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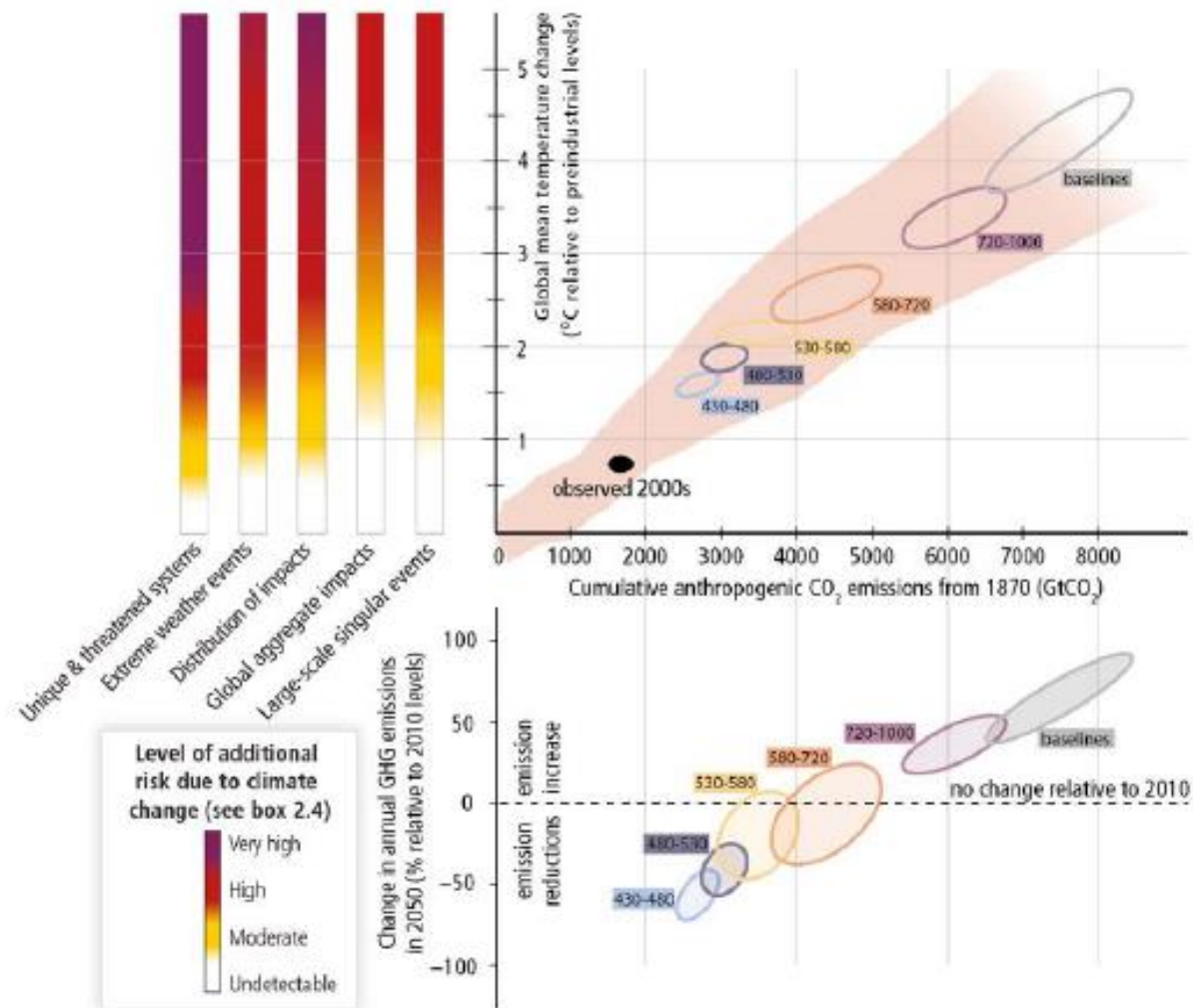
The potential biodiversity cost of renewable energy

Dr James Pearce-Higgins
Director of Science
james.pearce-higgins@bto.org



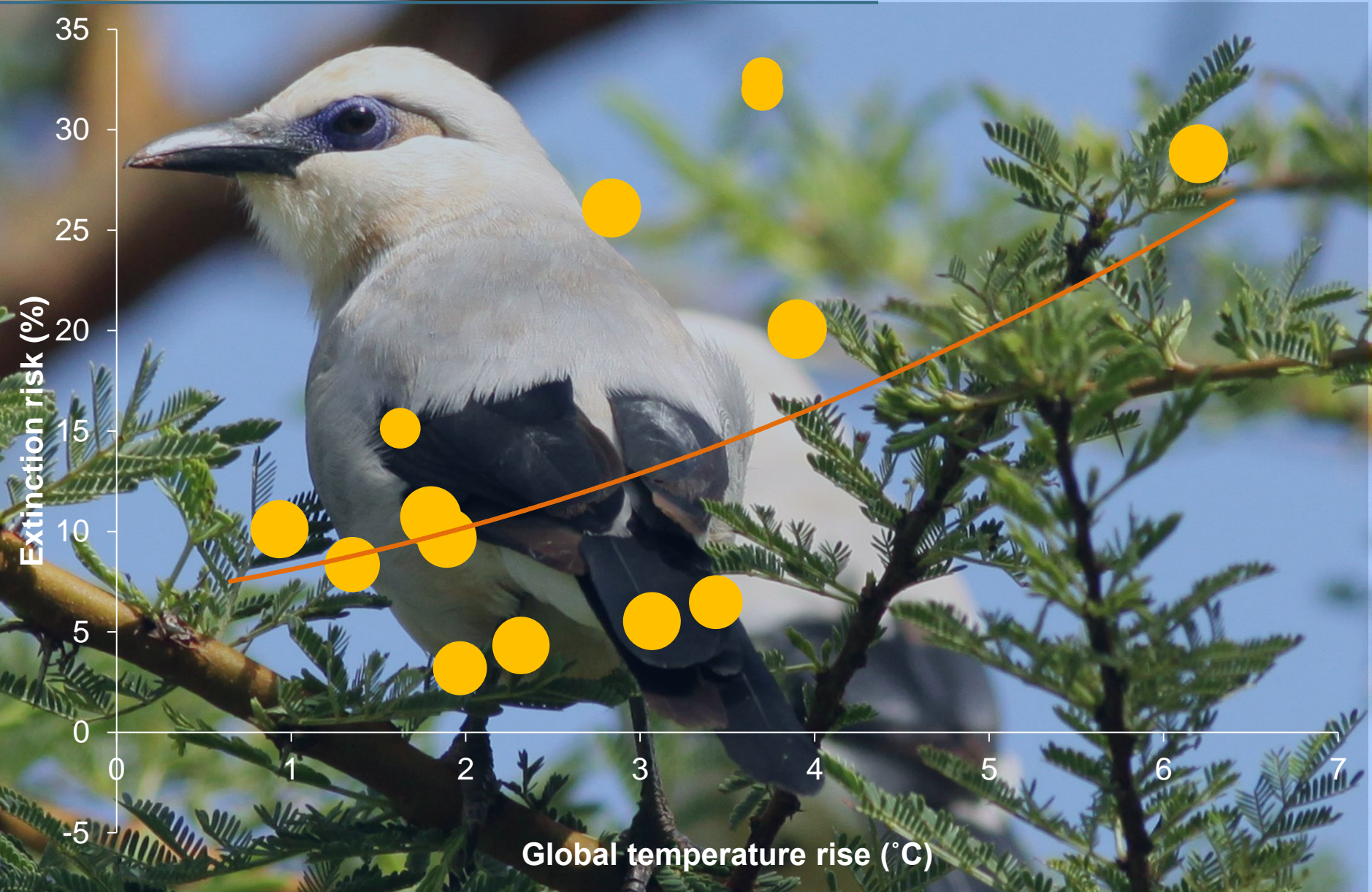
The need for mitigation

(A) Risks from climate change... (B) ...depend on cumulative CO₂ emissions...

