the Wildfire Working Group, so that wildfire resilience could be established at the landscape level. Our work in Wild Purbeck, has led to the development of national guidance.

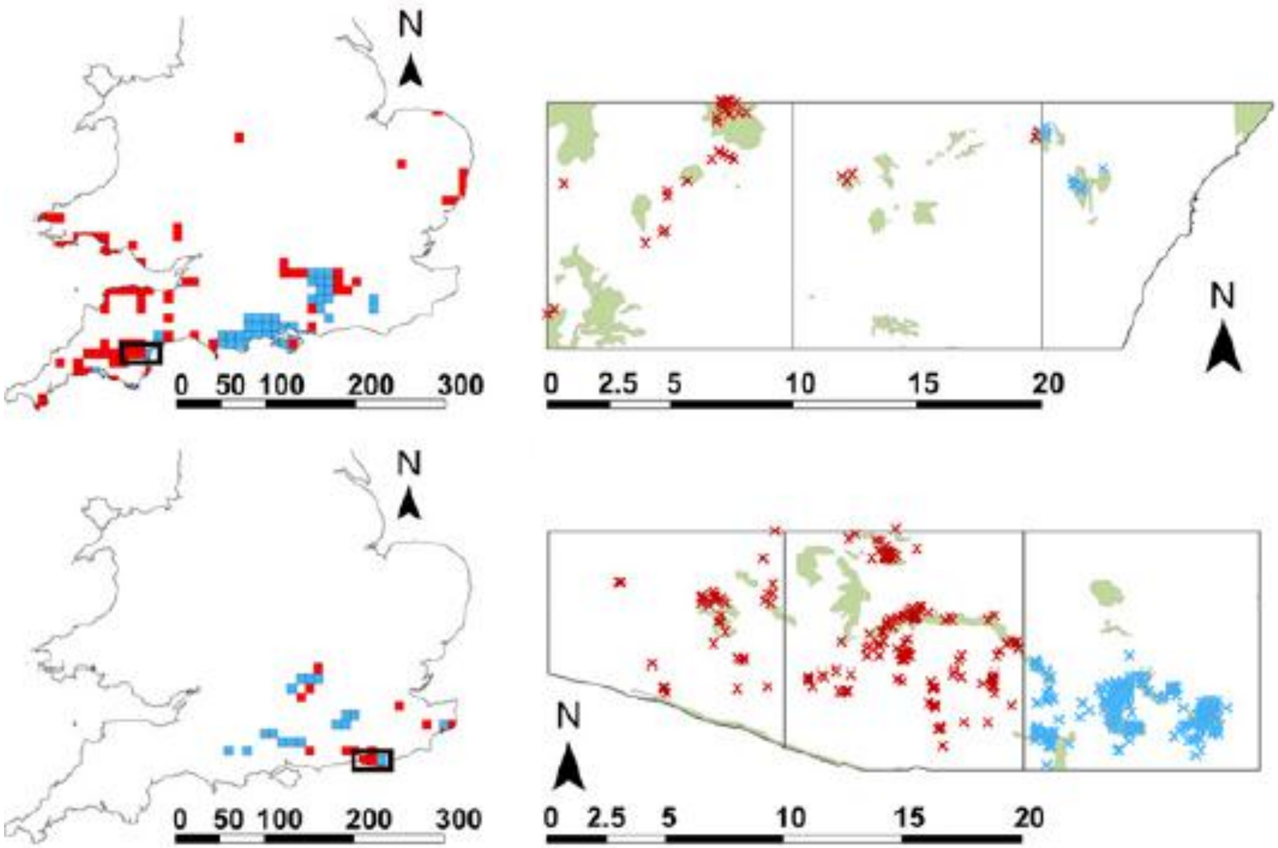
Heathlands are the most important UK habitat for reptiles, such as the rare smooth snake. Fred Holmes.

Proposals for new work programme

- What does implementation best practice look like?

Protected Sites & climate change

Leading edge



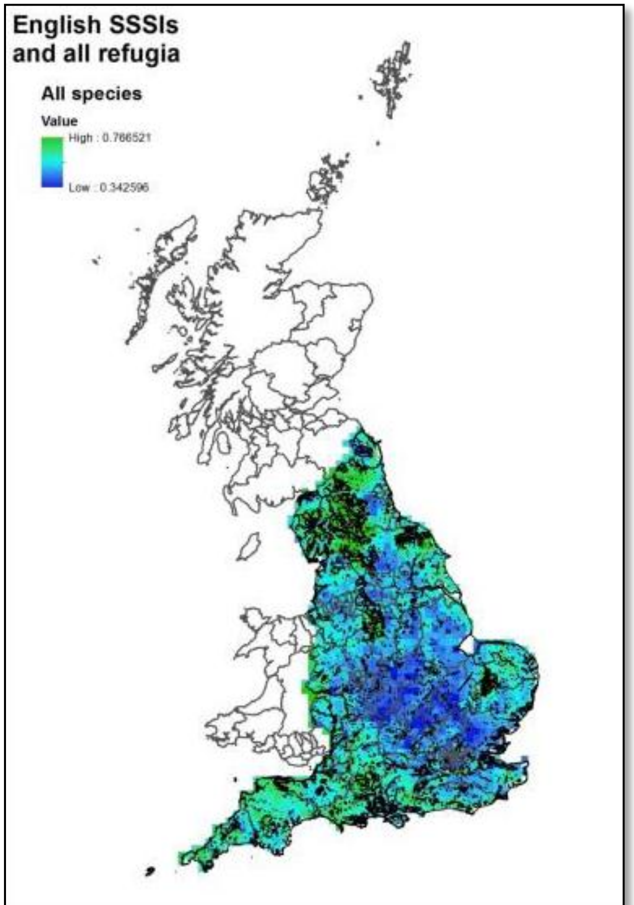
Thomas et al 2012

Species are preferentially colonising protected areas

Protected Sites & climate change

NATURAL ENGLAND

Trailing edge



Suggitt et al. 2014

Species group		Proportion SSSI
All species	Slope	+
	P value	0.0525
Higher plants	Slope	-
	P value	0.0622
Lower plants	Slope	+
	P value	0.0303
Beetles	Slope	+
	P value	0.3857
Butterflies and moths	Slope	+
	P value	<0.0005
Other insects	Slope	+
	P value	0.0011
Other arthropods	Slope	+
	P value	0.0144

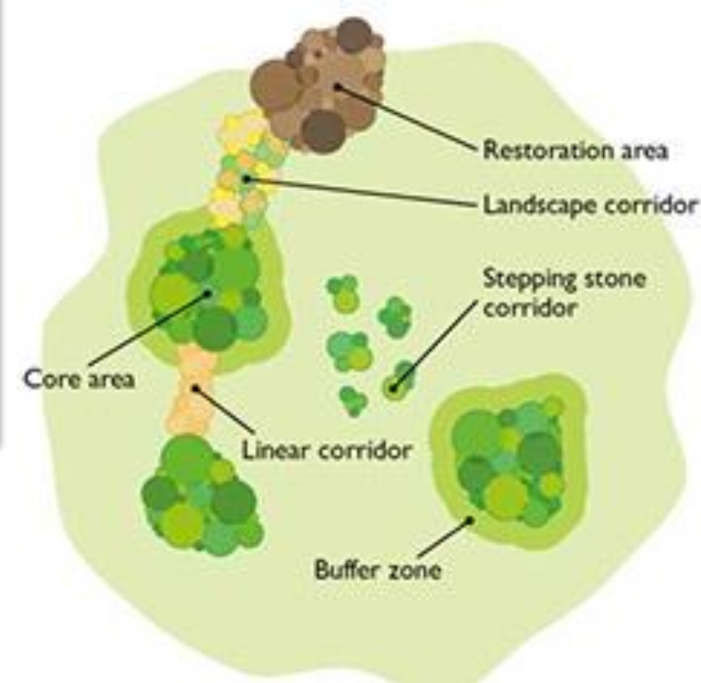
Long term persistence is greatest in protected areas.

