

Uwe Potthoff via Flickr creative commons

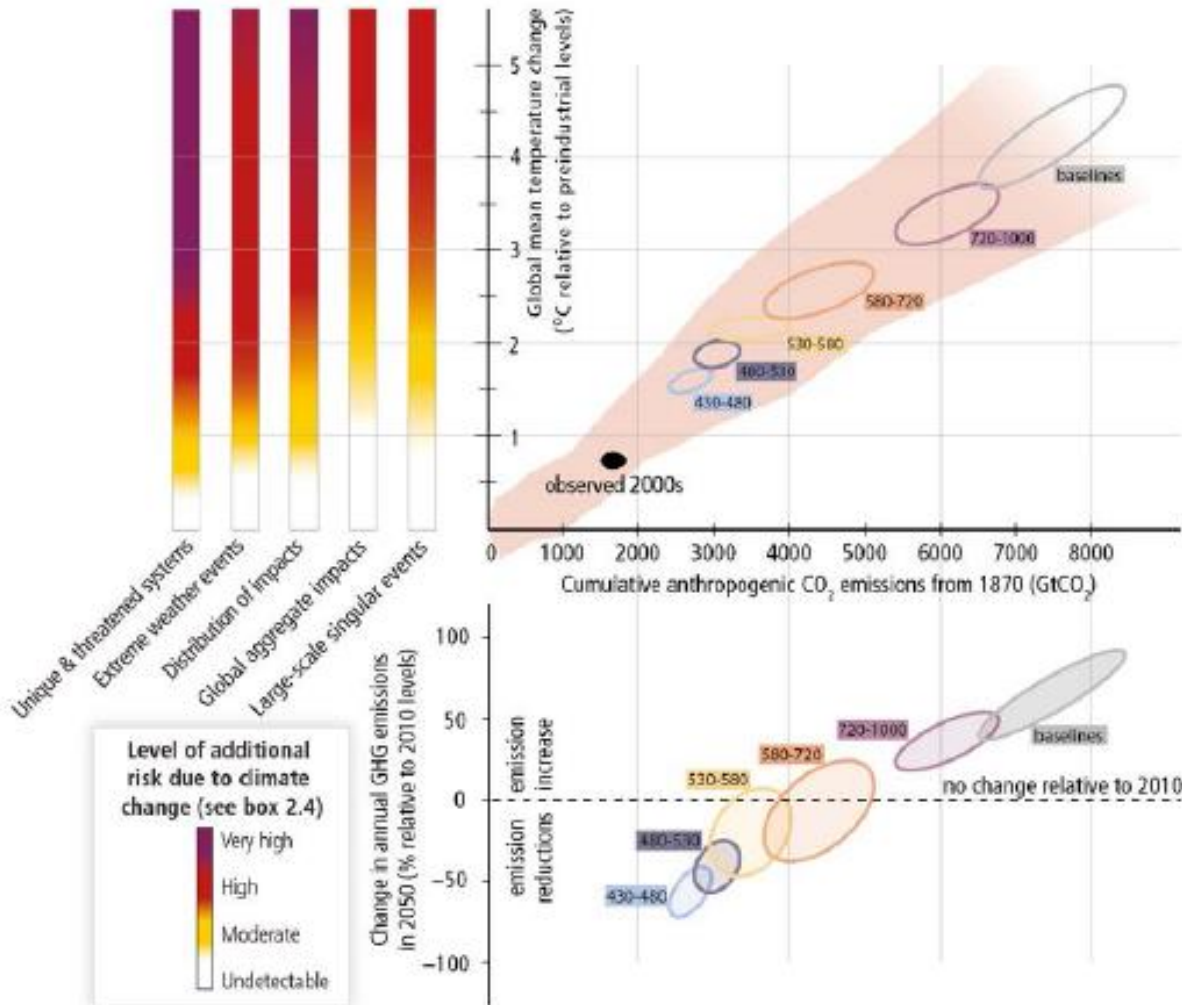
# The potential biodiversity cost of renewable energy

Dr James Pearce-Higgins  
Director of Science  
*[james.pearce-higgins@bto.org](mailto:james.pearce-higgins@bto.org)*



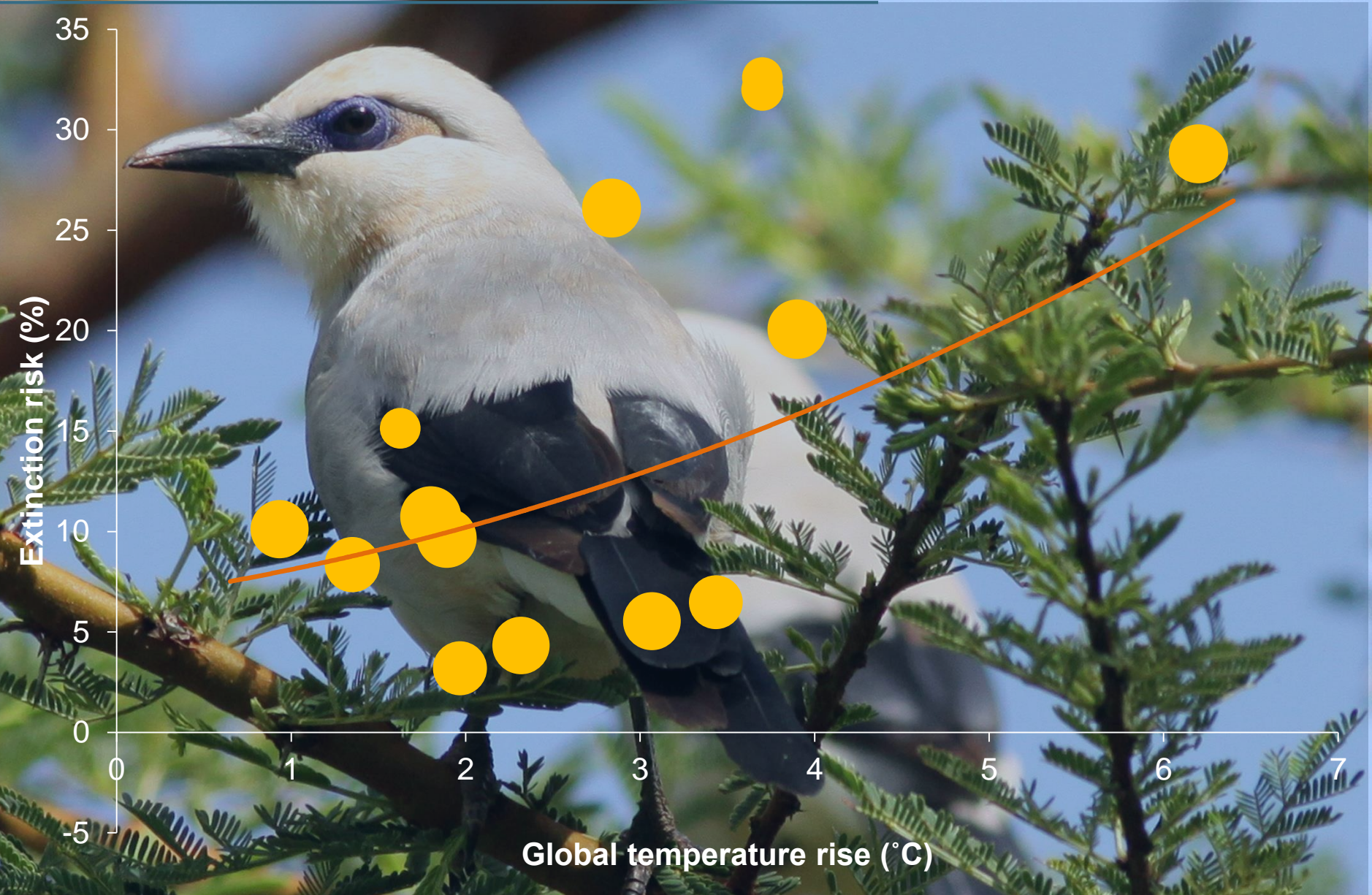
# The need for mitigation

(A) Risks from climate change... (B) ...depend on cumulative CO<sub>2</sub> emissions...