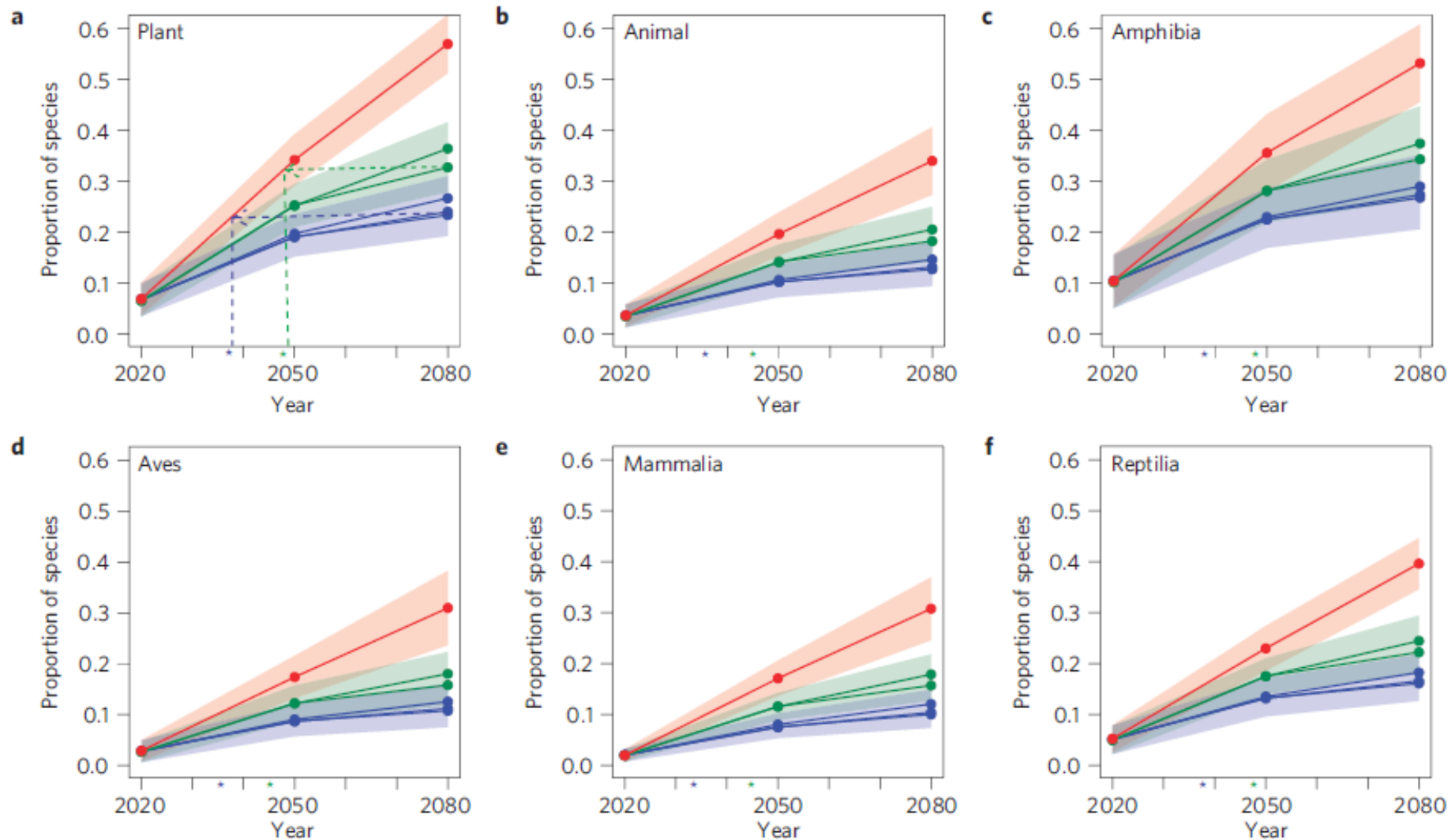


(C) ...which in turn depend on annual GHG emissions over the next decades

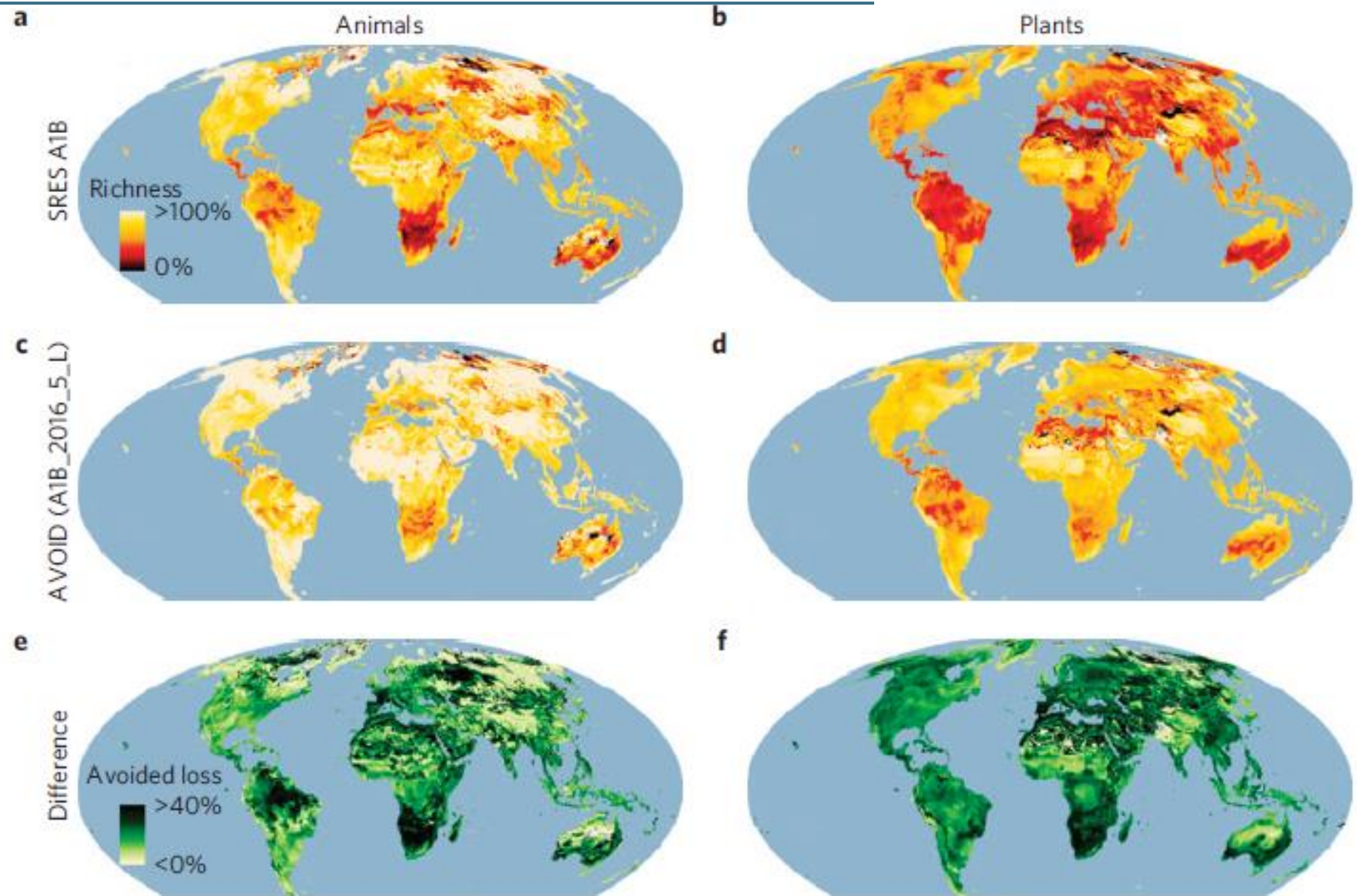
The need for mitigation



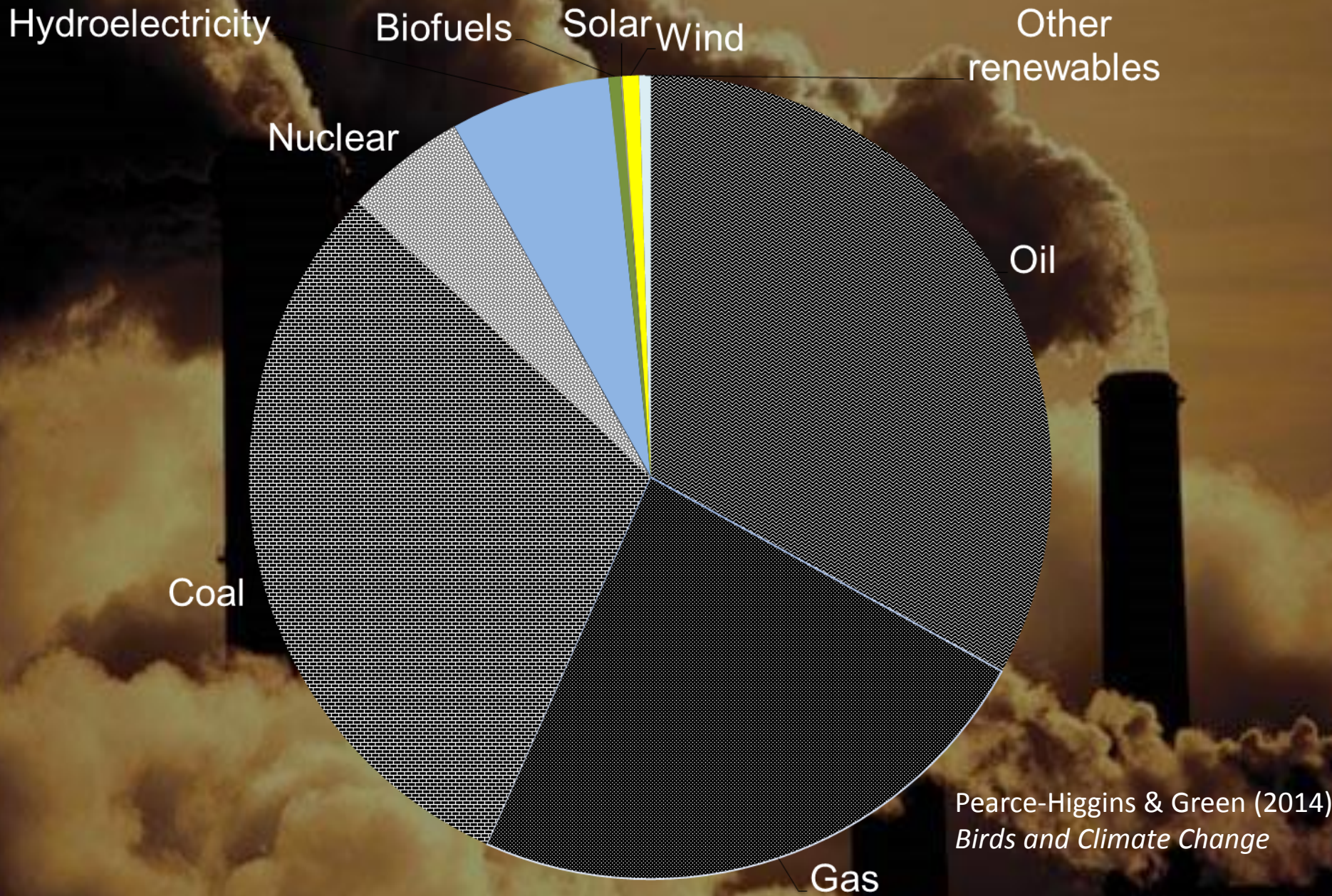
The need for mitigation



The need for mitigation



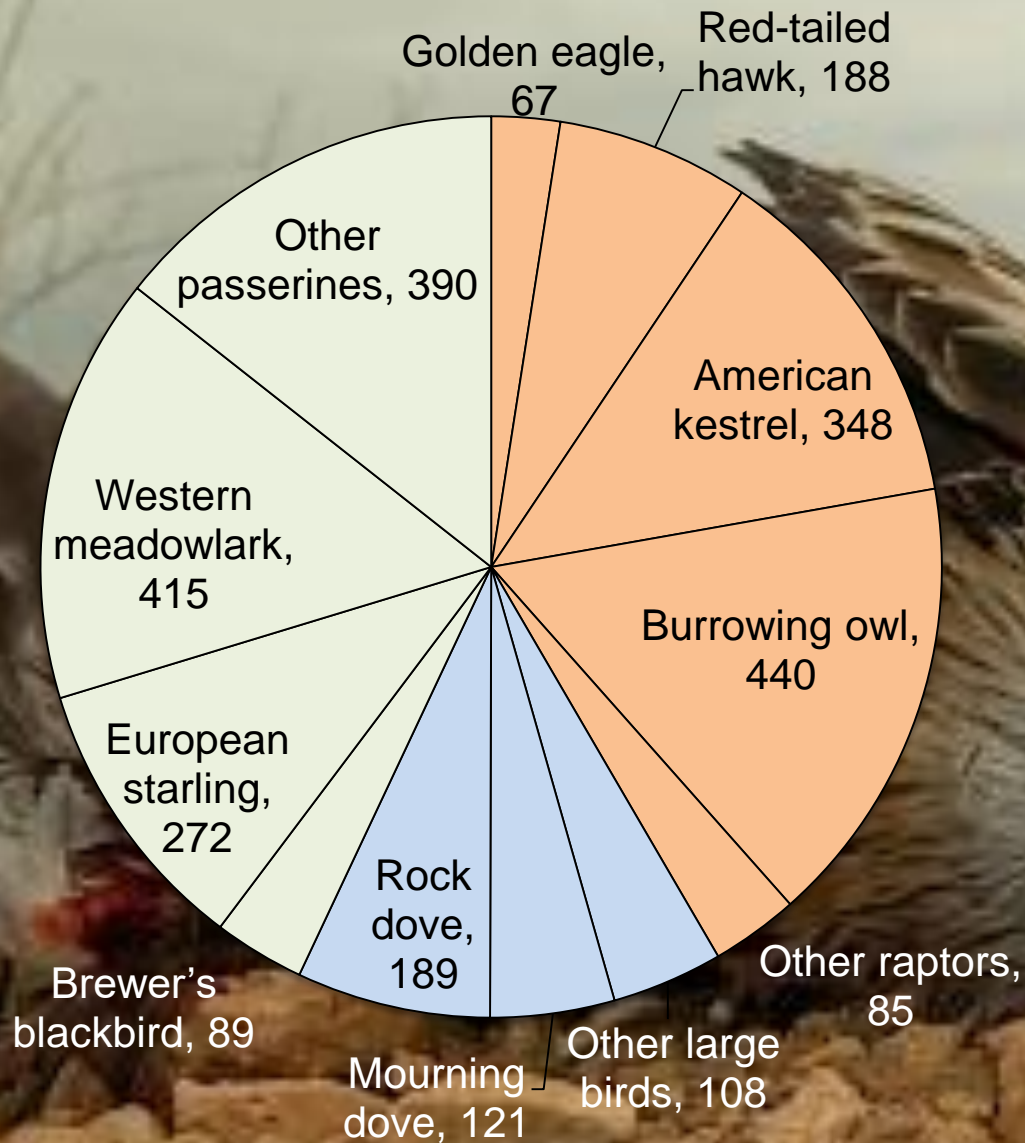
The need for renewable energy



The potential cost of renewable energy



