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

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General principles of CC adaptation

Hopkins et al. 2007; Huntley 2007; Mitchell et al. 2007; Smithers et al. 2008; Mawdsley et al. 2009

For example:

• **Improve** protected area **management**
• Create **buffer zones** around high quality habitats
• **Improve matrix** for landscape permeability
• **Translocate** species at risk of extinction

But **unclear which actions should take priority**, which inhibits application of principles (Heller & Zavaleta 2009; Perkins et al. 2007)
Adaptation actions collated

(Hopkins et al. 2007; Huntley 2007; Smithers et al. 2008; Mawdsley et al. 2009)

Priority depends on species- and site-context
Context-dependency for adaptation actions

Appropriate actions depend upon:

1. Climatic zone (‘Adversely sensitive’, ‘Climate Overlap’, ‘New Climate Space’)

2. Landscape characteristics

3. Species/ populations attributes (e.g. population size, dispersal capacity)
Climatic zone

- Delineate zones based on bioclimate model (‘SDM’)
- Incorporate uncertainty (e.g. absence of species records; differences between climate scenarios)
The Decision Framework

NEW CLIMATE SPACE

Better

Bigger

More

Joined

Translocate/ ex situ

The Decision Framework

New Climate Space
Decision 'free' for areas beyond a species' current range, projected to become climatically suitable

Monitor

What is the availability of suitable habitat?

What is the quality of suitable habitat?

What is the potential for unassisted colonisation?

What is the availability of suitable habitat within colonisation distance of existing populations?

What potential has wider habitat restoration to improve connectivity?

What potential has wider habitat creation to improve connectivity?

What potential has matrix management to improve permeability/connectedness?

What potential has translocation to benefit suitable habitats?

Focus on connectivity between sites within colonisation distance of existing populations

Buffer (edge)

Practise existing Climate

In-situ site management

Restoring degraded habitats adjacent or near to suitable sites within colonisation distance of existing populations to increase habitat area

Create (expand)

Create (nearby sites)

Restore (nearby sites)

Manage matrix

Intensive farming, urbanisation

Use habitat creation to create/ enhance corridors and stepping stones

Translocate

Tree for areas Adversely Sensitive
The Decision Framework

NEW CLIMATE SPACE

CLIMATE OVERLAP

ADVERSELY SENSITIVE

Monitor & Research

If necessary, conduct research on species, communities, habitats or ecological processes and responses to climate change

Buffer (edge impacts)

Reduce or remove other threats, improve habitat quality, conserve habitat heterogeneity

In-situ site management

Restore (expand)

Restore habitats adjacent or near to existing sites to increase habitat area

Create (expand)

Create (nearby sites)

What is the impact of negative edge effects?

High - Low

What (me) must we do?

Monitor & Research

If necessary, conduct research on species, communities, habitats or ecological processes and responses to climate change

Buffer (edge impacts)

Prioritise sites with broad environmental gradients, reduce or remove other threats, improve habitat quality, conserve habitat heterogeneity

In-situ site management

Go to decision ‘tree’ for areas of Climate Overlap

Go to decision ‘tree’ for areas of New Climate Space

What is the impact of negative edge effects?

High - Low

What potential have existing (meta)populations to be self-sustaining?

Observation, modelling, expert opinion

What is the availability of adjacent regions with suitable climate space?

To what extent are adjacent regions already occupied?

Ex-situ

Accept loss

START

New Climate Space
Decision ‘tree’ for areas beyond a species’ current range, projected to become climatically suitable

CLIMATE OVERLAP
Decision ‘tree’ for areas within a species’ current range, projected to remain climatically suitable

ADVERSELY SENSITIVE
Decision ‘tree’ for areas within a species’ current range, projected to become climatically unsuitable in the future
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Classified from ‘High Risk’ to ‘High Benefit’ (Thomas et al. 2011 MEE)
Comparison with existing conservation recommendations

- Natural England-funded project on assessing CC risks
- 30 UK threatened species occupying woodland, heathland or chalk grassland
- Each with JNCC conservation recommendations

**KEY SIMILARITIES**

1. Need for monitoring and research
2. Importance of in-situ management

**KEY DIFFERENCES**

1. Actions in *New Climate Space* versus *Adversely Sensitive Areas*
2. Balance of actions (e.g. *Buffer edge impacts* versus matrix management)
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