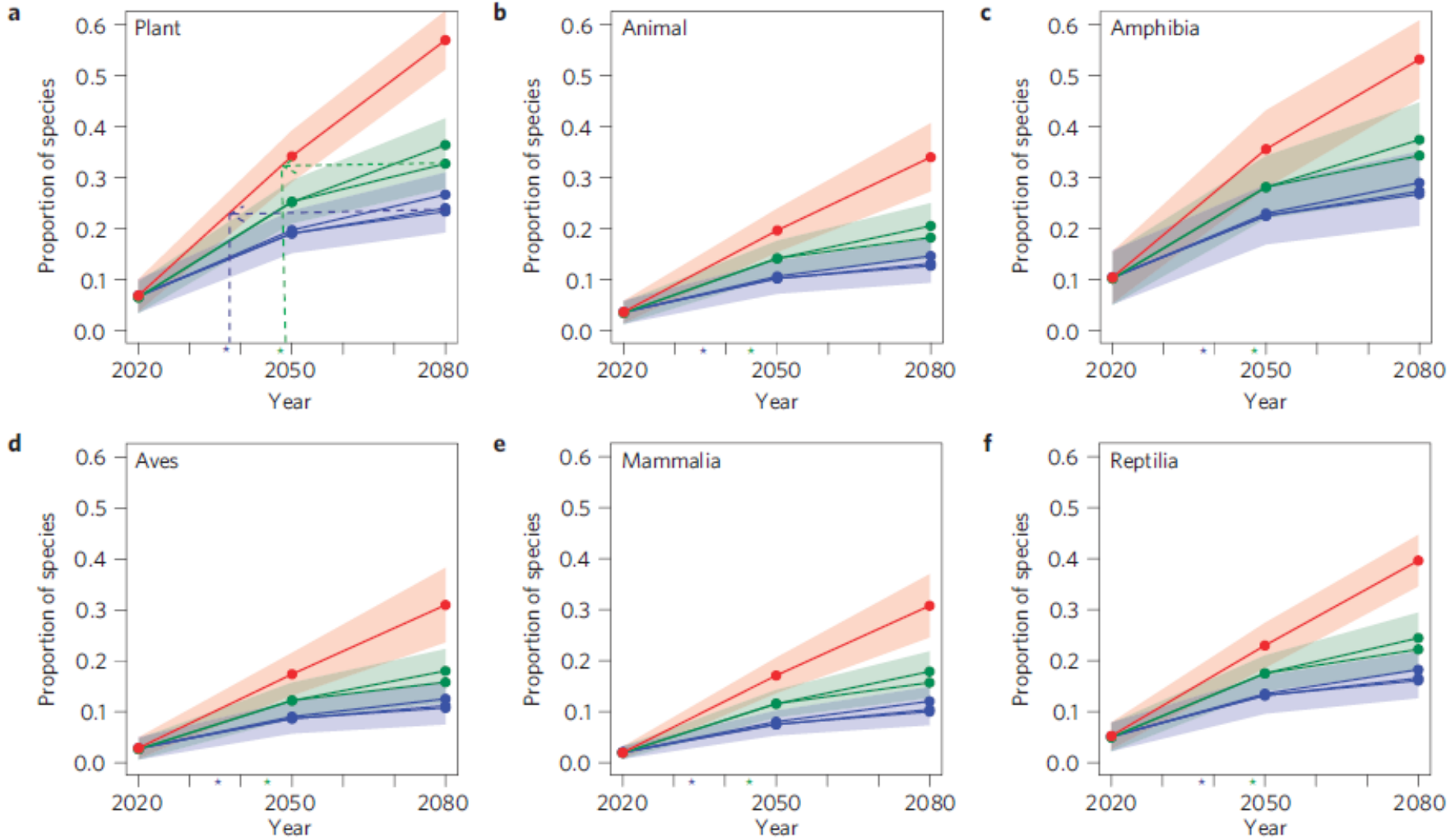


(C) ...which in turn depend on annual GHG emissions over the next decades

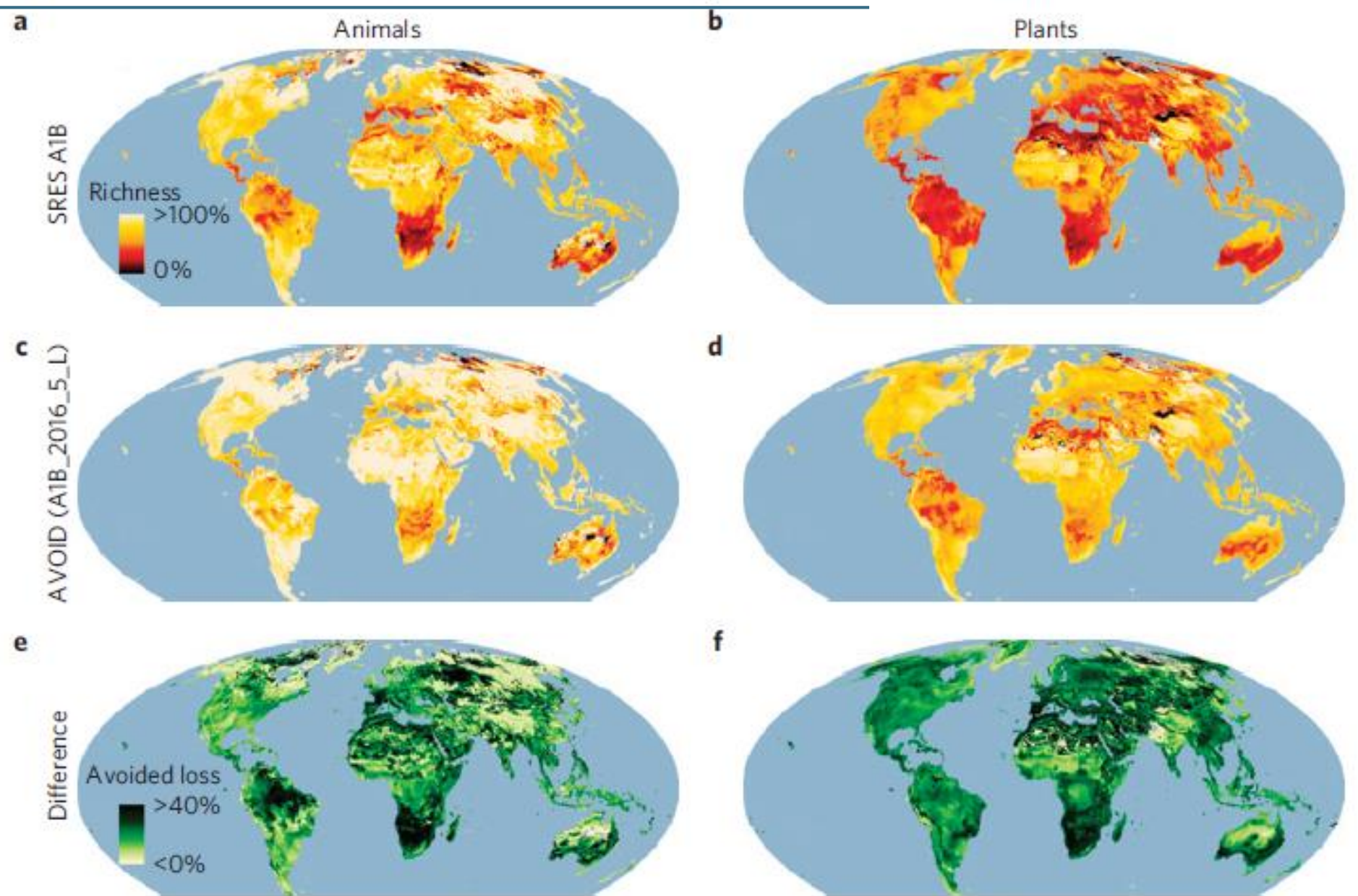
# The need for mitigation



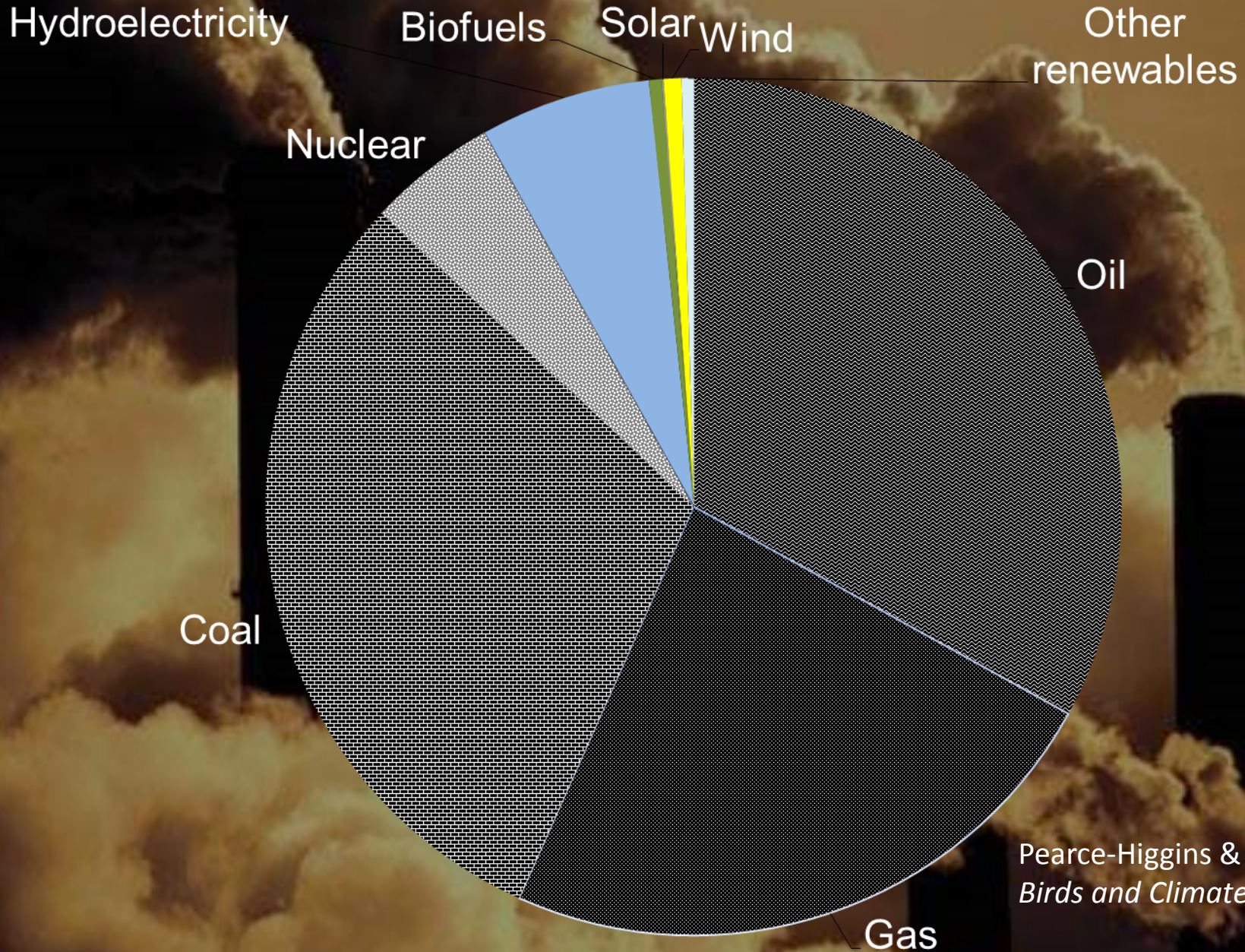
# The need for mitigation



# The need for mitigation



# The need for renewable energy



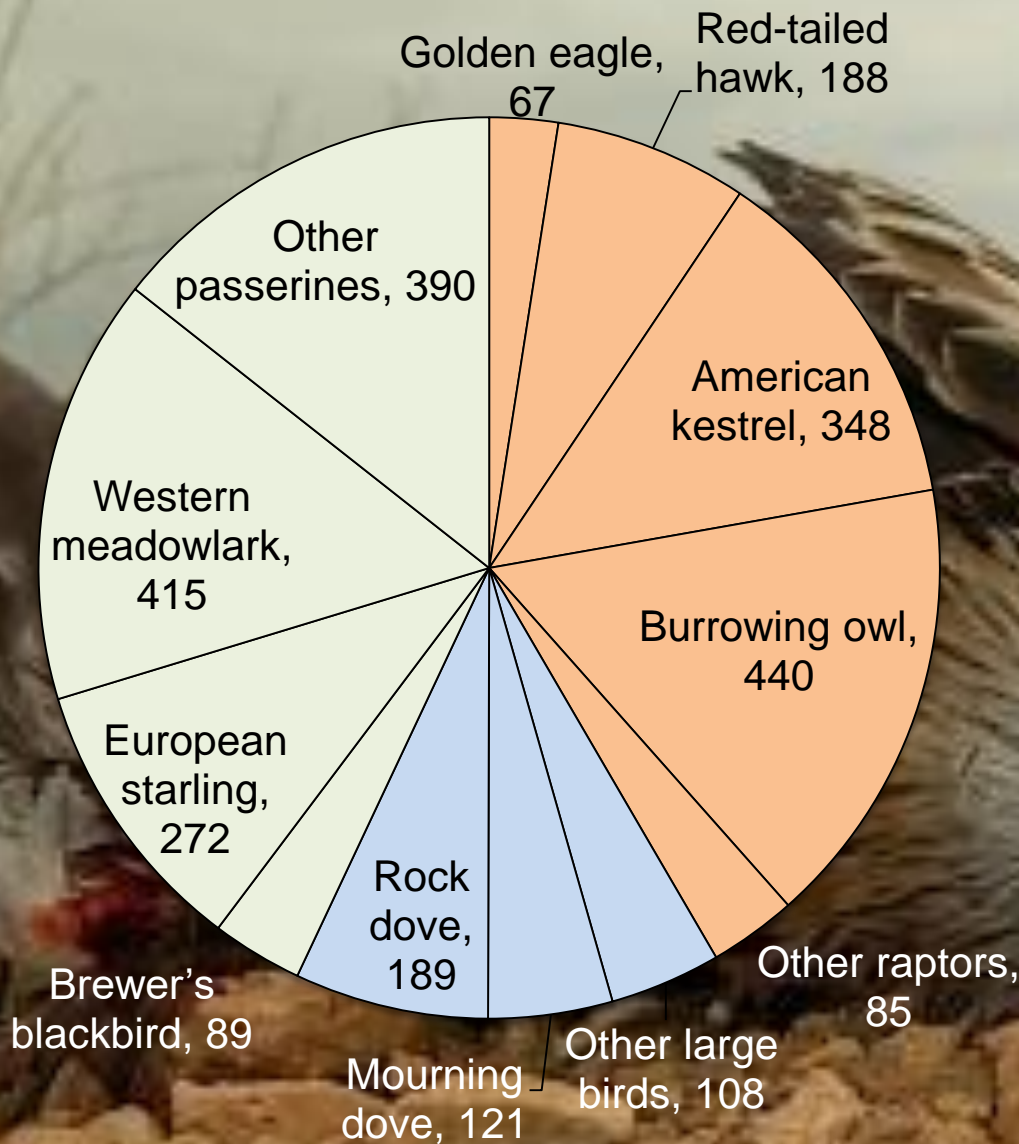