The potential cost of wind



23,000 birds USA¹

17,000 birds Canada¹

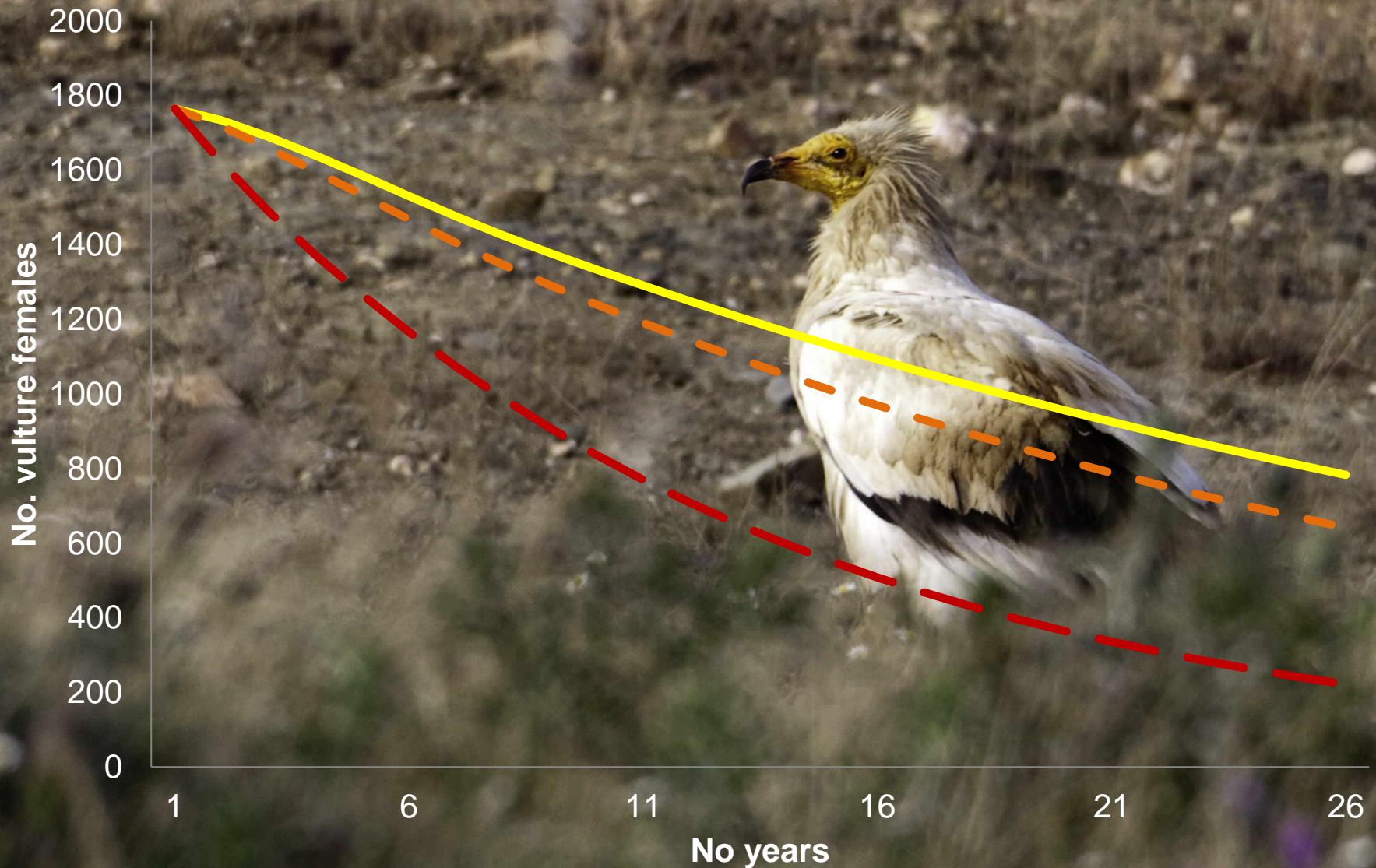
47,000 bats Canada²

¹Loss *et al.* 2012 *Ann. Rev. Ecol. Evol. Sys.*

² Zimmerling & Francis 2016 *J. Wild. Man.*

Pearce-Higgins & Green (2014)
Birds and Climate Change

The potential cost of wind



Carette *et al.* (2009) *Biological Conservation*

Pearce-Higgins & Green (2014) *Birds and Climate Change*