Coherent Ecological Networks

NATURAL ENGLAND

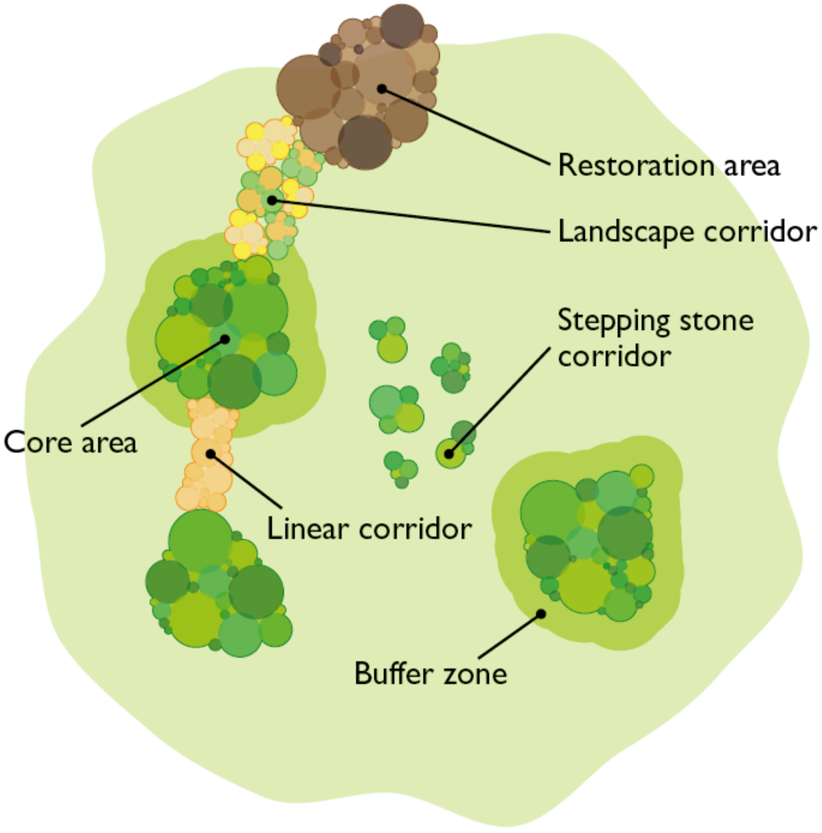
- Many sites too small
- Historic habitat loss means many species destined to decline
- Natural processes lost
- Many sites not adequately protected.

2010 International Year of Biodiversity



Adaptation – building resilience

2. Increase size of existing patches (bigger)
1. Restore habitats (better)
3. Create new habitat patches (more)
4. Link existing patches (joined), through corridors, stepping stones, improving the matrix.



Lawton et al. 2010

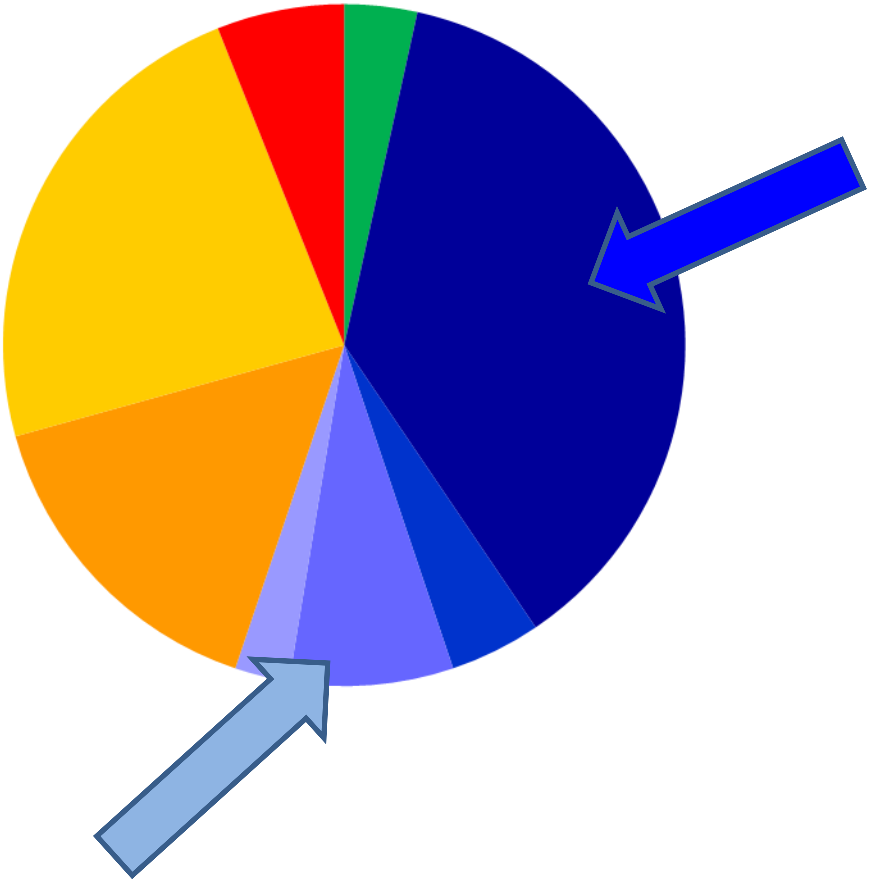
NNR - Responses

- Refugia

Resilience

- Mitigating other pressures (RP)
- Improving connectivity (RC)
- Increasing the number of sites (RCr)
- Improving the matrix (RM)

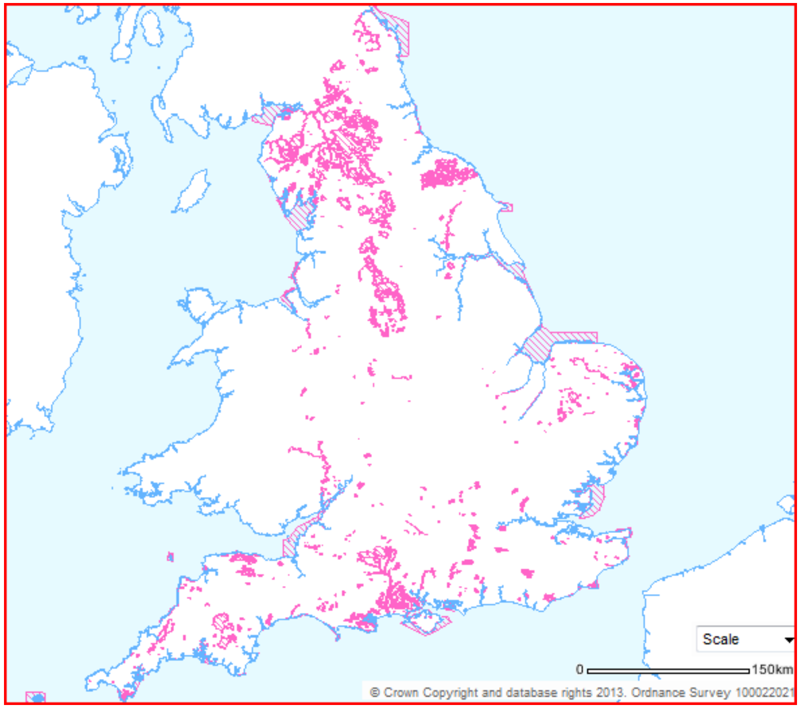
- Accomodating Change (AC)
- Flexible adaptive management (AM)
- Developing the evidence (EV)