Pearce-Higgins & Green (2014)  
*Birds and Climate Change*

# The potential cost of renewable energy

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# The potential cost of wind



23,000 birds USA<sup>1</sup>

17,000 birds Canada<sup>1</sup>

47,000 bats Canada<sup>2</sup>

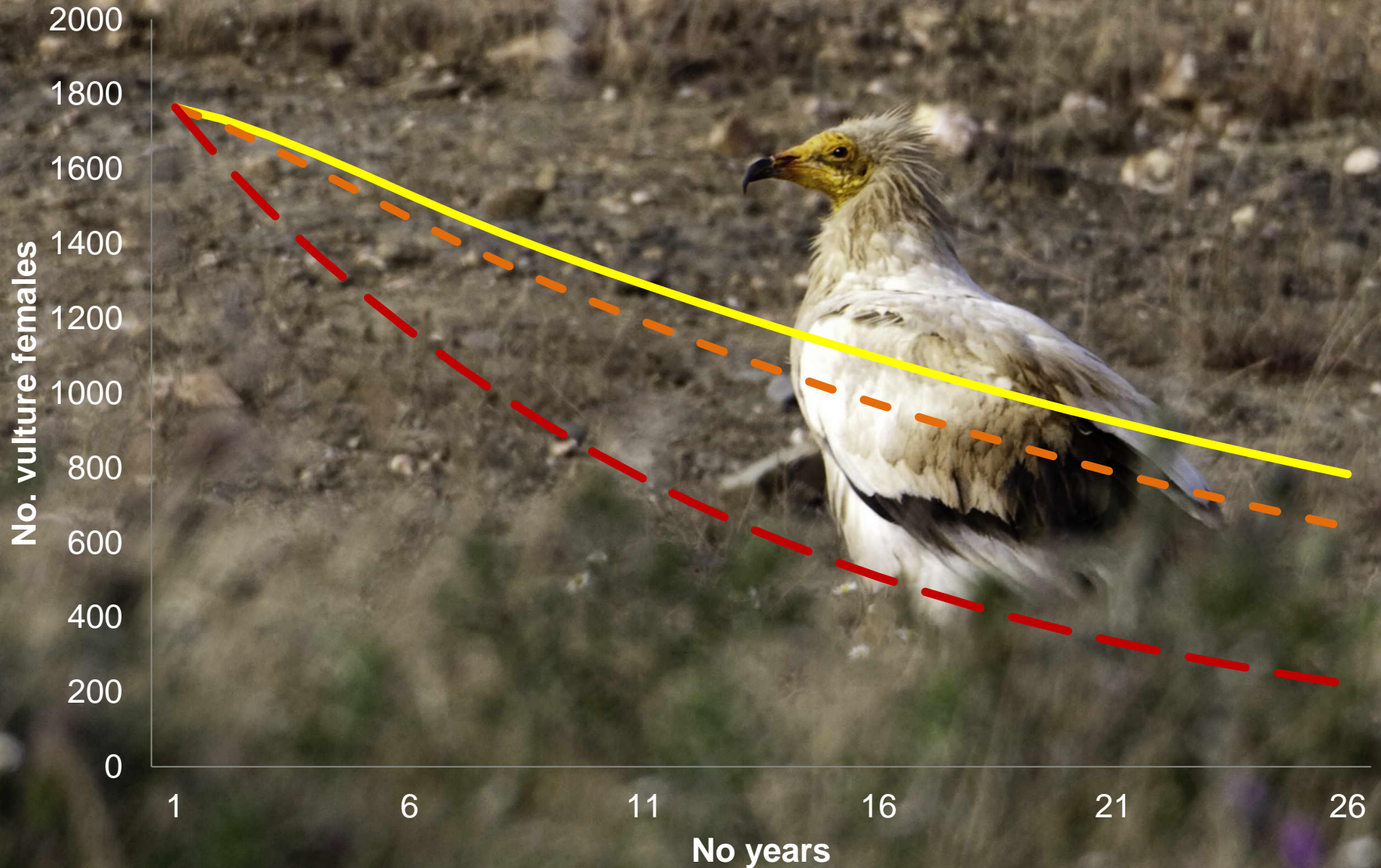
<sup>1</sup>Loss *et al.* 2012 *Ann. Rev. Ecol. Evol. Sys.*