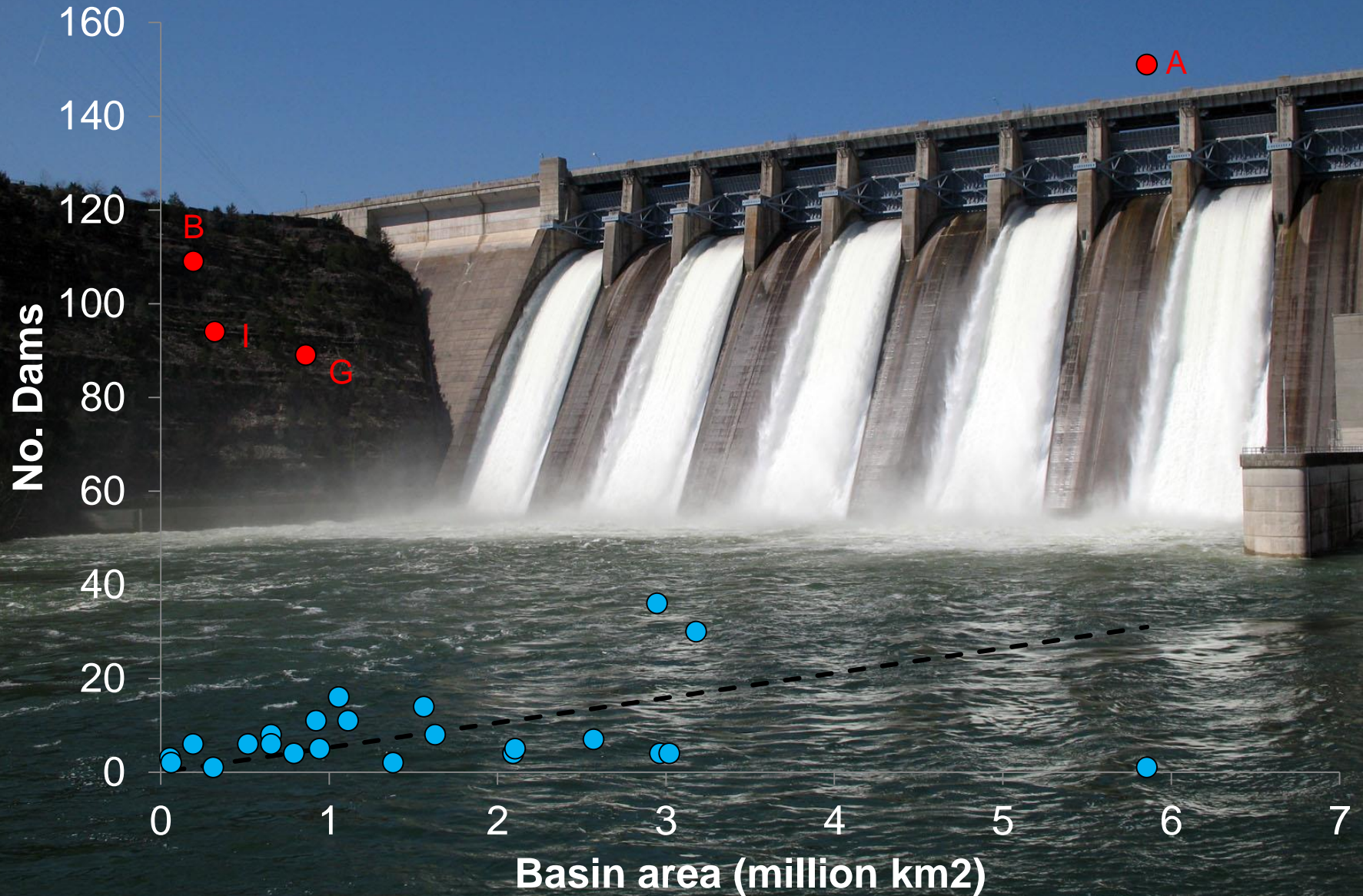
The potential cost of solar



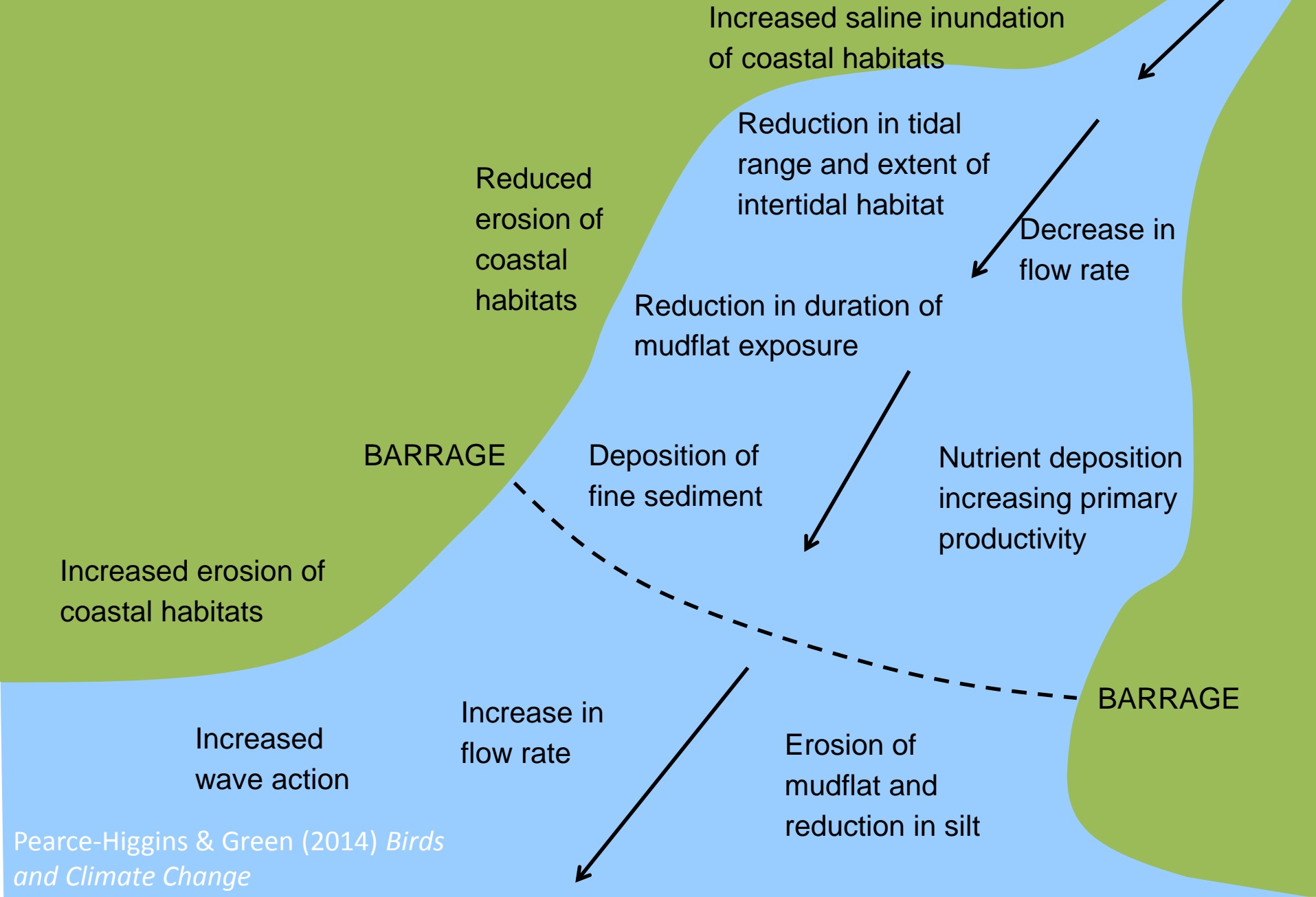
McCrary *et al.* (1986) *J. Ornith*



The potential cost of hydropower



The potential cost of hydropower



The potential cost of biofuel

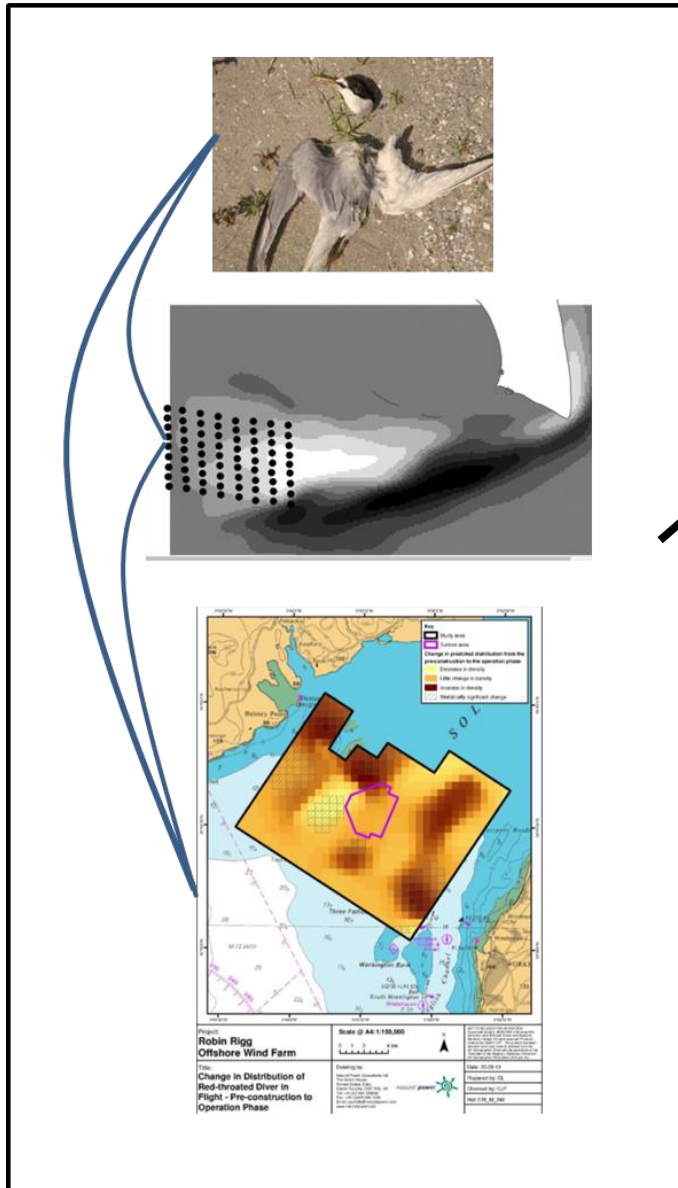


Energy efficiency

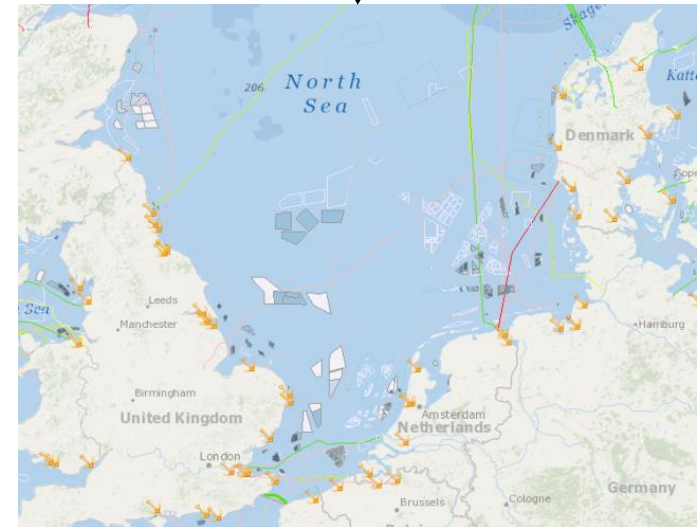
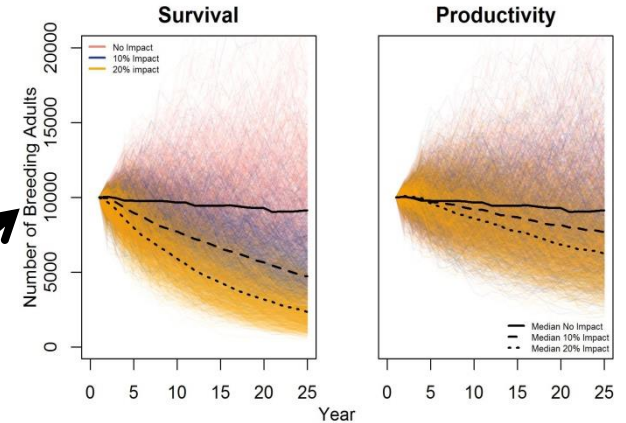