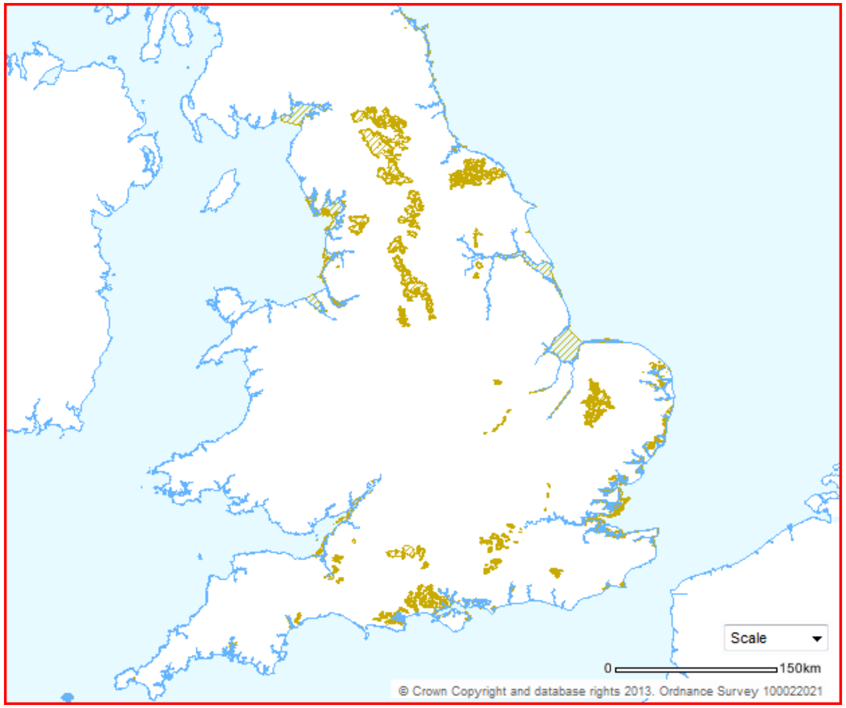


The matrix

- 250 SACs
- 1,276,110 ha

- 85 SPAs
- 1,305,159 ha

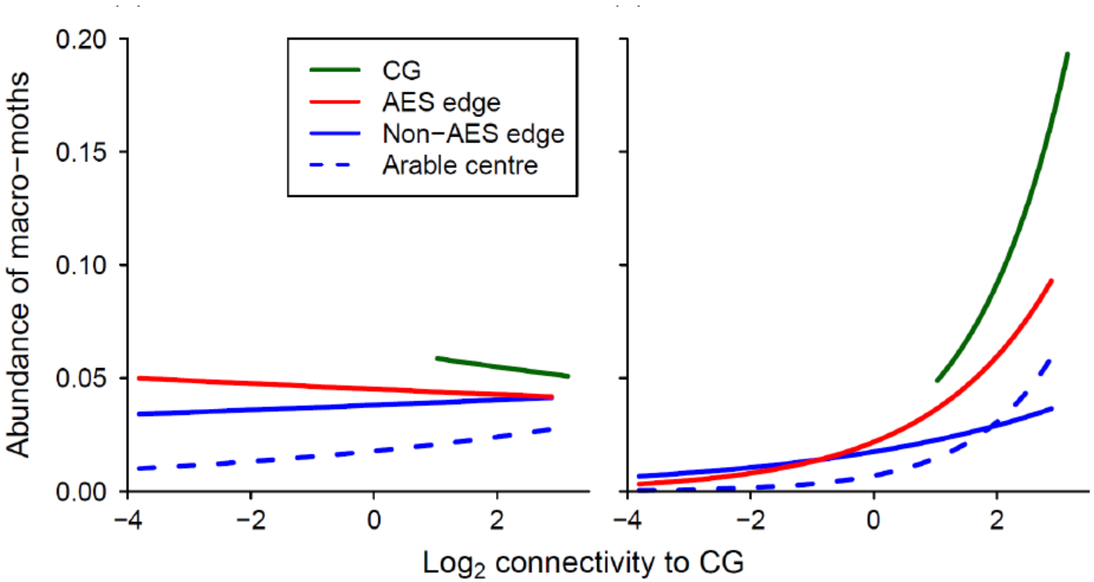


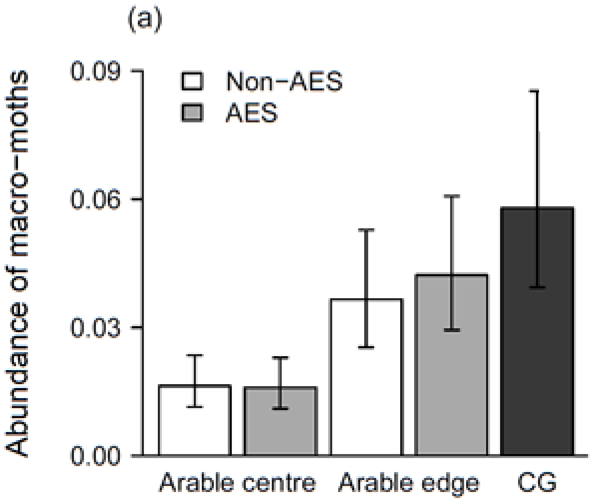


Softening the matrix



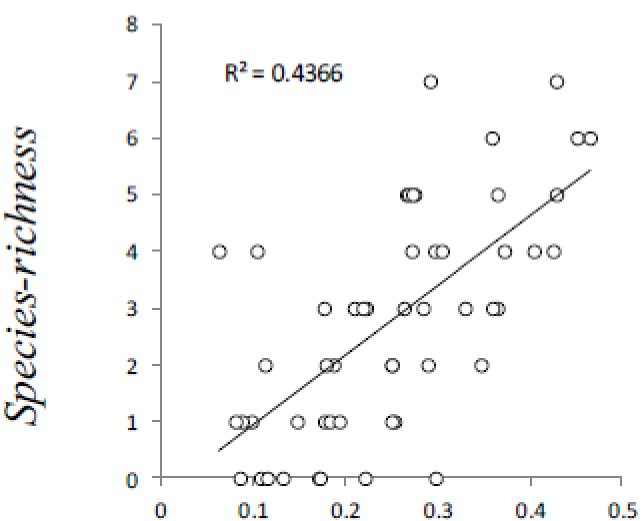

Softening the matrix



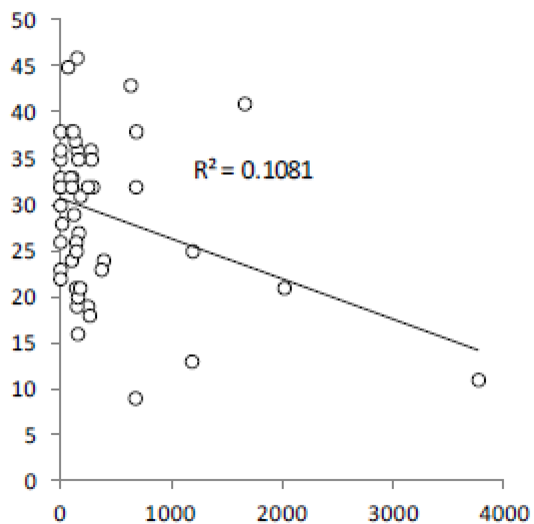


Alison et al. 2015