<sup>2</sup>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*

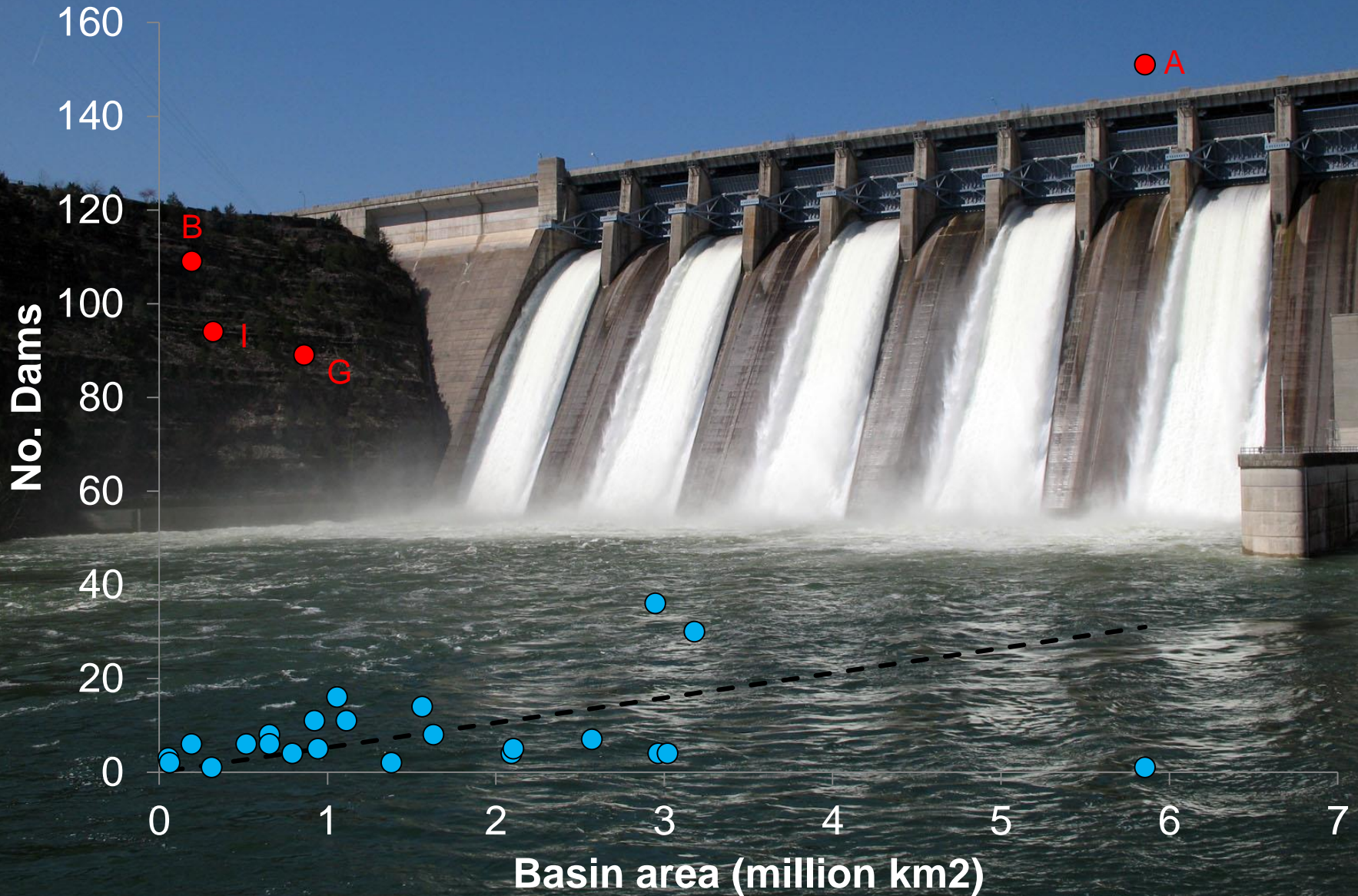
# The potential cost of solar



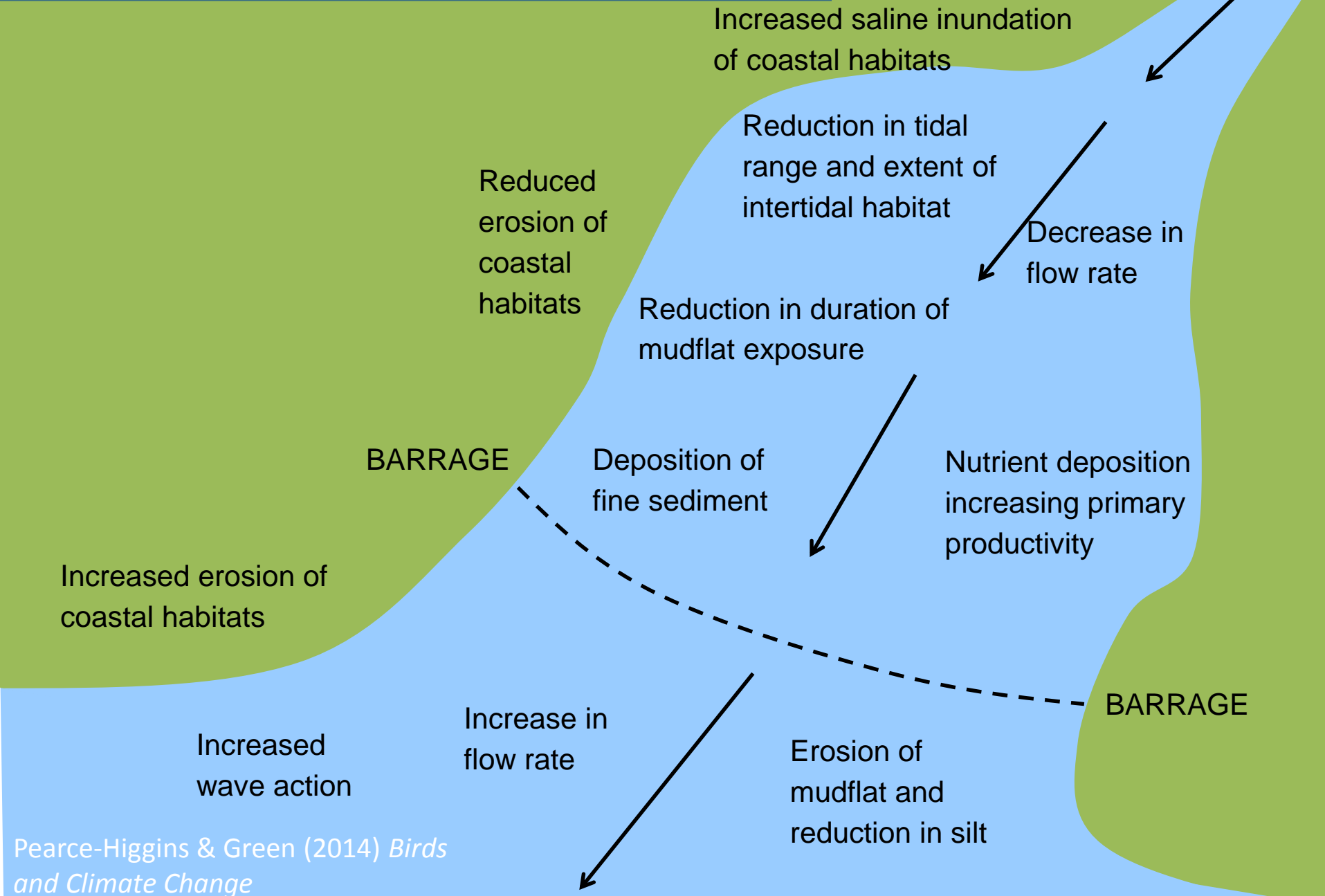
McCrary *et al.* (1986) *J. Ornith*



# The potential cost of hydropower



# The potential cost of hydropower



# The potential cost of biofuel



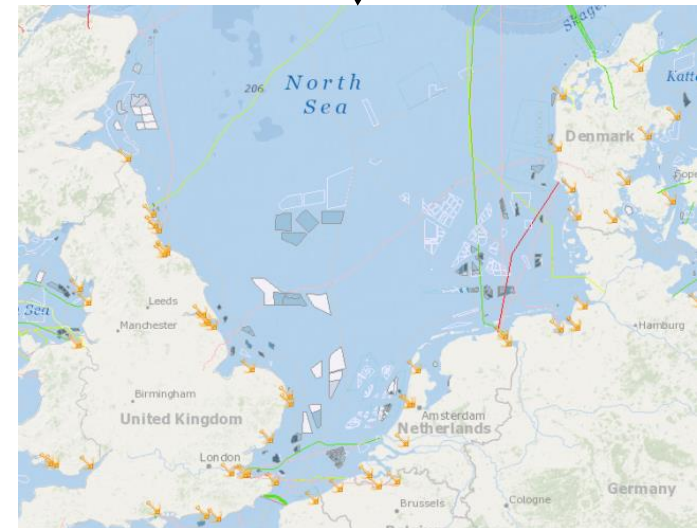
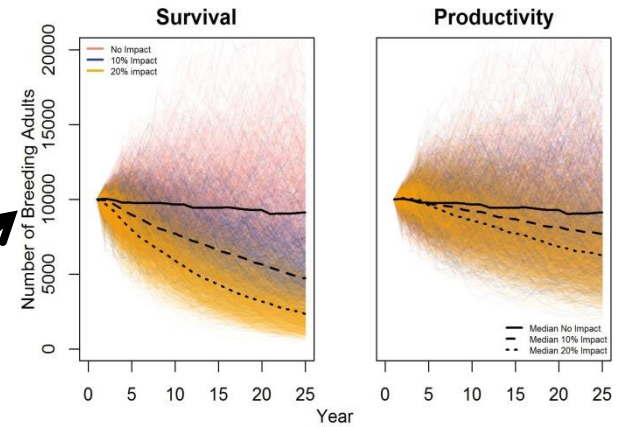
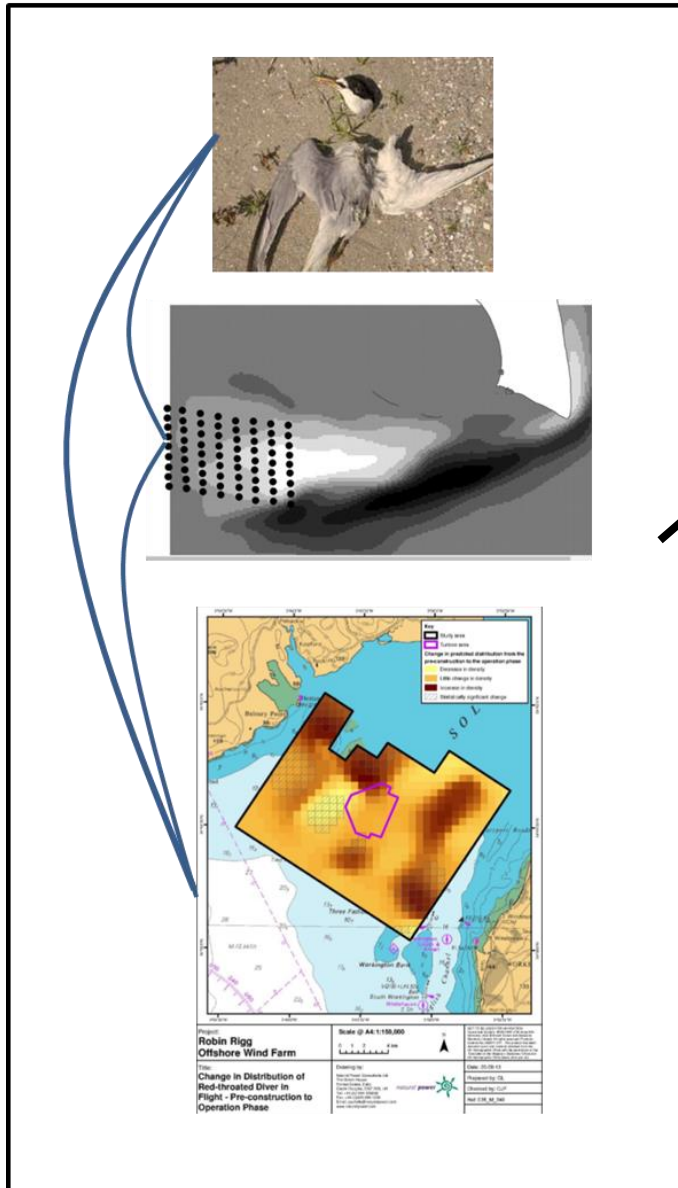
# Energy efficiency