Impacts on species

IMPACTS ON INDIVIDUALS



IMPACTS ON POPULATIONS



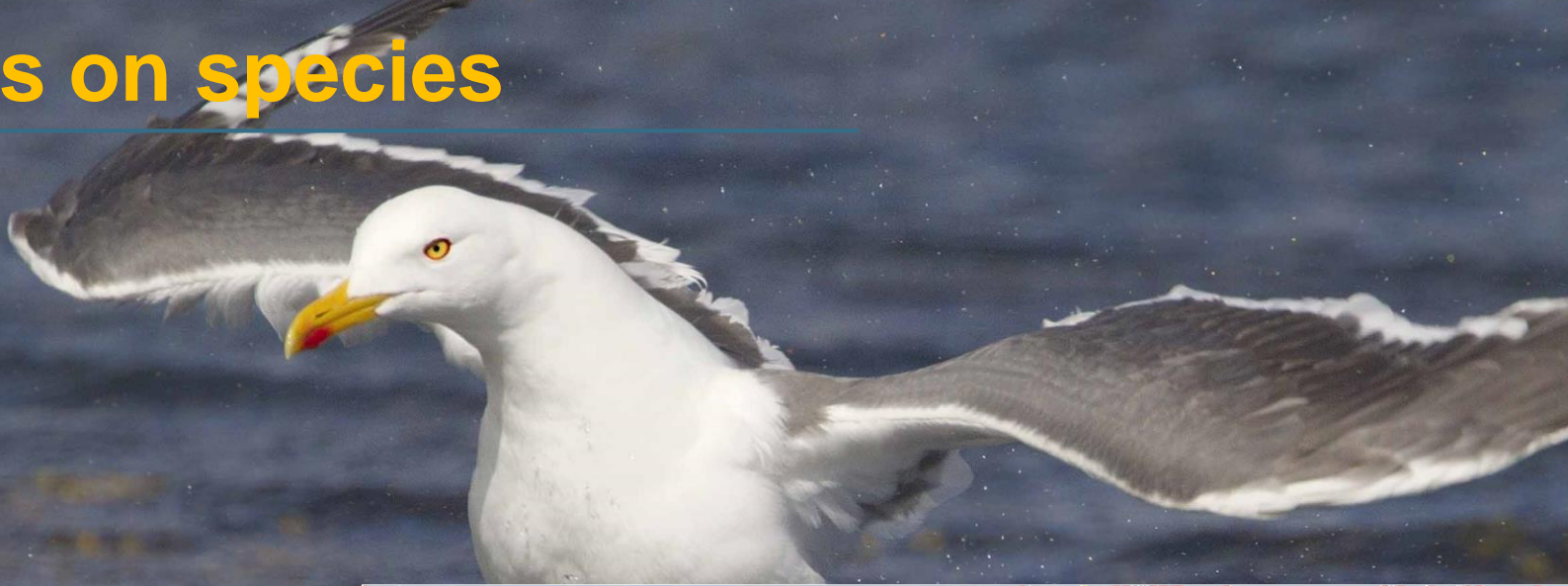
CUMULATIVE IMPACTS

Key questions

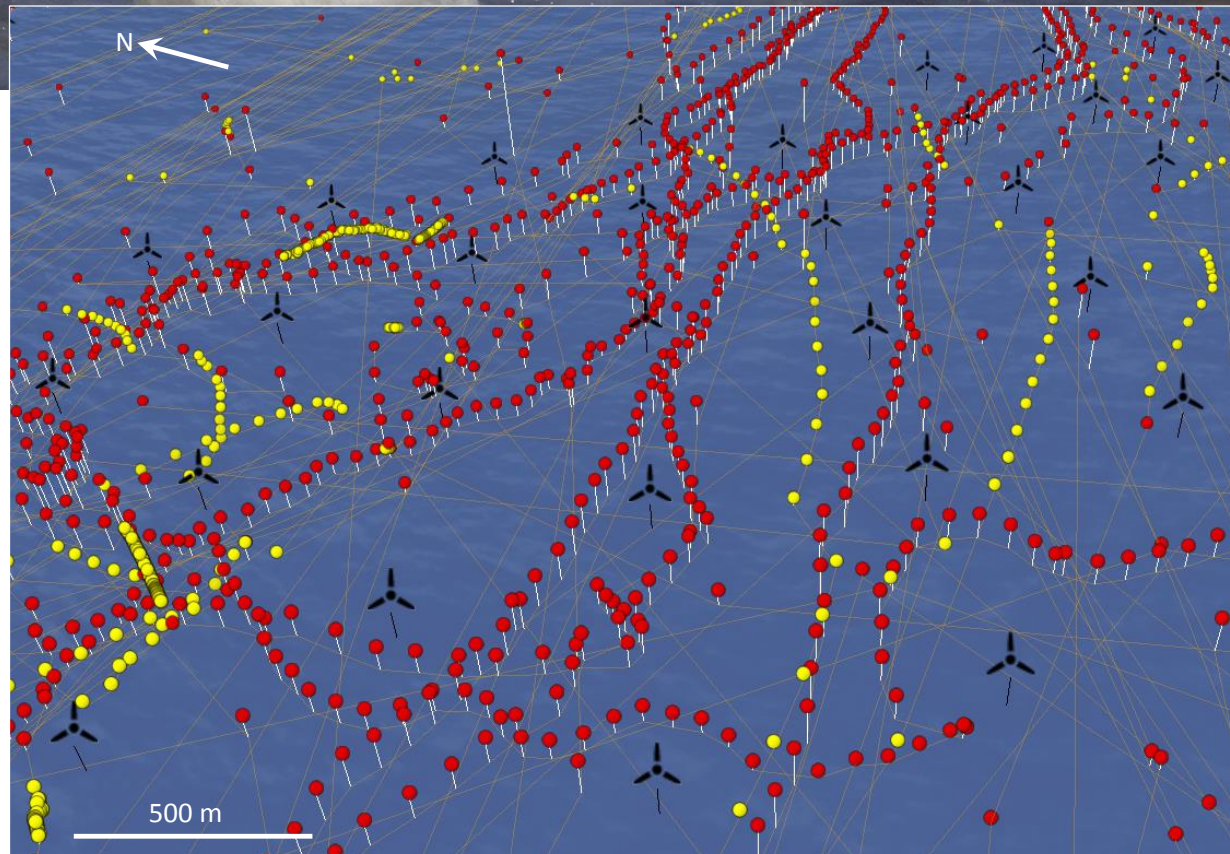
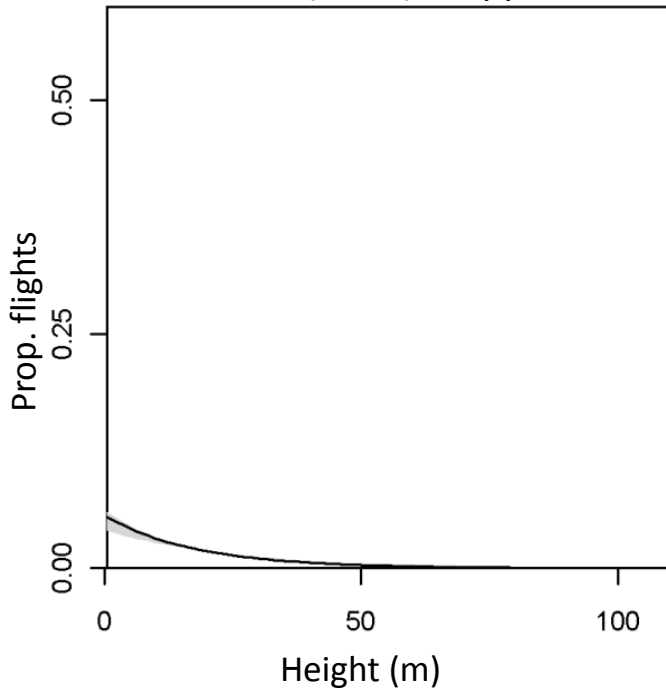
- What are impacts on populations?
- What is cumulative impact on species?
- How can impacts be avoided?



Impacts on species



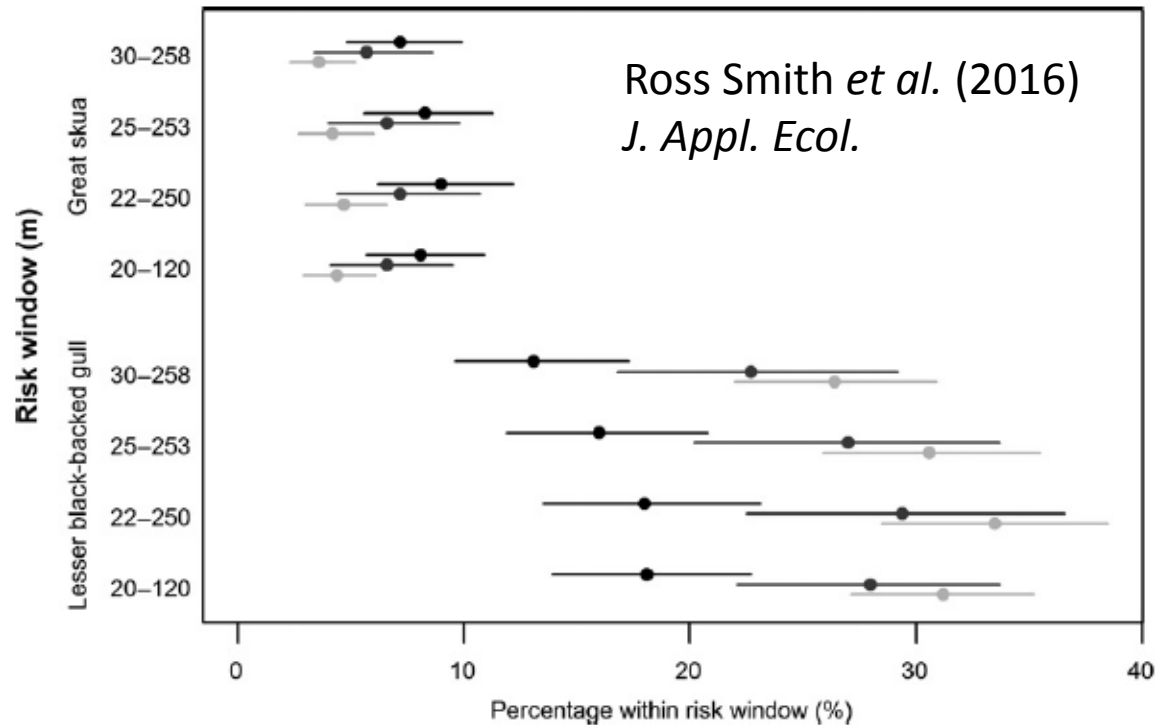
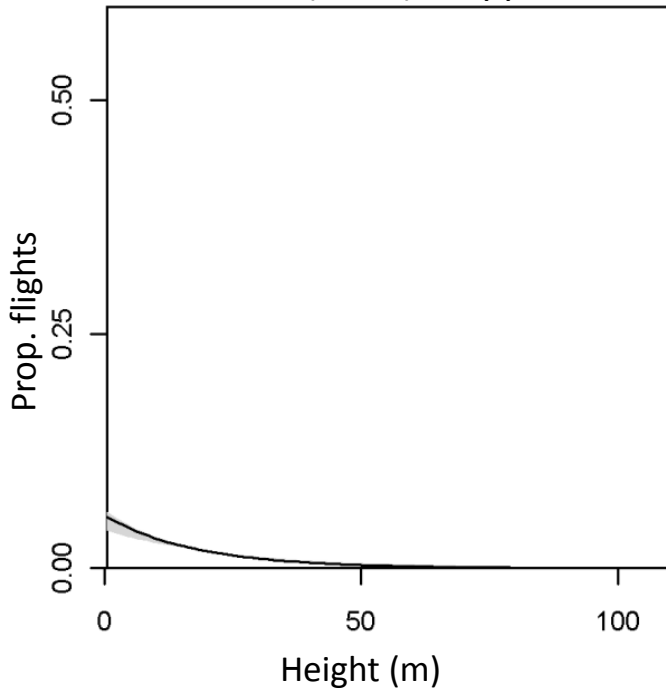
Johnston *et al.* (2014) *J. Appl. Ecol*



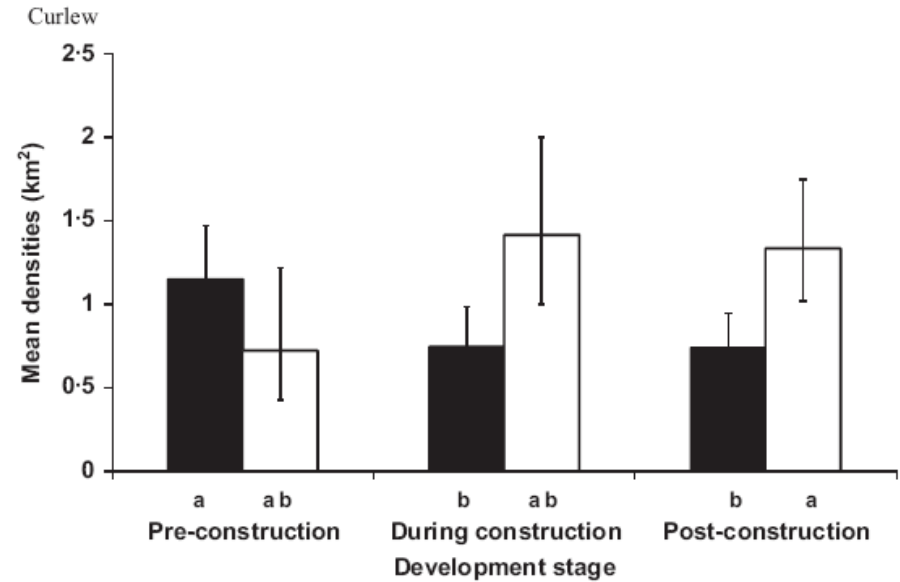
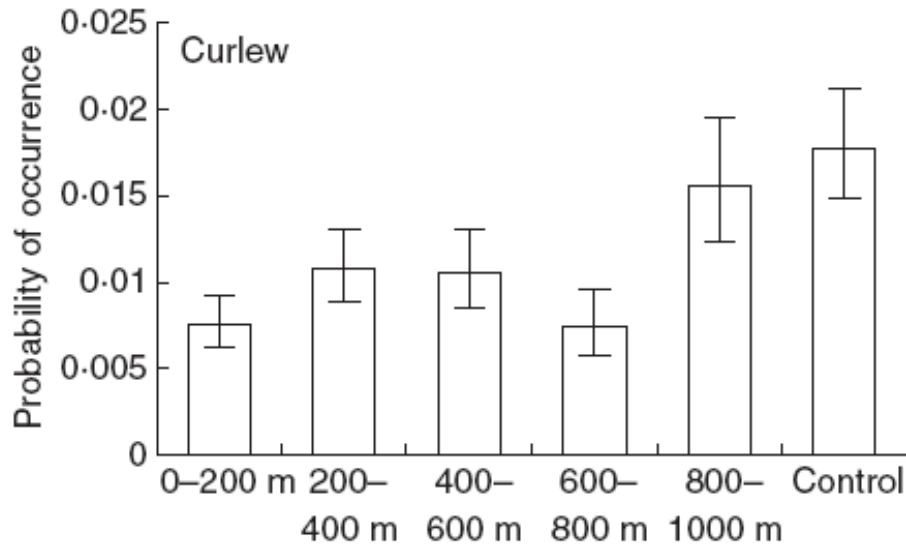
Impacts on species