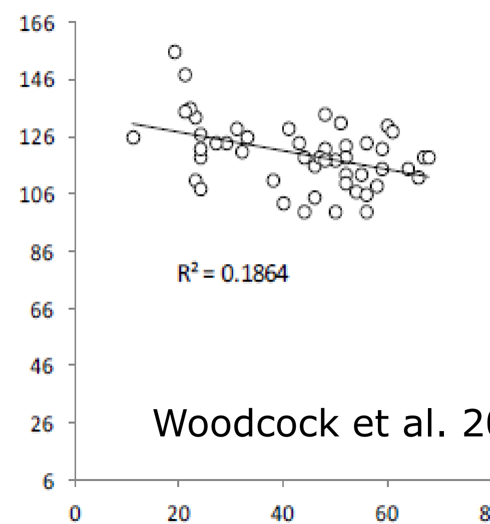
Softening the matrix



Similarity of sward to target grassland



Distance (m) from calcareous grassland



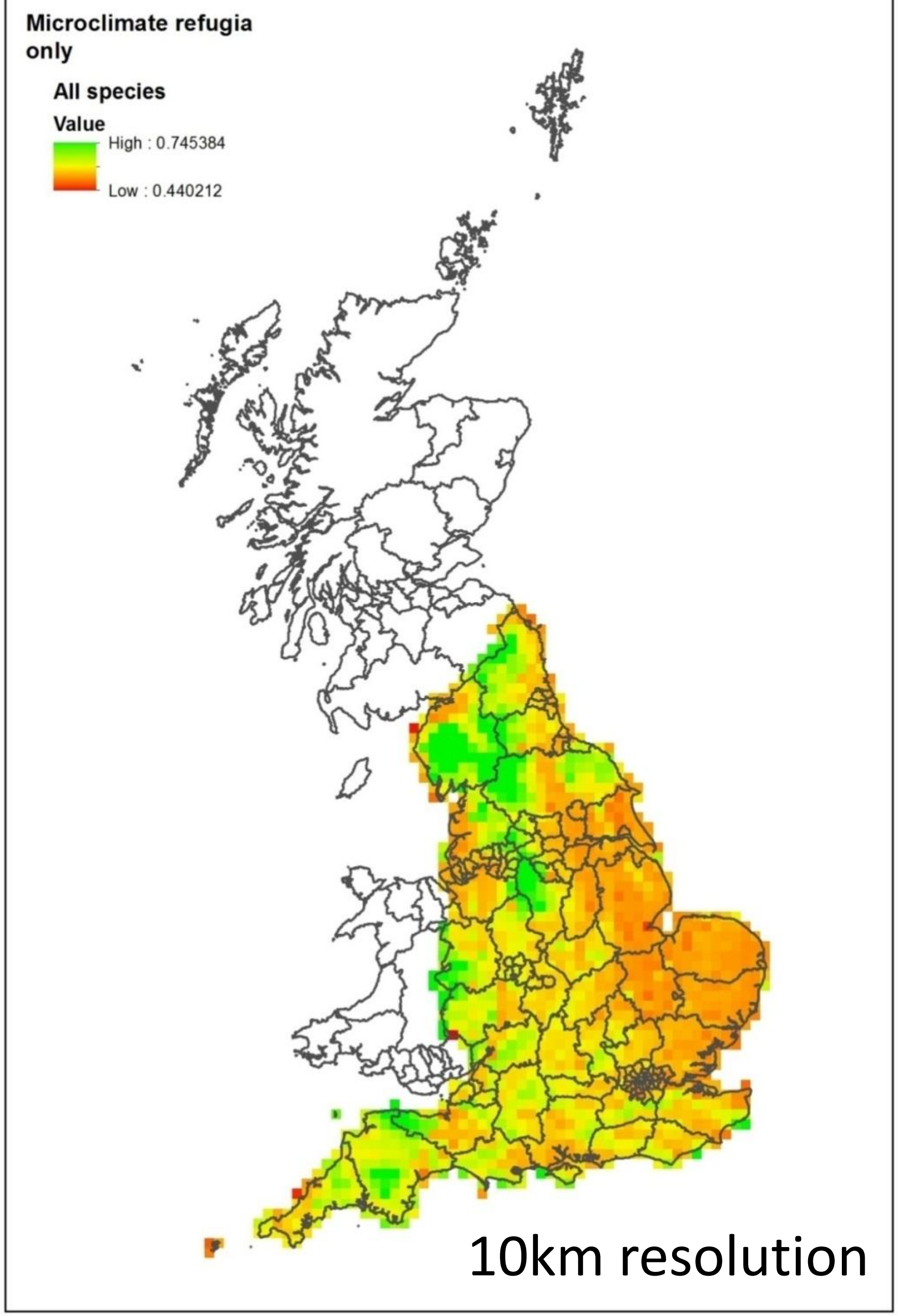
Woodcock et al. 2015

% Arable cover in landscape

The importance of location

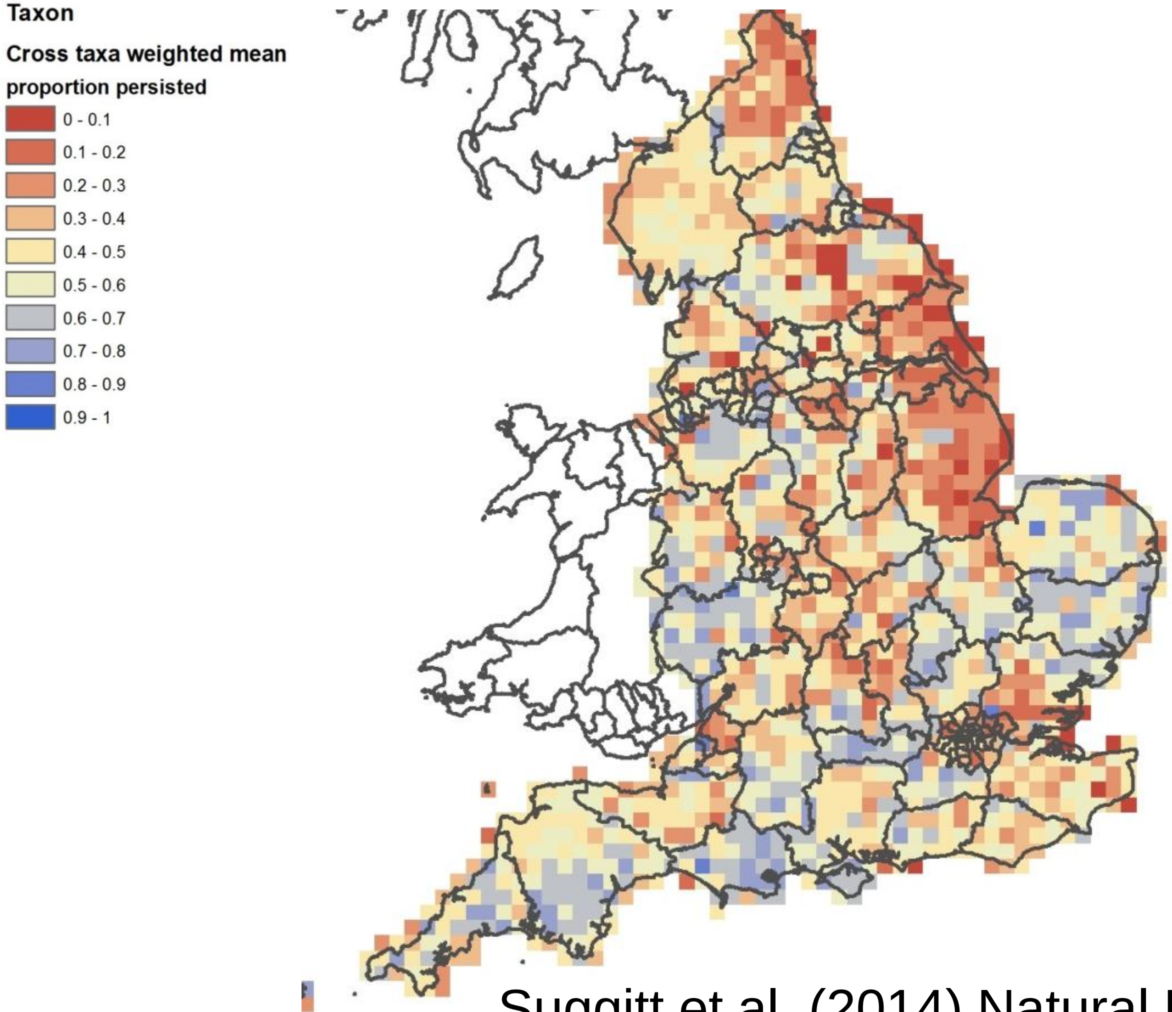
High refugium potential

Low refugium potential



Suggitt et al. (2014)