# Impacts on species

## IMPACTS ON POPULATIONS

### IMPACTS ON INDIVIDUALS



### CUMULATIVE IMPACTS

# Key questions

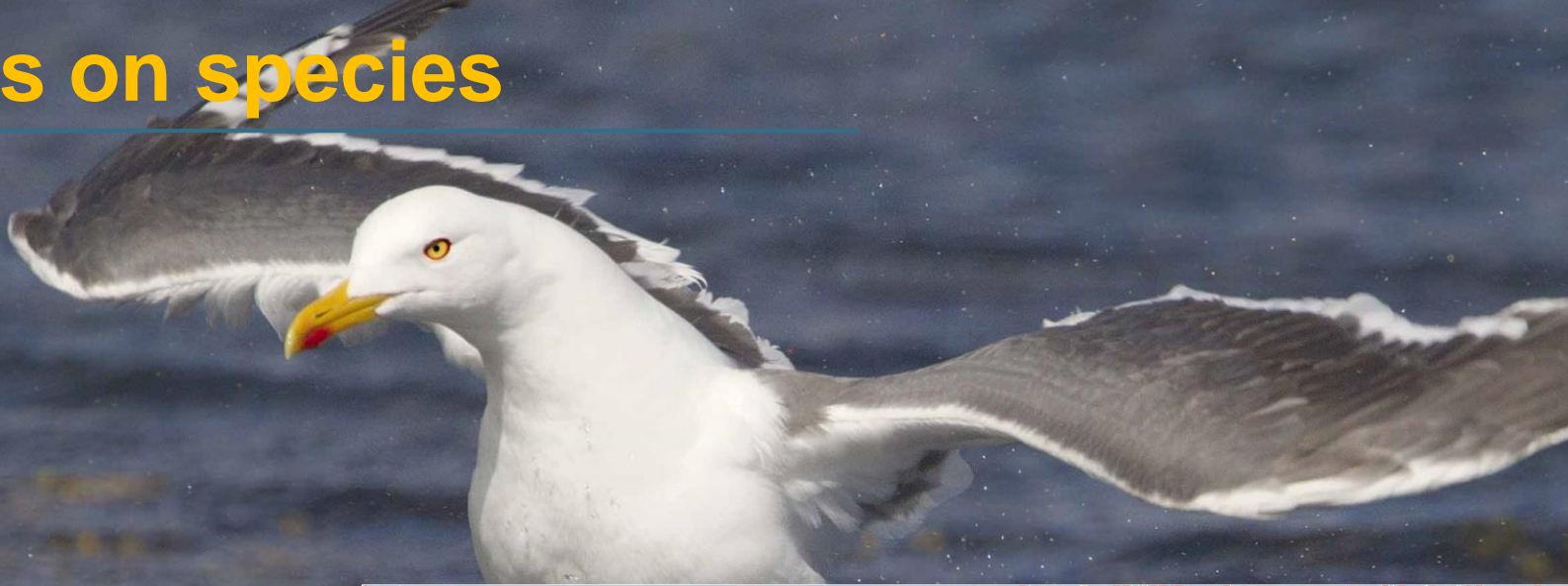
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- What are impacts on populations?
- What is cumulative impact on species?
- How can impacts be avoided?

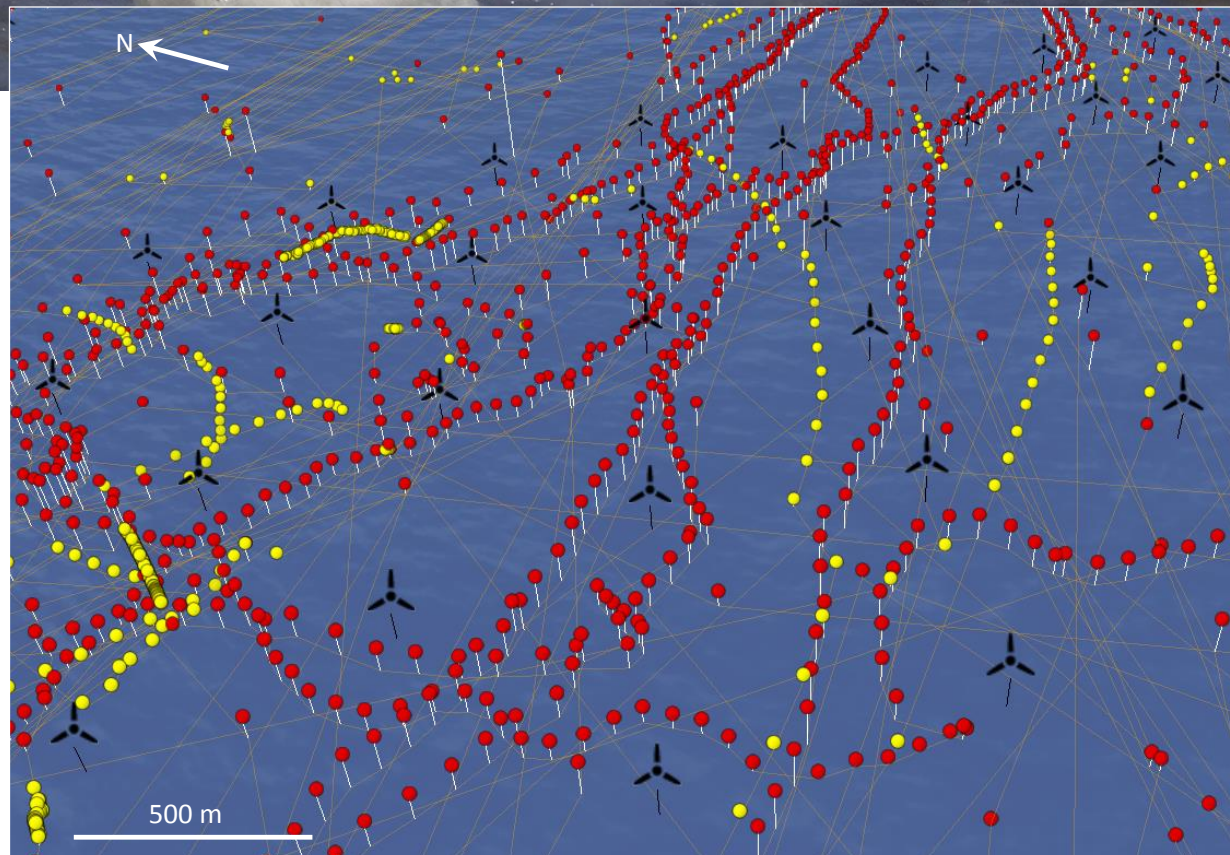
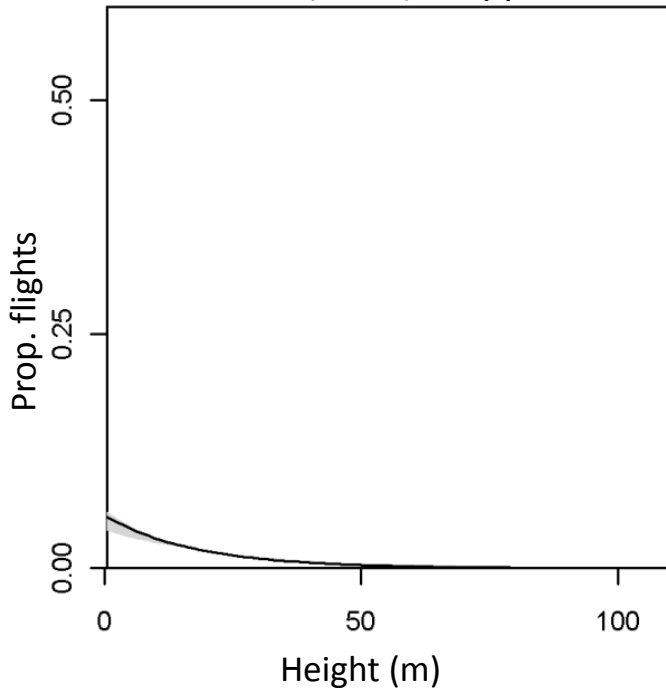