Johnston *et al.* (2014) *J. Appl. Ecol.*



Impacts on species



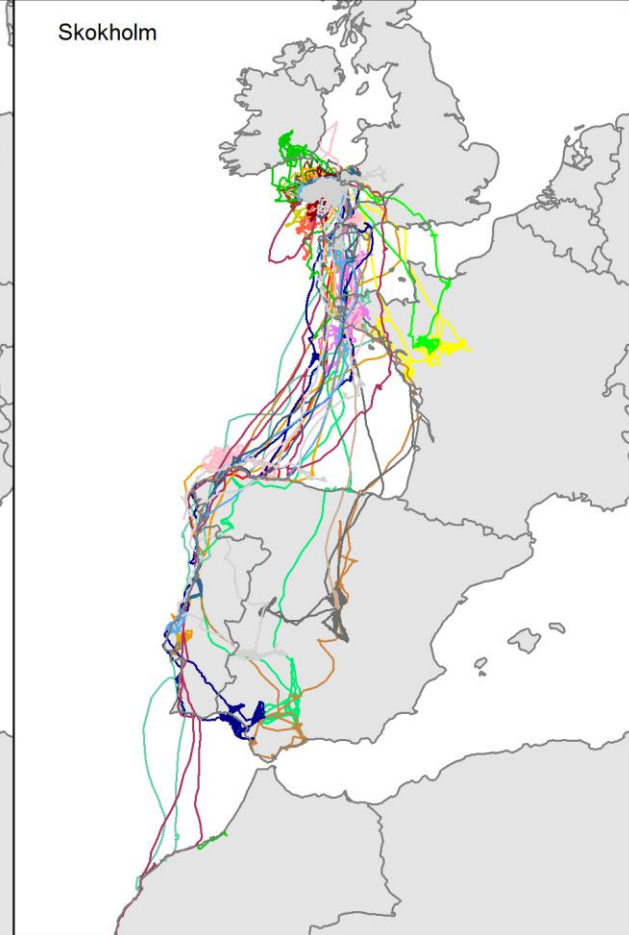
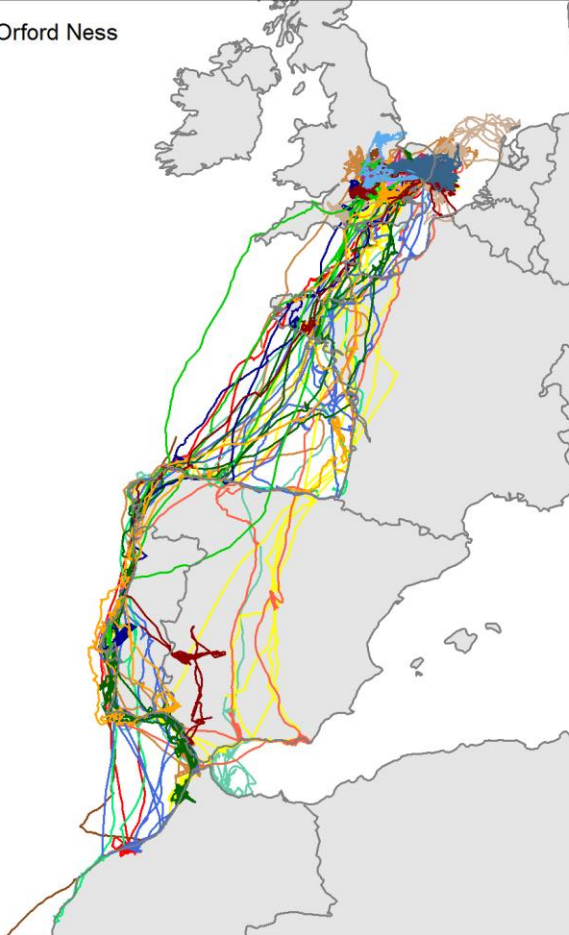
Impacts on species