The importance of location

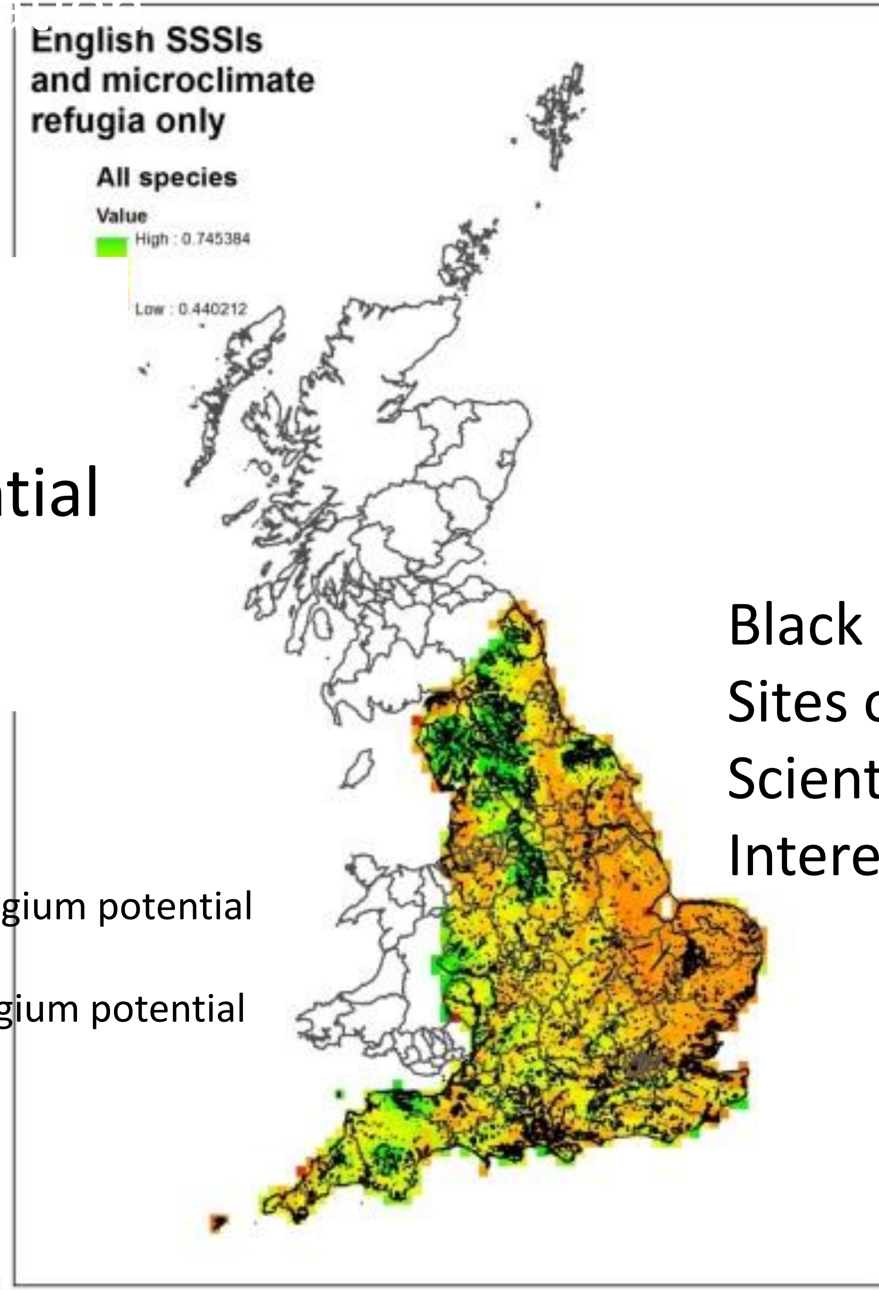


Proportion of species persisting in 10km squares

Suggitt et al. (2014) Natural England Report NECR162

The importance of location

Existing protected areas cover areas of high refugium potential quite well



High refugium potential

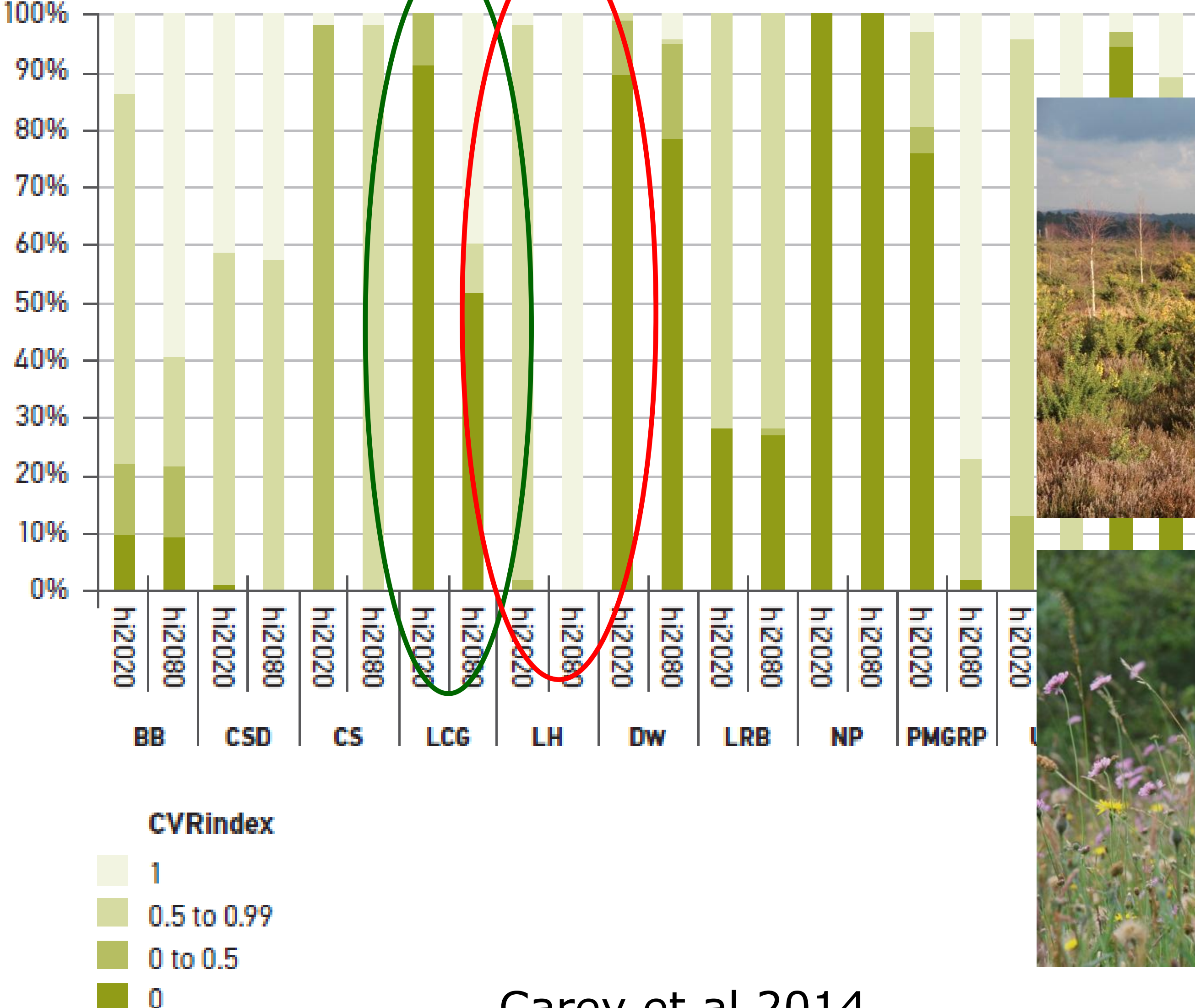
Low refugium potential

Black dots are Sites of Special Scientific Interest

NATURAL ENGLAND