# Impacts on species



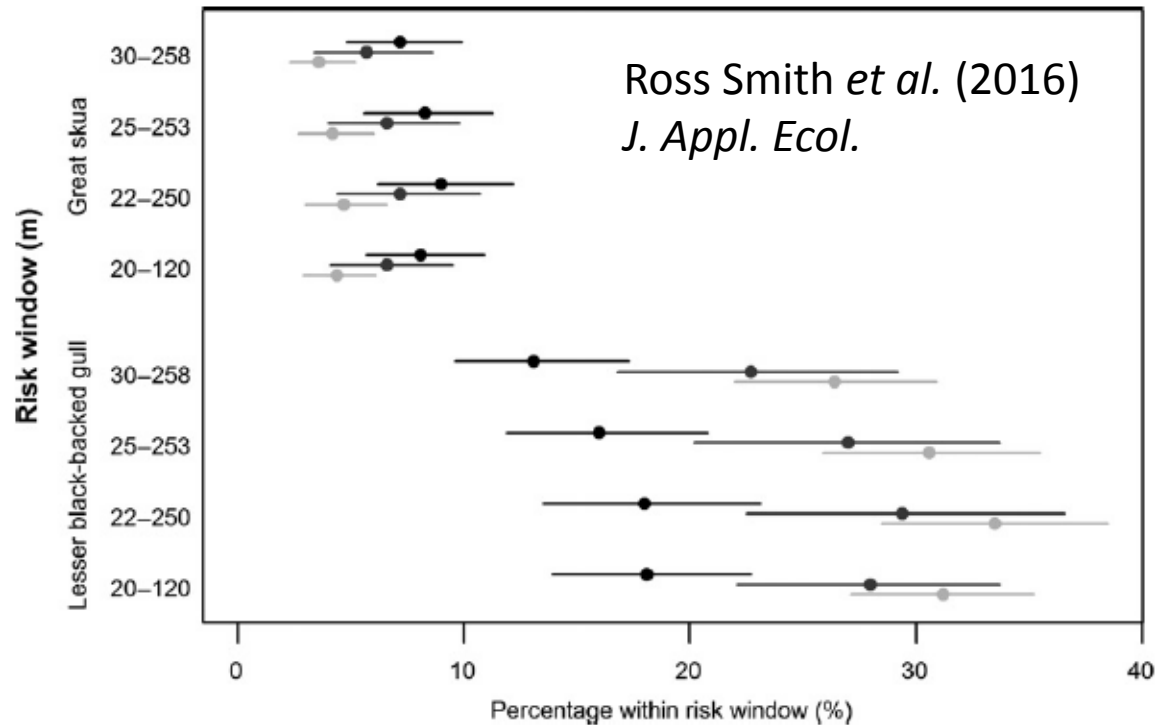
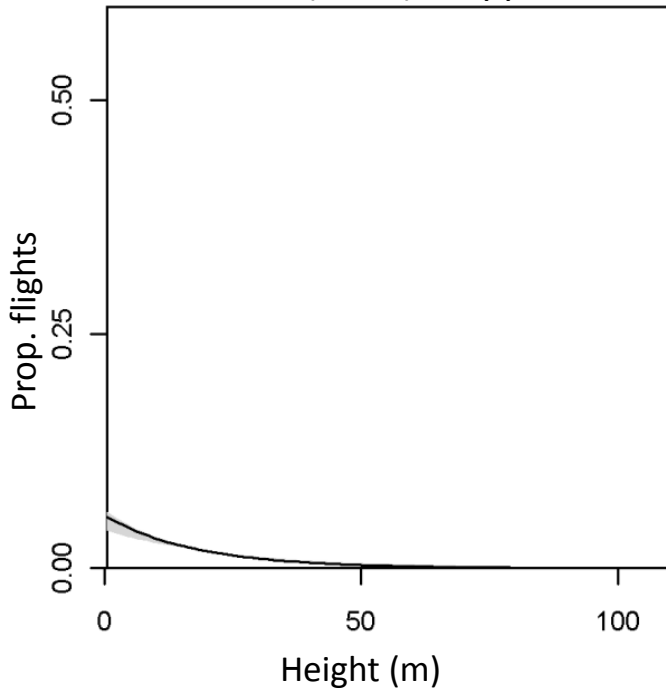
Johnston *et al.* (2014) *J. Appl. Ecol*



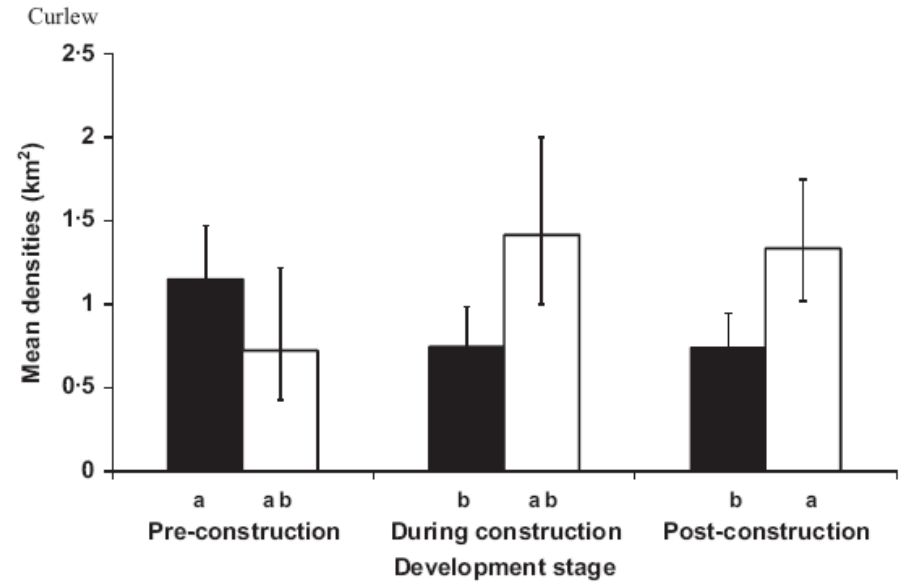
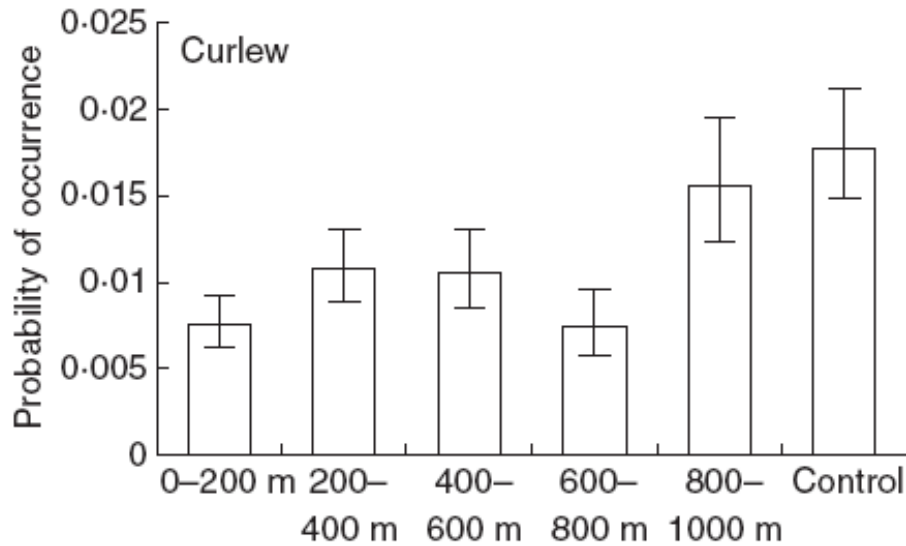
# Impacts on species