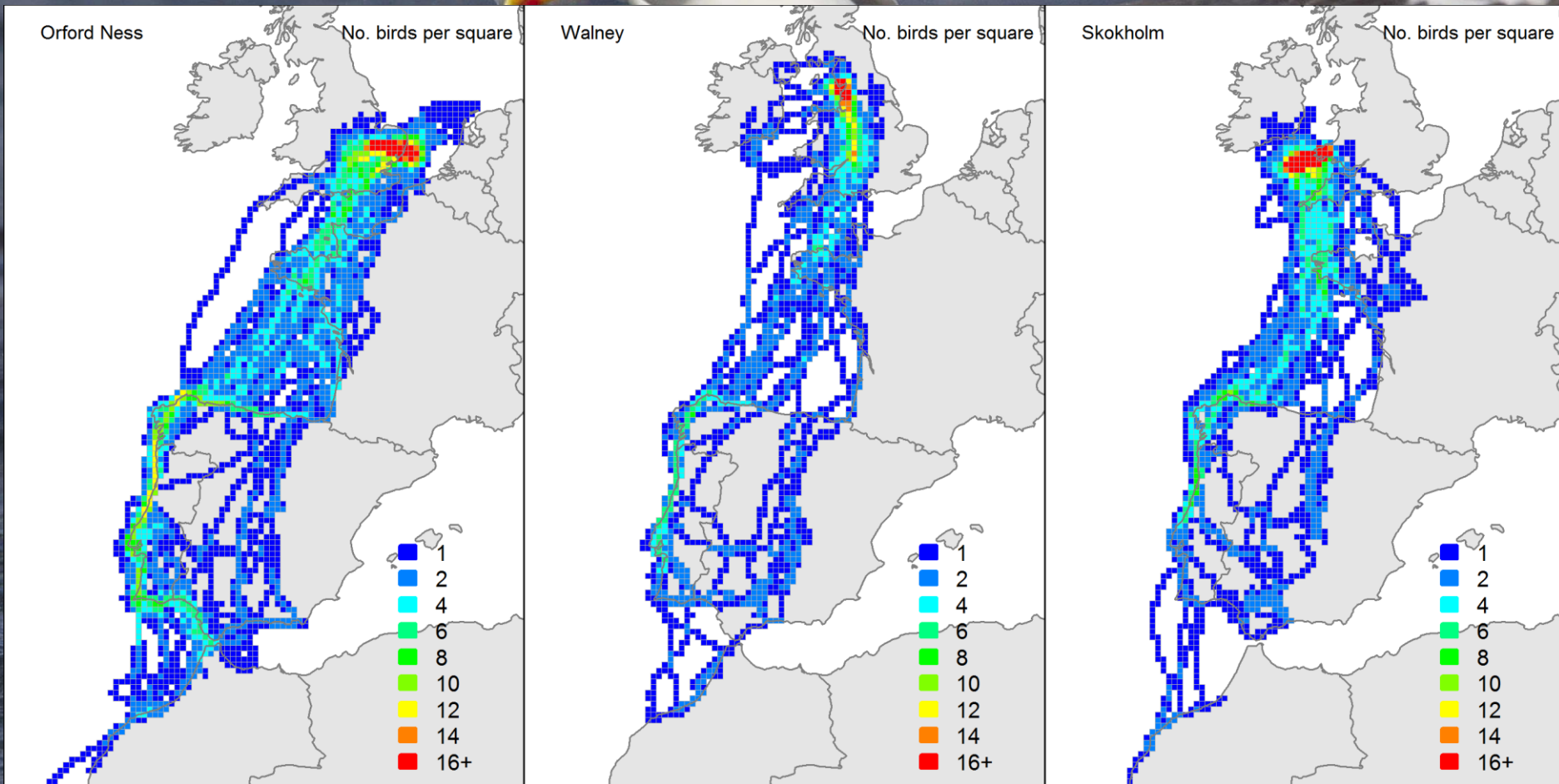
Orford Ness

Walney

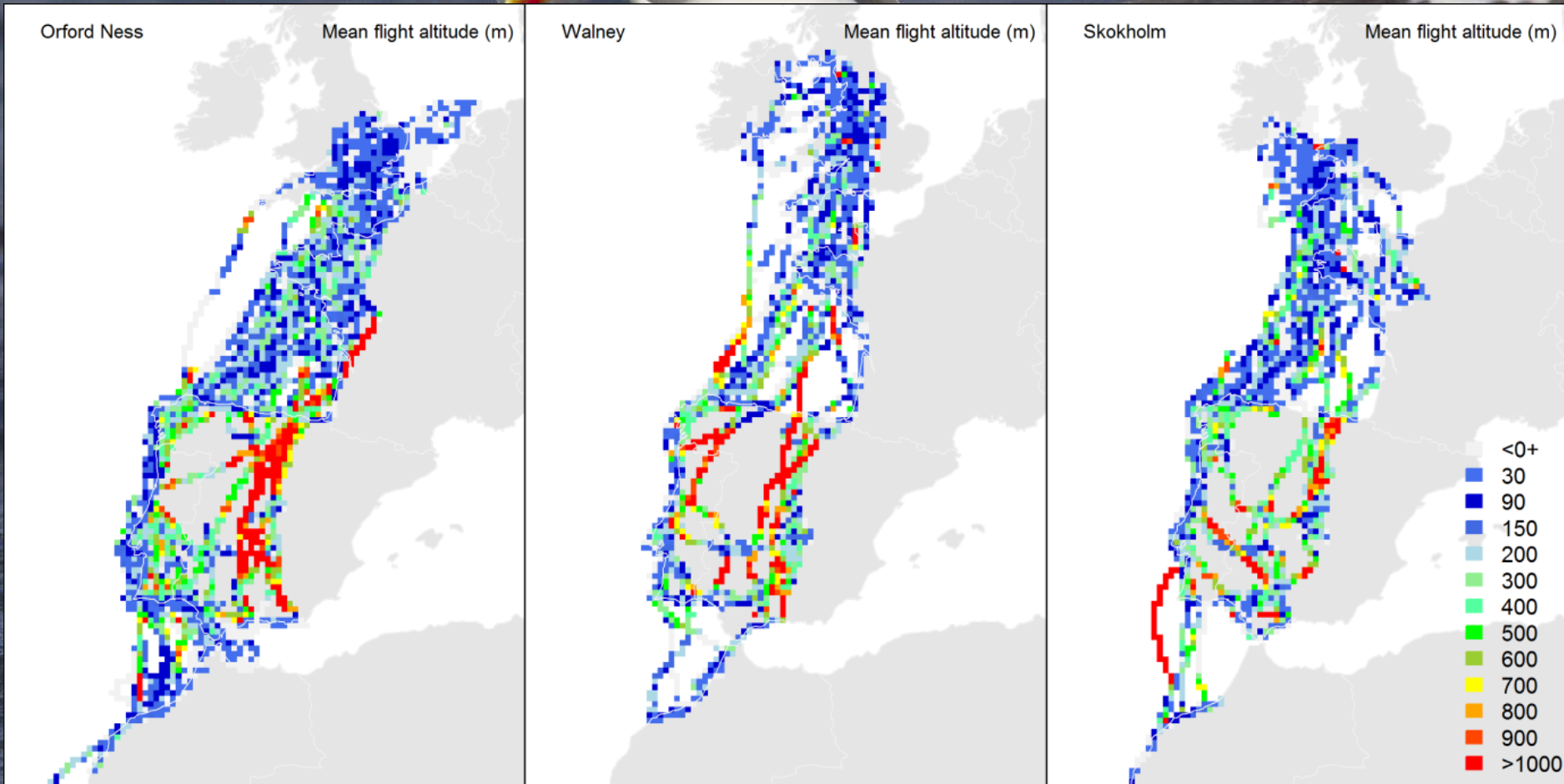
Skokholm



Impacts on species



Impacts on species



Impacts on species



Orford Ness

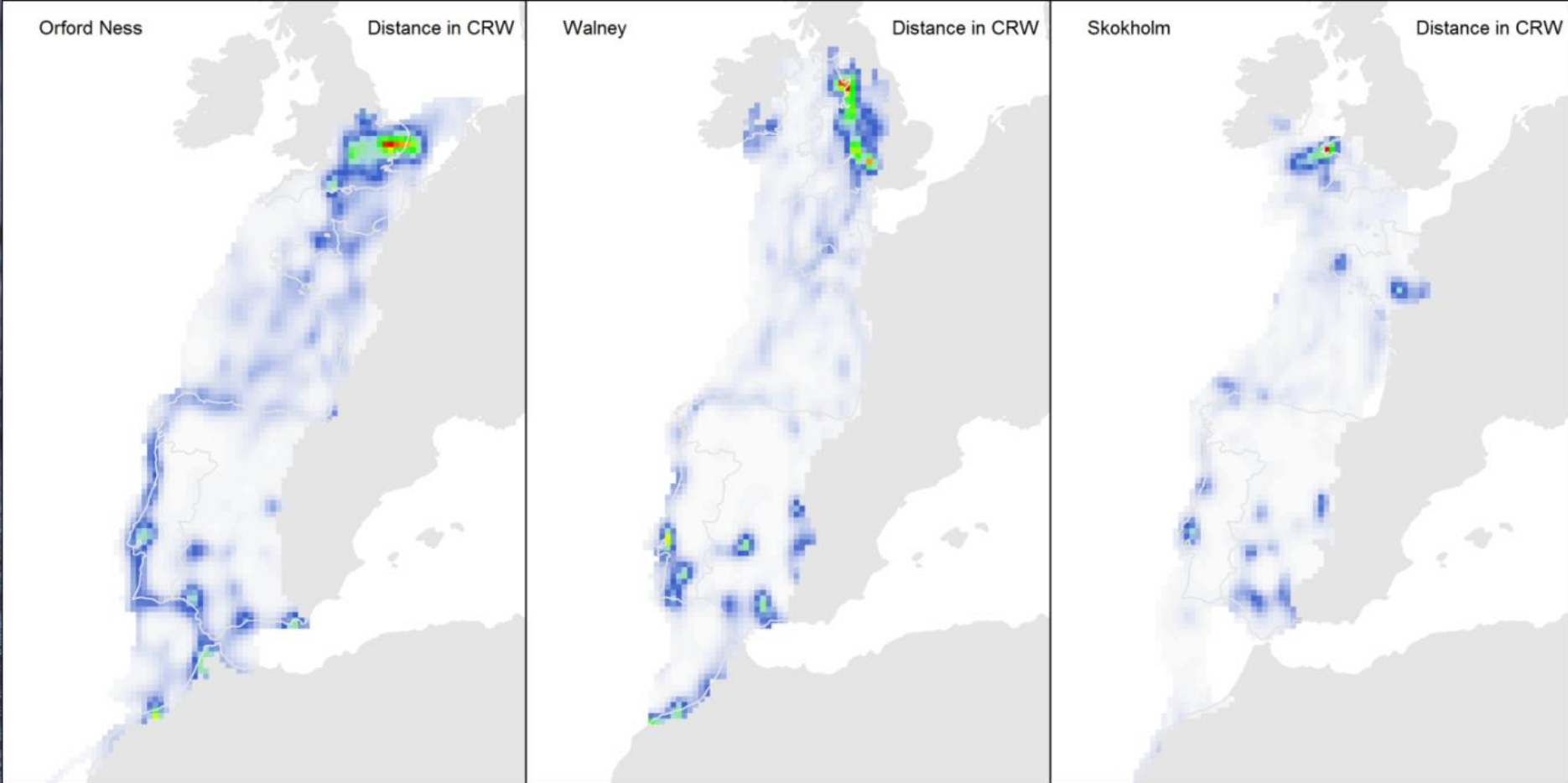
Distance in CRW

Walney

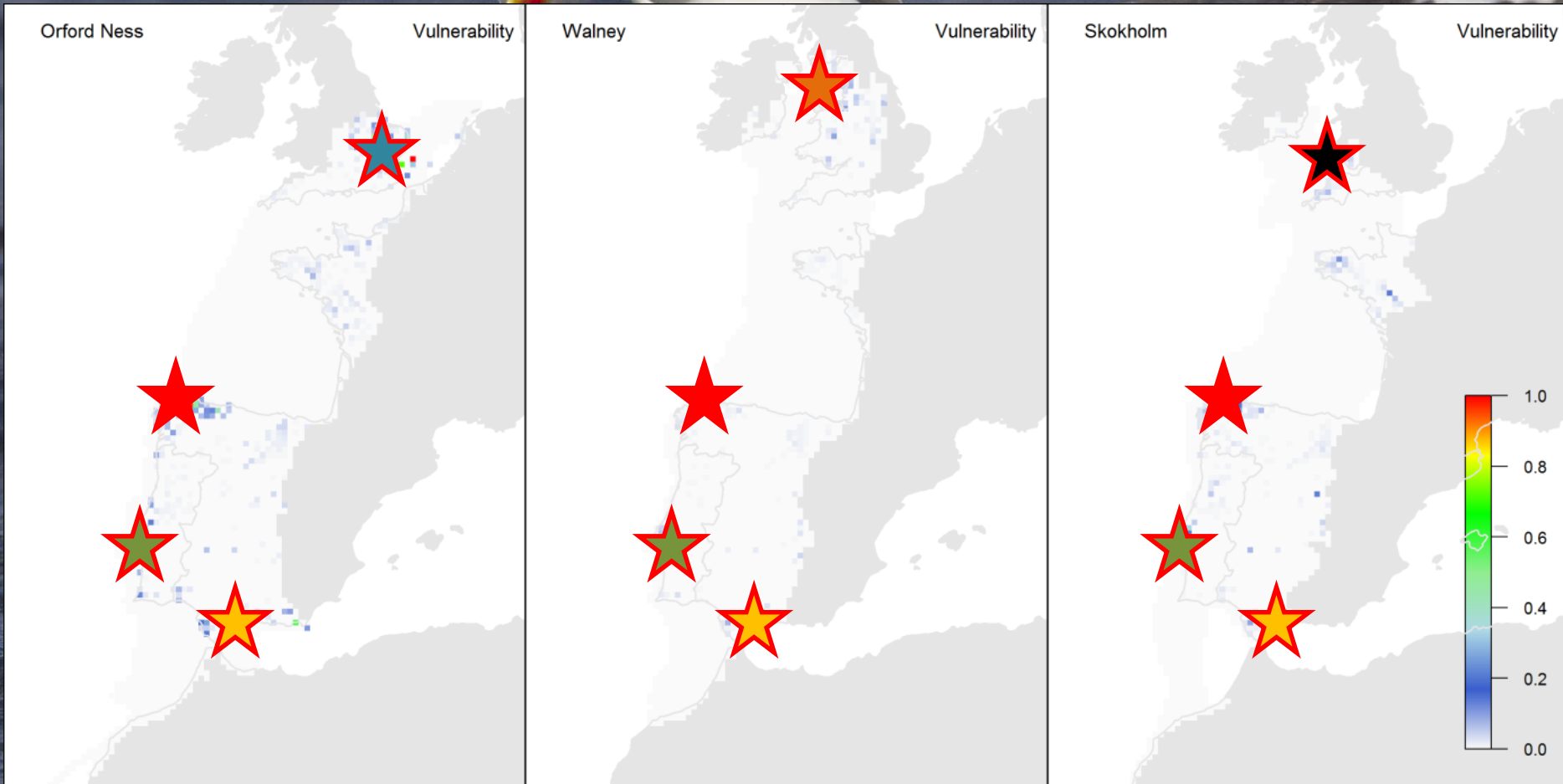
Distance in CRW

Skokholm

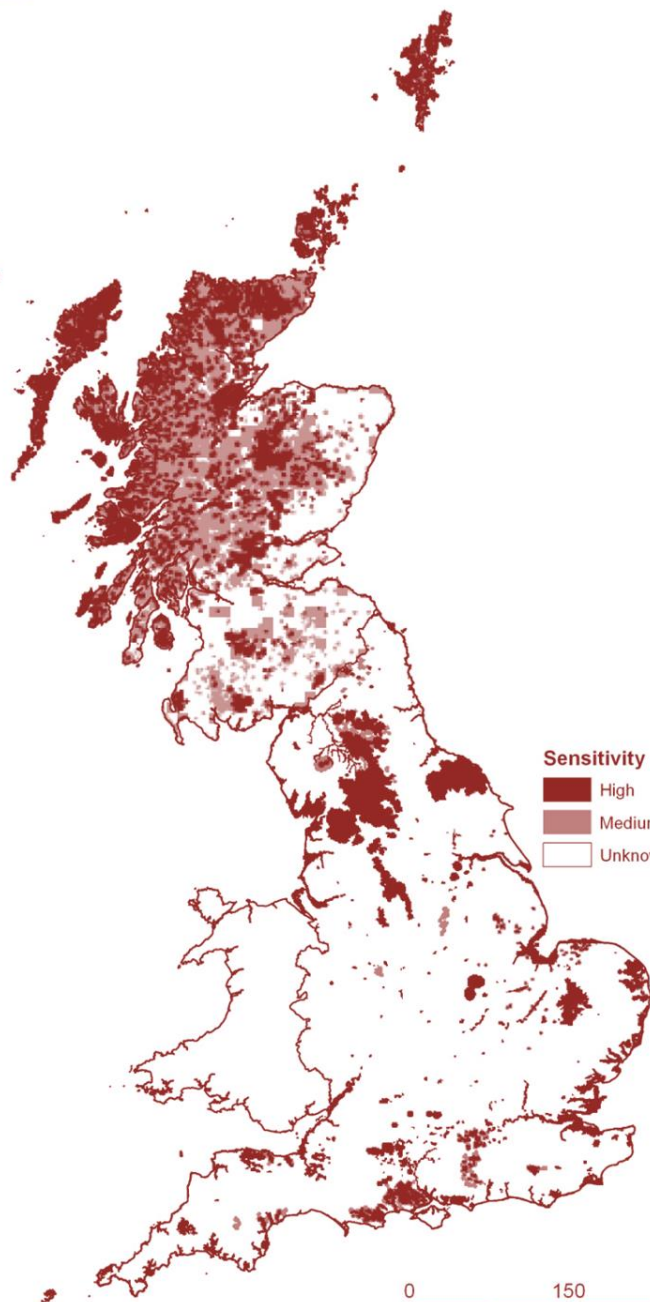
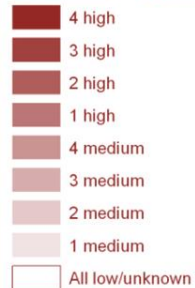
Distance in CRW



Impacts on species



Sensitivity - Scotland



Sensitivity - England



Edmund Fellowes / BTO

Key questions

Impact on populations (sensitivity)

Overlap of species with renewables (exposure)

Gives vulnerability (potential impact on species)

Vulnerability = sensitivity x exposure



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Impacts of renewable energy on global biodiversity – an overlooked cost of climate change mitigation?

James Pearce-Higgins, Chris Thaxter, Doug Crawford-Brown, Graeme Buchanan, Jamie Carr, Rhys Green, Tim Newbold, Stuart Butchart

CambridgeConservationInitiative

transforming the landscape of biodiversity conservation



UNIVERSITY OF
CAMBRIDGE

Sensitivity



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- Impacts of renewable energies assessed through land-use change and species' habitat associations.