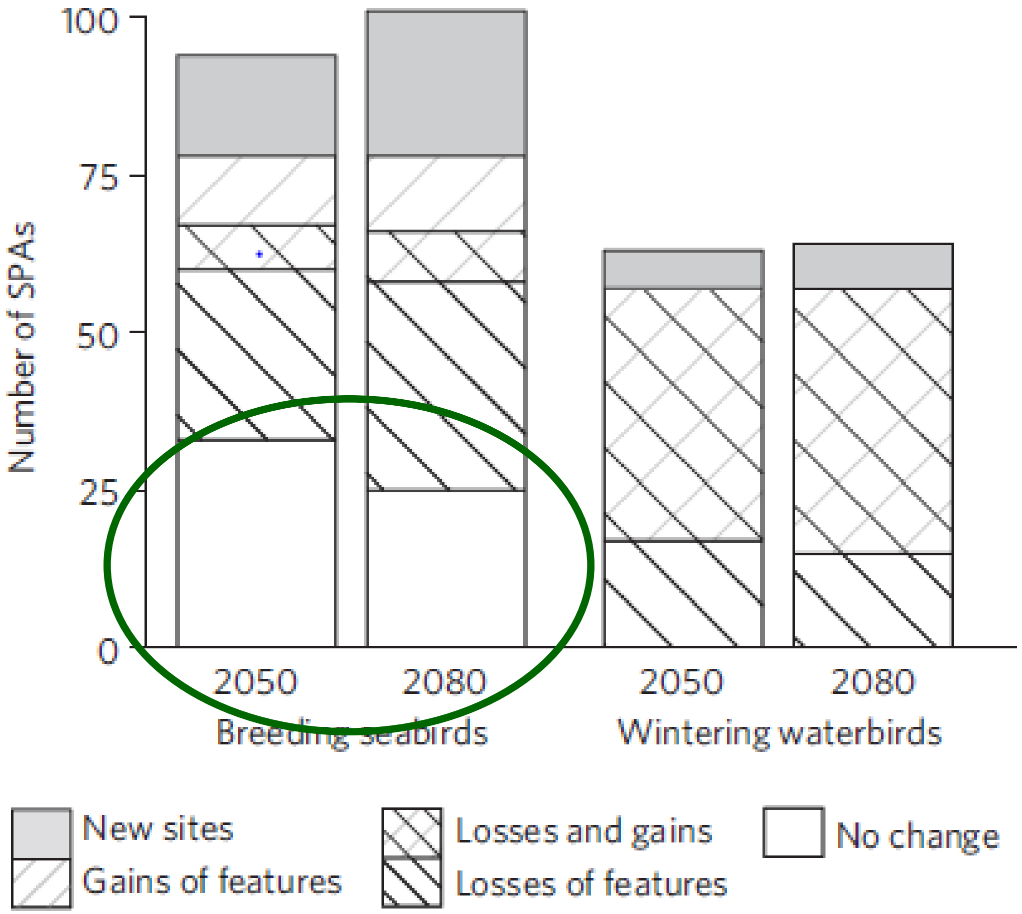
1. What does implementation best practice look like?
2. Are the existing “site based” interventions sufficient to build resilience of designated species and habitats to climate change?
3. Are there sufficient protected sites in the correct place to adequately respond to climate change?

Projected change in conservation status of habitats

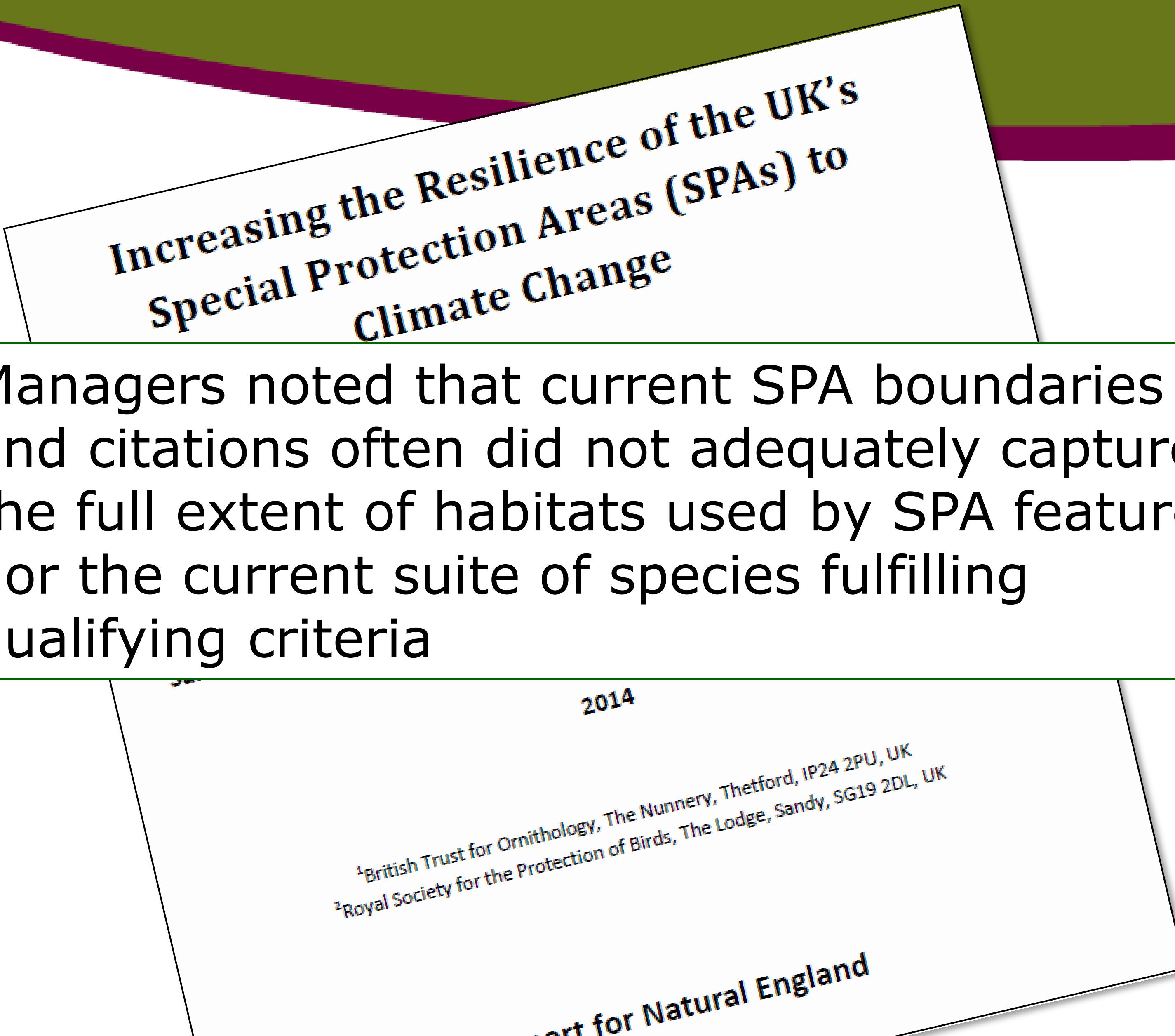


Carey et al 2014.