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



# Impacts on species



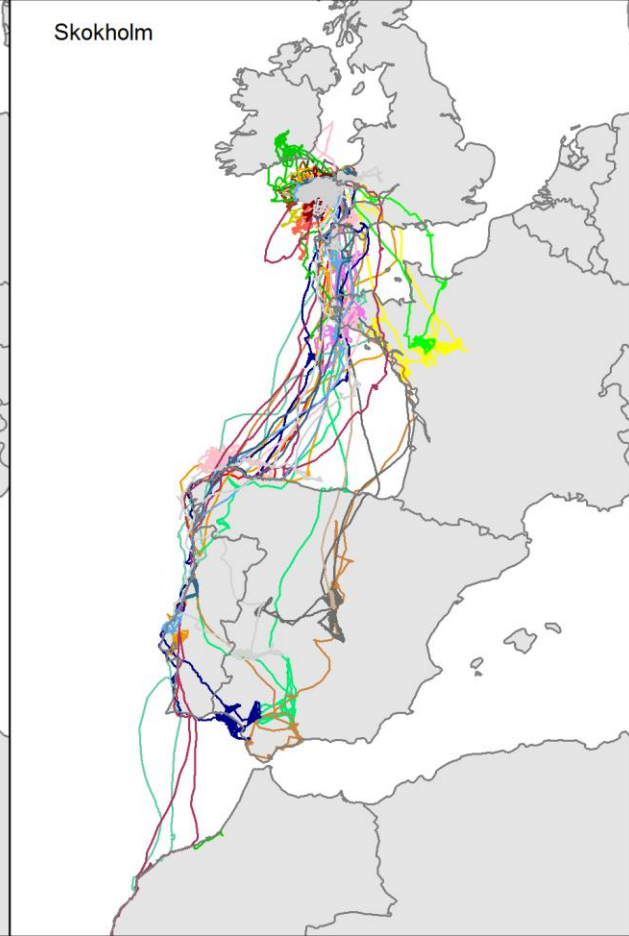
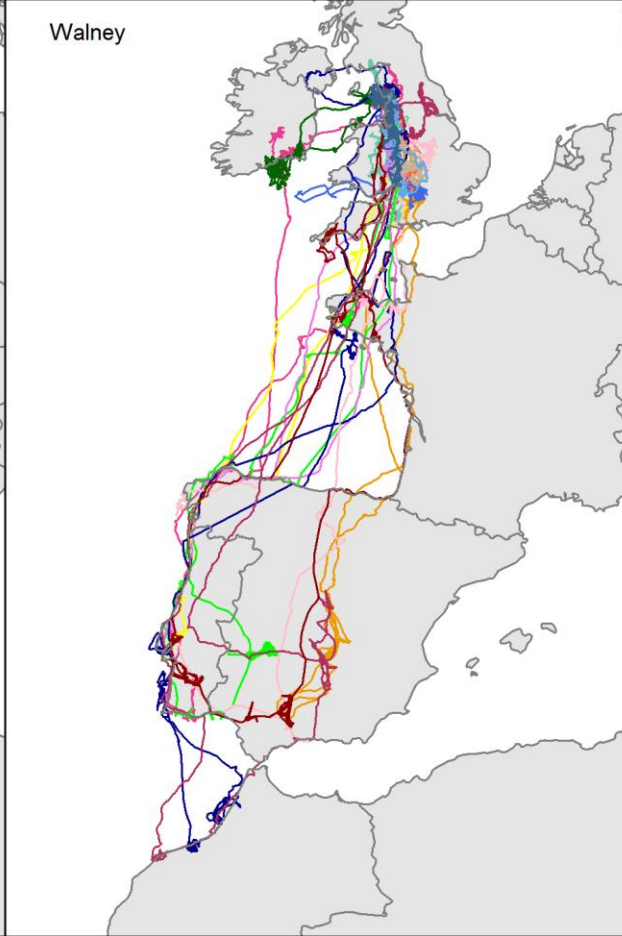
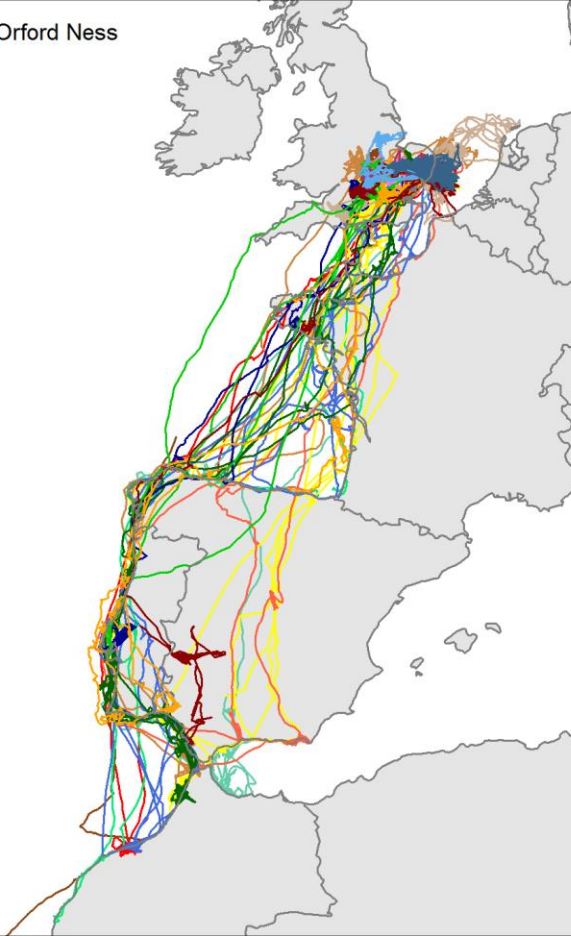
# Impacts on species