Sensitivity



Uwe Potthoff via Flickr creative commons

- Impacts of renewable energies assessed through land-use change and species' habitat associations.
- Additional impacts of collision mortality with wind farms for birds and bats assessed through literature review and metaanalysis

Collision mortality



Literature review
Extract data, compile database



Collision data



+

Study data



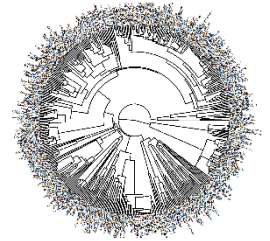
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Trait data



+

Phylogeny



Trait-based modelling



Predictions to all species based on trait relationships

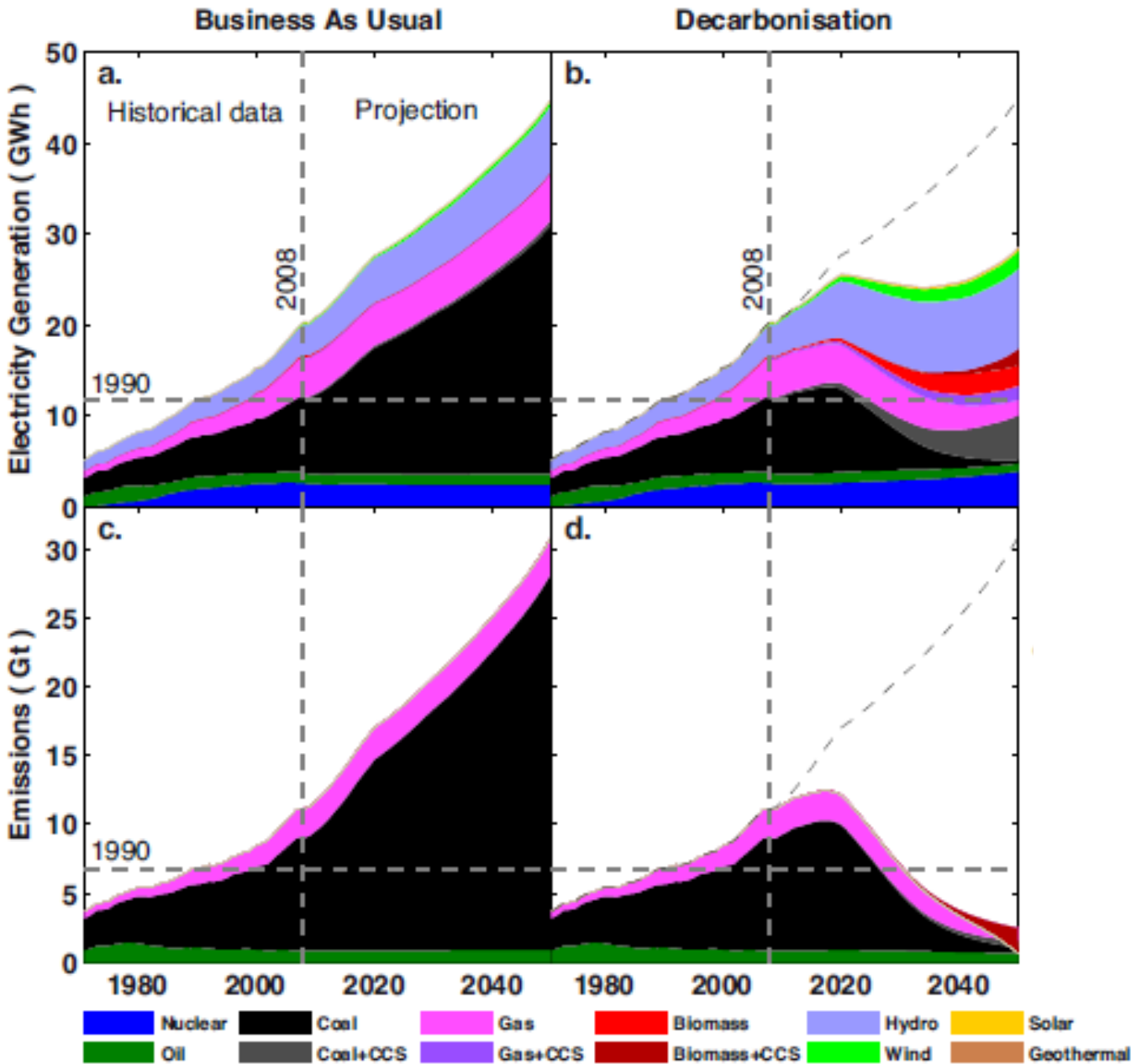
Exposure



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- 4CMR macro-economic models used to assess future energy mixes for 3 scenarios ('business as usual', 'medium ambition', 'high sustainability'), 3 time periods (2015, 2030, 2050) and four renewables (wind, solar, hydro, bioenergy).
- Overlap between renewable energy and species distributions determines exposure.

Exposure



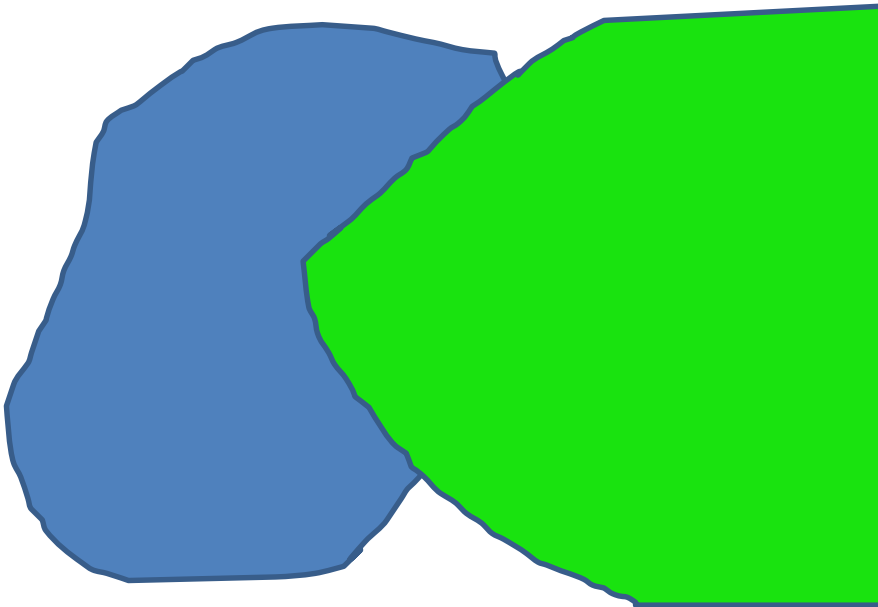
Mecure *et al.* (2014)
Energy Policy

Vulnerability



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- Vulnerability = sensitivity x exposure

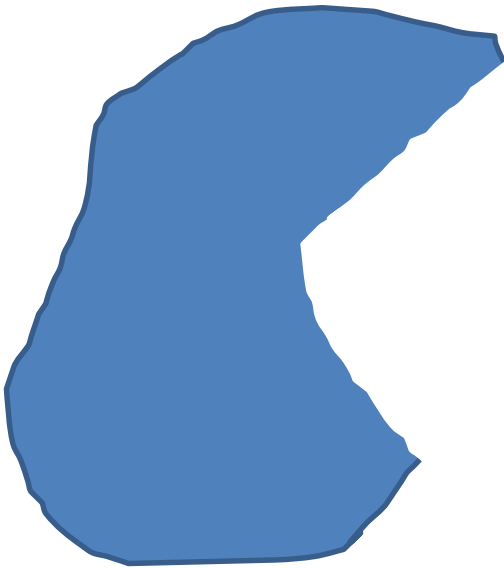


Vulnerability



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- Vulnerability = sensitivity x exposure



50% loss of range extent

Outputs



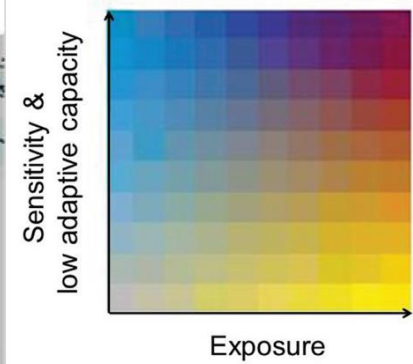
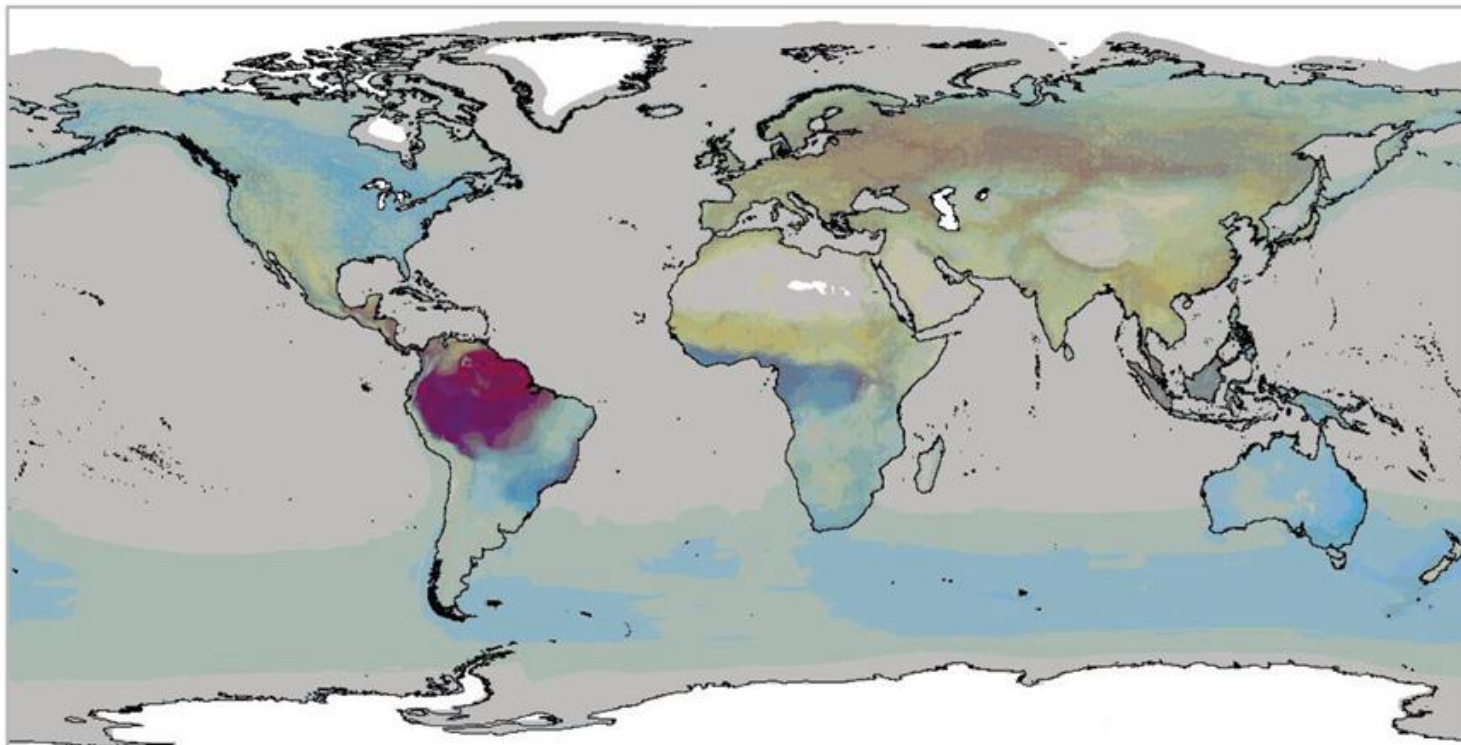
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- Paper of species' sensitivity to collision rates with turbines.
- Species assessments incorporated within Species Information Service.
- Hotspot maps of vulnerability to different renewable energies.
- Paper summarising potential global assessment of vulnerability to different mitigation scenarios.
- Policy-focussed dissemination

Outputs



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Foden *et al.* (2013)
PLoS ONE

Acknowledgements



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