Species composition of individual N2K sites will change



Johnston et al 2013 – *Nature Climate Change*



Increasing the Resilience of the UK's Special Protection Areas (SPAs) to Climate Change

2014

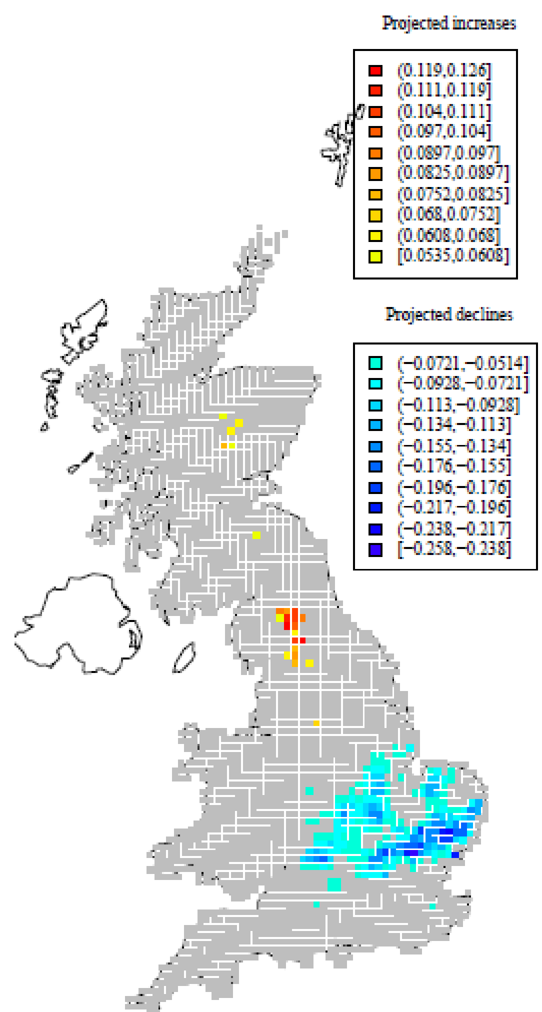
[1]British Trust for Ornithology, The Nunnery, Thetford, IP24 2PU, UK
[2]Royal Society for the Protection of Birds, The Lodge, Sandy, SG19 2DL, UK

for Natural England

Managers noted that current SPA boundaries and citations often did not adequately capture the full extent of habitats used by SPA features nor the current suite of species fulfilling qualifying criteria

1. What does implementation best practice look like
2. Are the existing site based interventions sufficient to build resilience of designated species and habitats to climate change?
3. Are there sufficient protected sites in the correct place to adequately respond to climate change?
4. Is the incidence of climate change driven species and community change resulting in failure to reach conservation status?
5. Is there sufficient flexibility in the designation process to respond to climate change driven range shifts?

Are some species are destined to extinction?



2070−2099 A1B scenario
Change in modelled probability of occurrence

What to do about species?

NATURAL ENGLAND

Journal of Applied Ecology

British Ecological Society

Journal of Applied Ecology 2012, **49**, 1247–1255 doi: 10.1111/1365-2664.12003

FORUM

A decision framework for considering climate change adaptation in biodiversity conservation planning

Tom H. Oliver[1]*, Richard J. Smithers[2], Sallie Bailey[3], Clive A.Walmsley[4] and Kevin Watts[5]

[1]*Centre for Ecology & Hydrology, Maclean Building, Benson Lane, Crowmarsh Gifford Wallingford, Oxfordshire, OX10 8BB, UK;* [2]*AEA Technology plc, The Gemini Building, Fermi Avenue, Harwell, Didcot, OX11 0QR, UK;* [3]*Forestry Commission, Silvan House, 231 Corstorphine Road, Edinburgh, EH12 7AT, UK;* [4]*Countryside Council for Wales, Maes-Y-Ffynnon, Penrhos Garnedd, Bangor, LL57 2LQ, UK; and* [5]*Forest Research, Alice Holt, Farnham, Surrey, GU10 4LH, UK*

MONITOR

BUFFER EDGE IMPACTS

MANAGE MATRIX

IN-SITU MANAGEMENT

RESTORE/ CREATE HABITAT (ADJACENT)

RESTORE/ CREATE HABITAT (NEARBY)

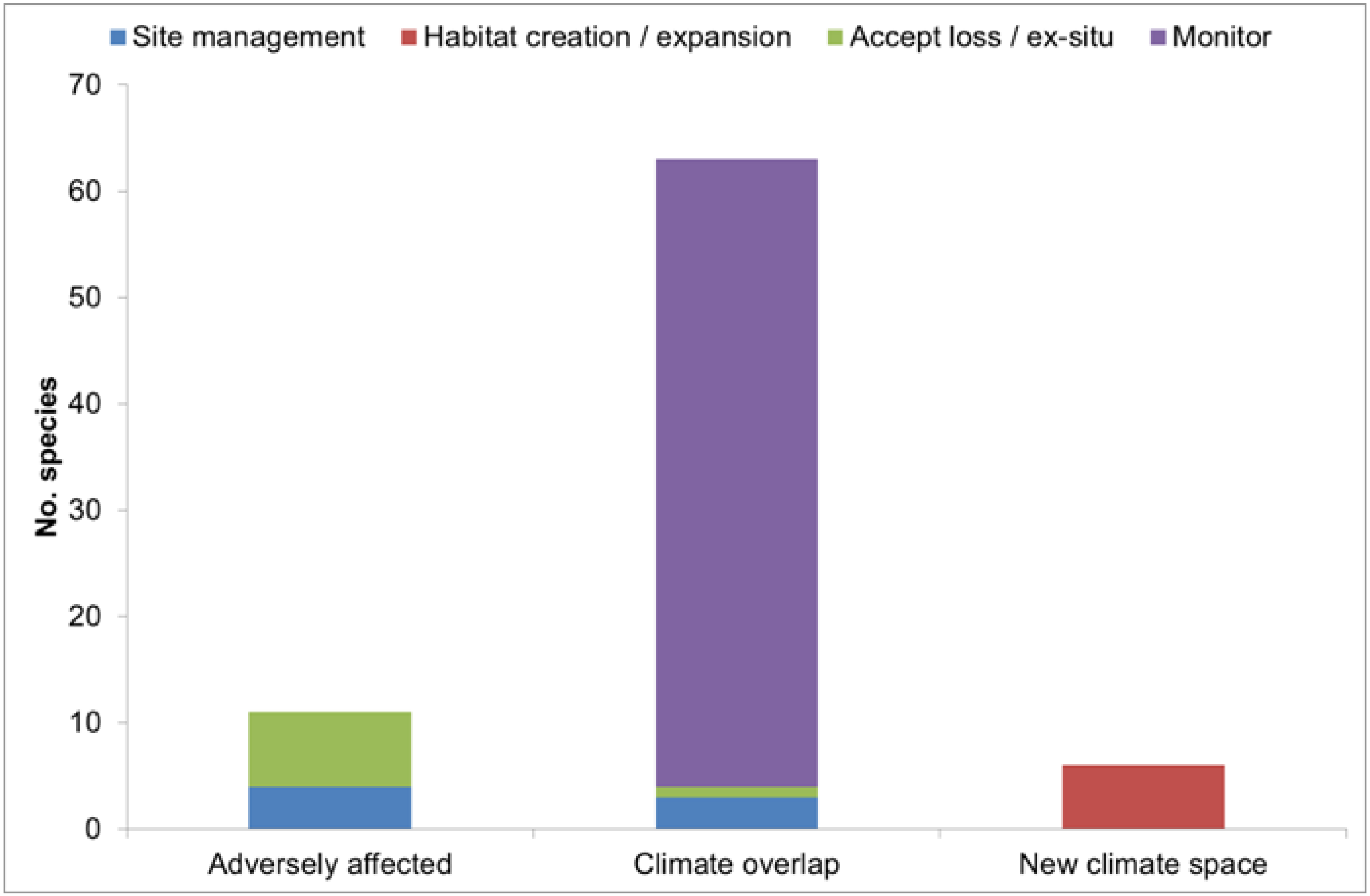
RESTORE/ CREATE HABITAT (OTHER SITES)

TRANSLOCATE

EX-SITU

ACCEPT LOSS

Migratory birds

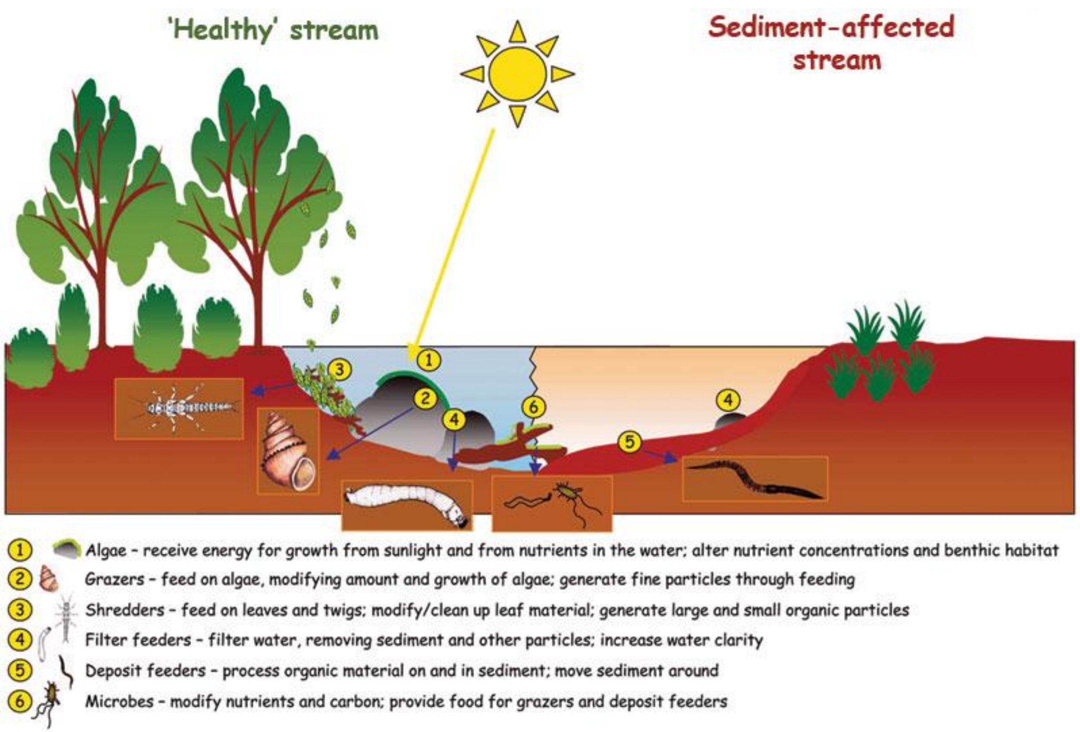


1. What does implementation best practice look like
2. Are the existing site based interventions sufficient to build resilience of designated species and habitats to climate change?
3. Are there sufficient protected sites in the correct place to adequately respond to climate change?
4. Is the incidence of climate change driven species and community change resulting in failure to reach conservation status?
5. Is there sufficient flexibility in the designation process to respond to climate change driven range shifts?
6. Review of options for species likely to face extinction

Characteristics of intact & functioning ecosystems

NATURAL ENGLAND

- **Efficient recycling of elements**
- **Characteristic structure**
- **Connectivity**
- **Large Scale**

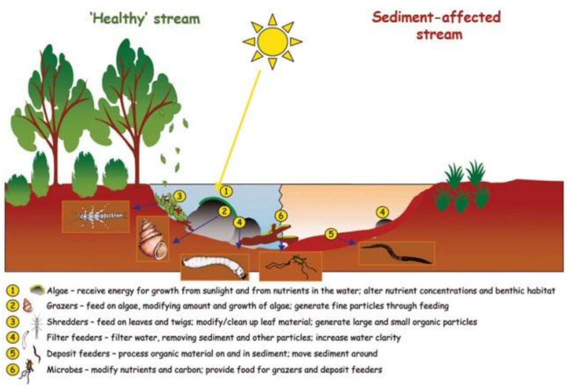


Moss B. (2008) Science of the Total Environment 400, 32–41

Characteristics of intact & functioning ecosystems

- **Efficient recycling of elements**
- **Characteristic structure**
- **Connectivity**
- **Large Scale**

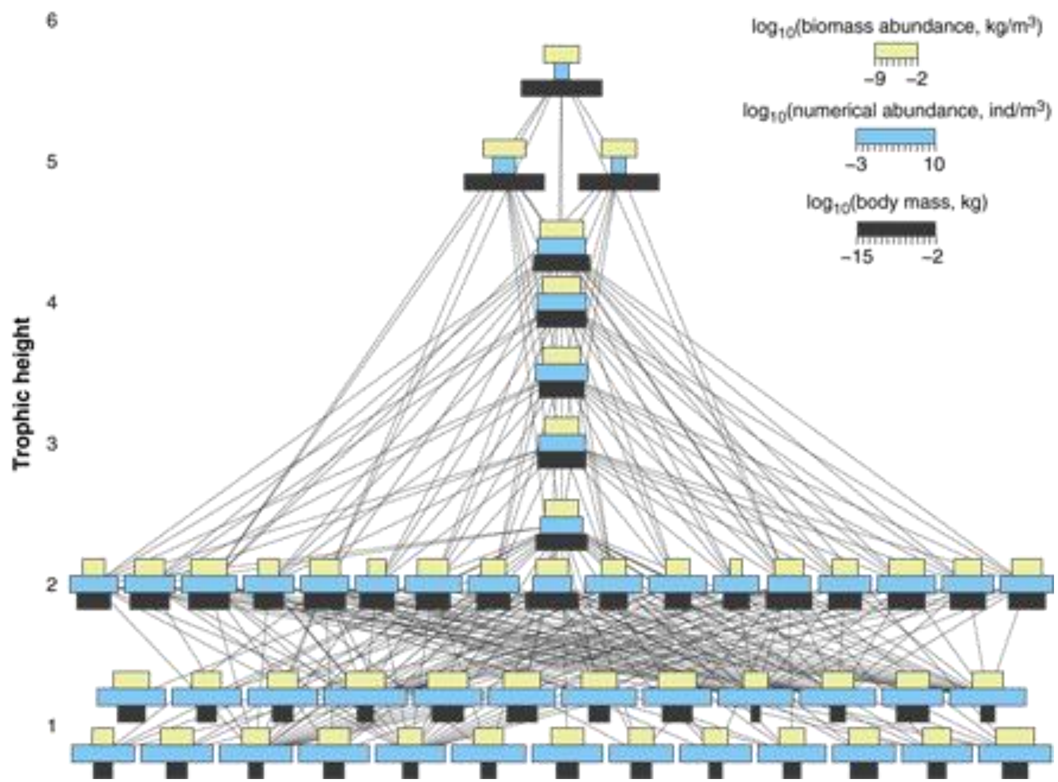
- **Better**
- **Better**
- **Joined**
- **Bigger & More**



Moss B. (2008) Science of the Total Environment 400, 32–41

Function and structure

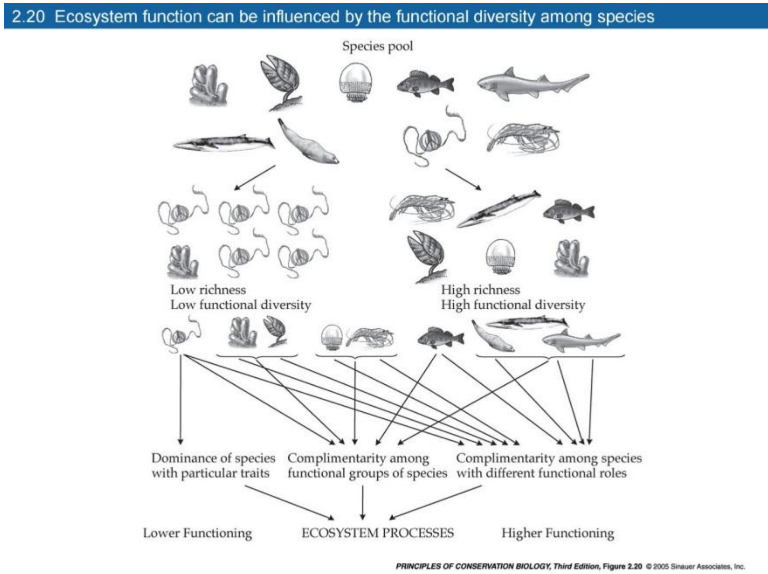
Lake Tuesday (Michigan) Food web



So….

NATURAL ENGLAND

- concentrate on ‘how’ natural systems work rather than simply ‘what they look like’
- But how to measure this?
  - Functional diversity?



MJ Groom, GK Meffe, CR Carroll – 2006 *Principles of conservation biology* -