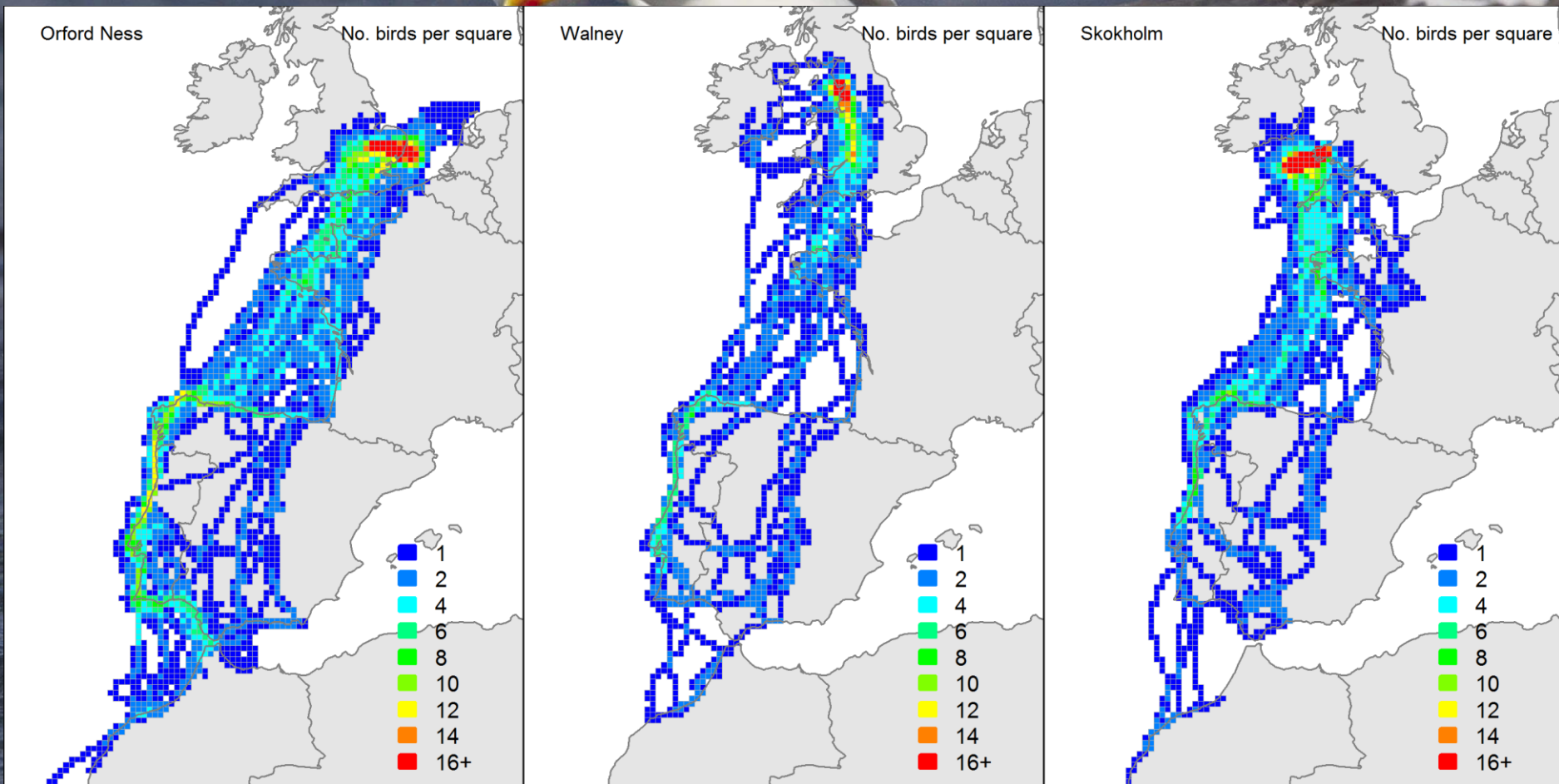
Orford Ness

Walney

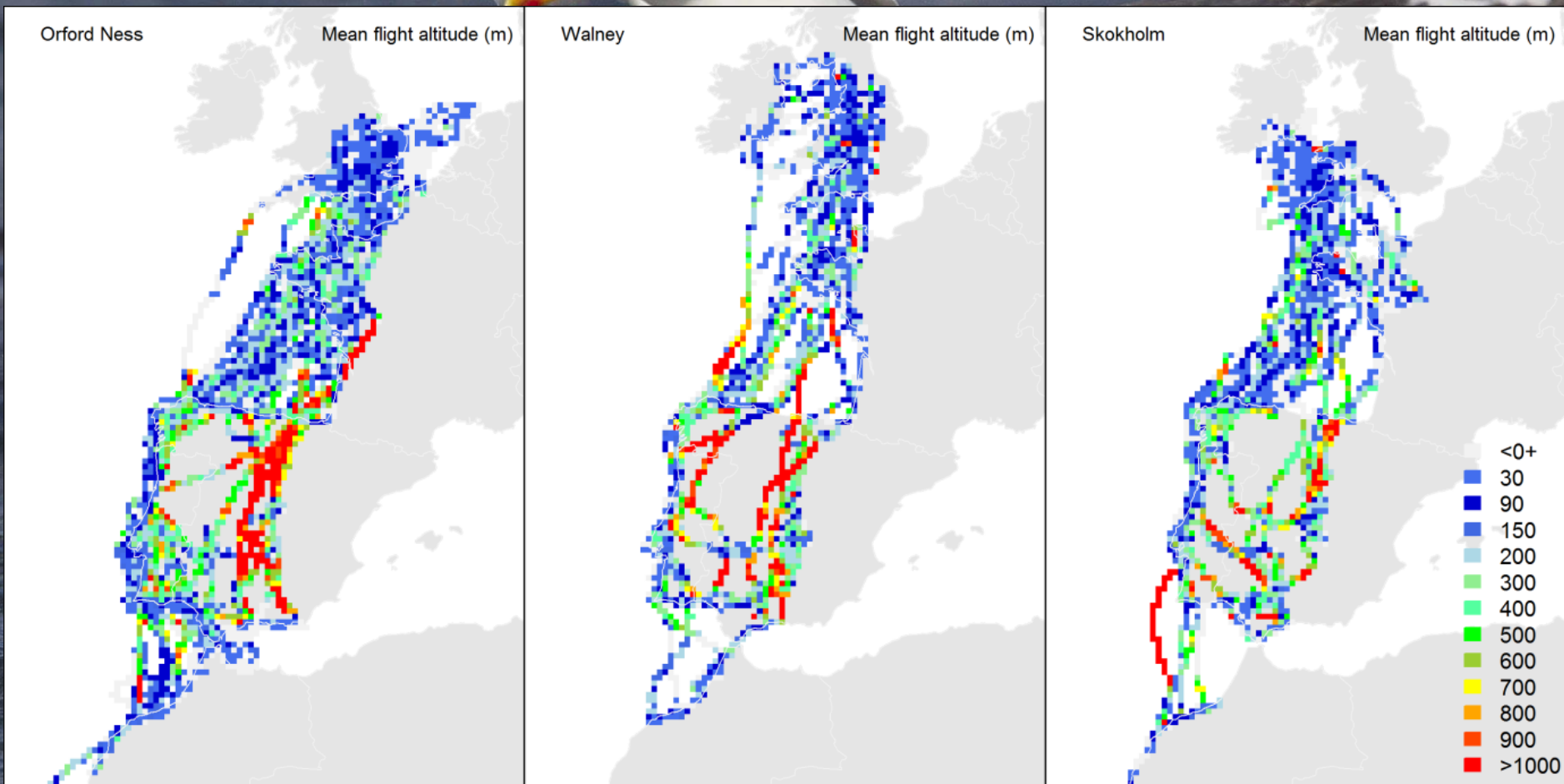
Skokholm



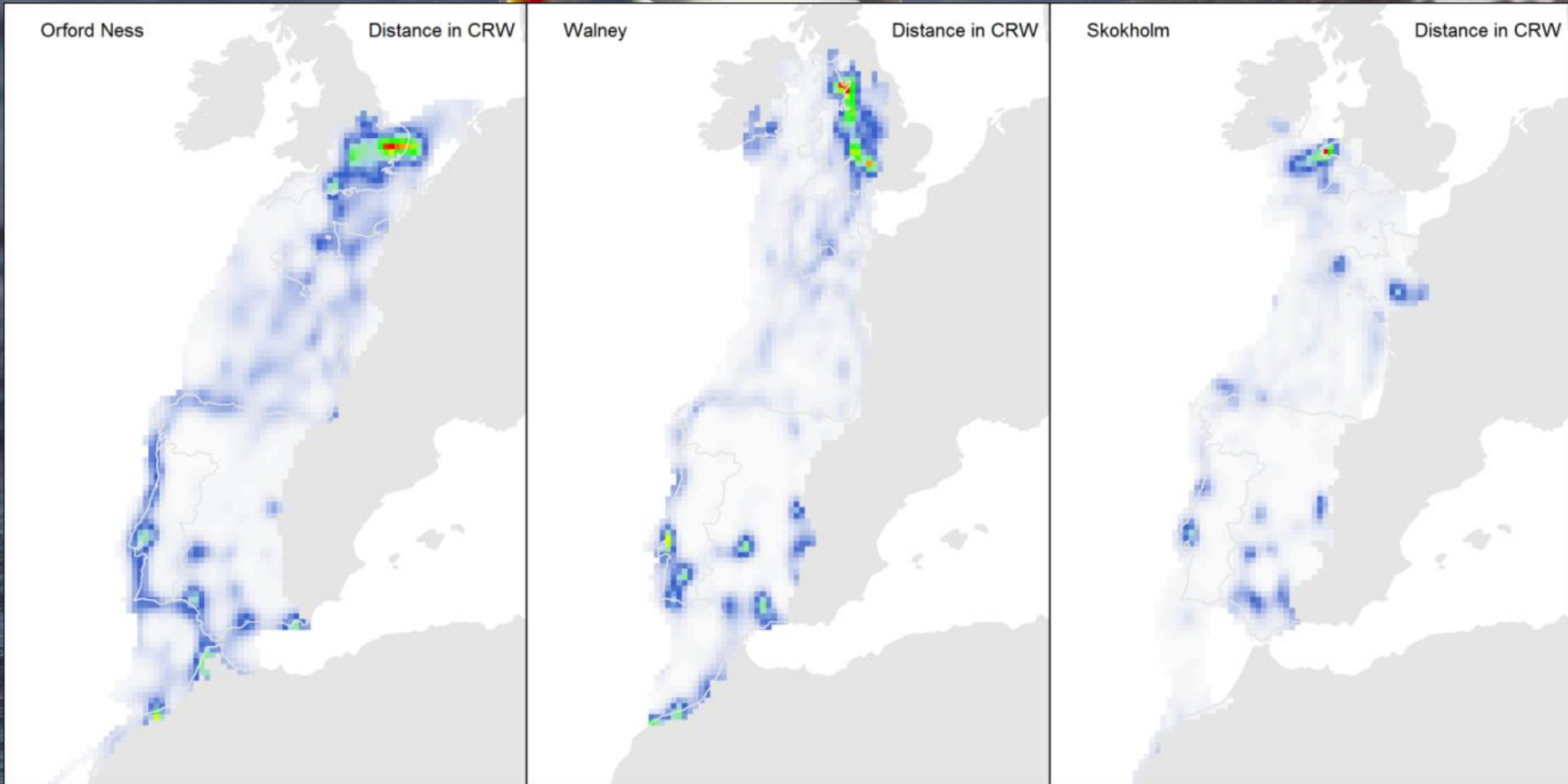
# Impacts on species



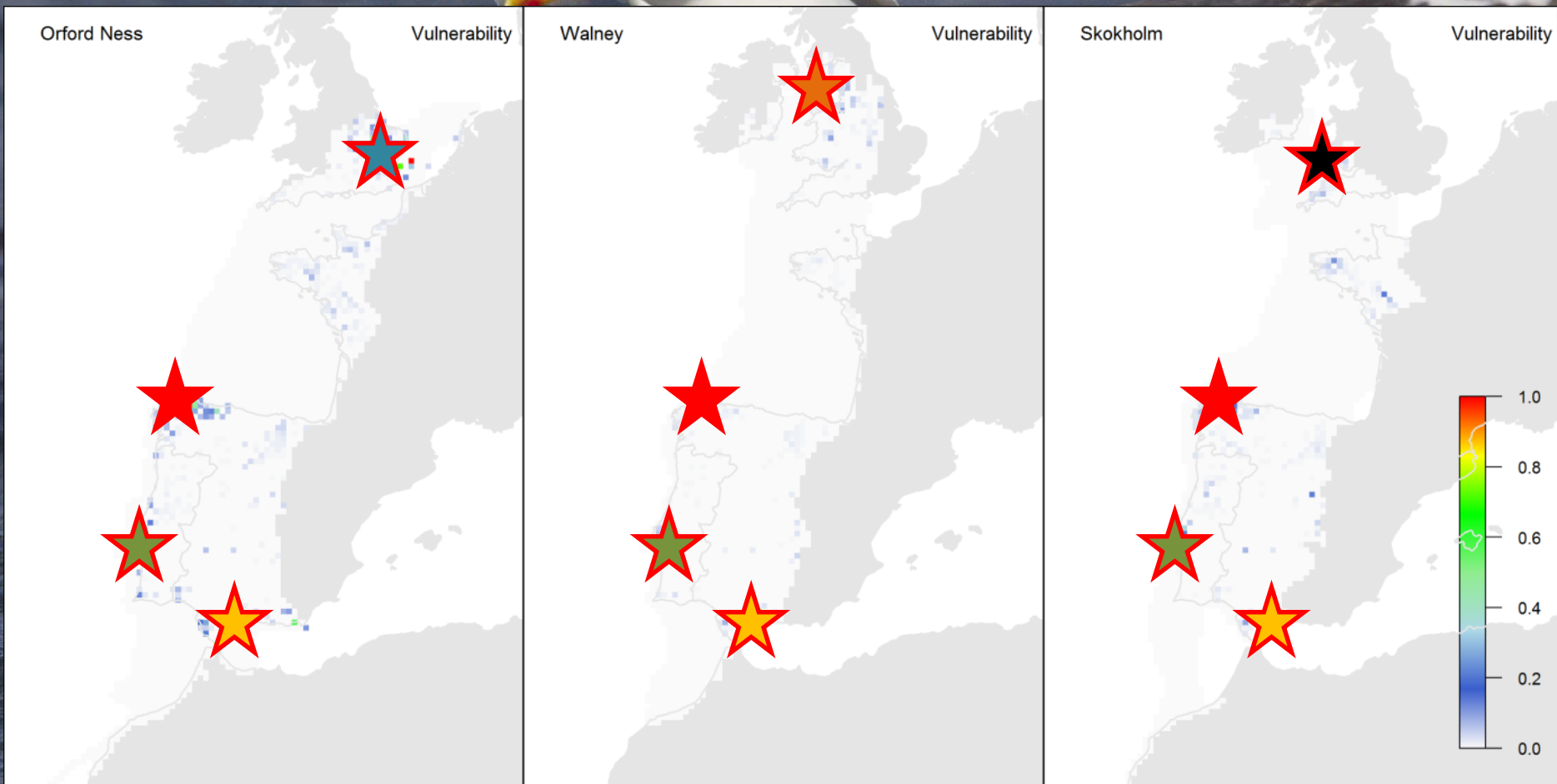
# Impacts on species



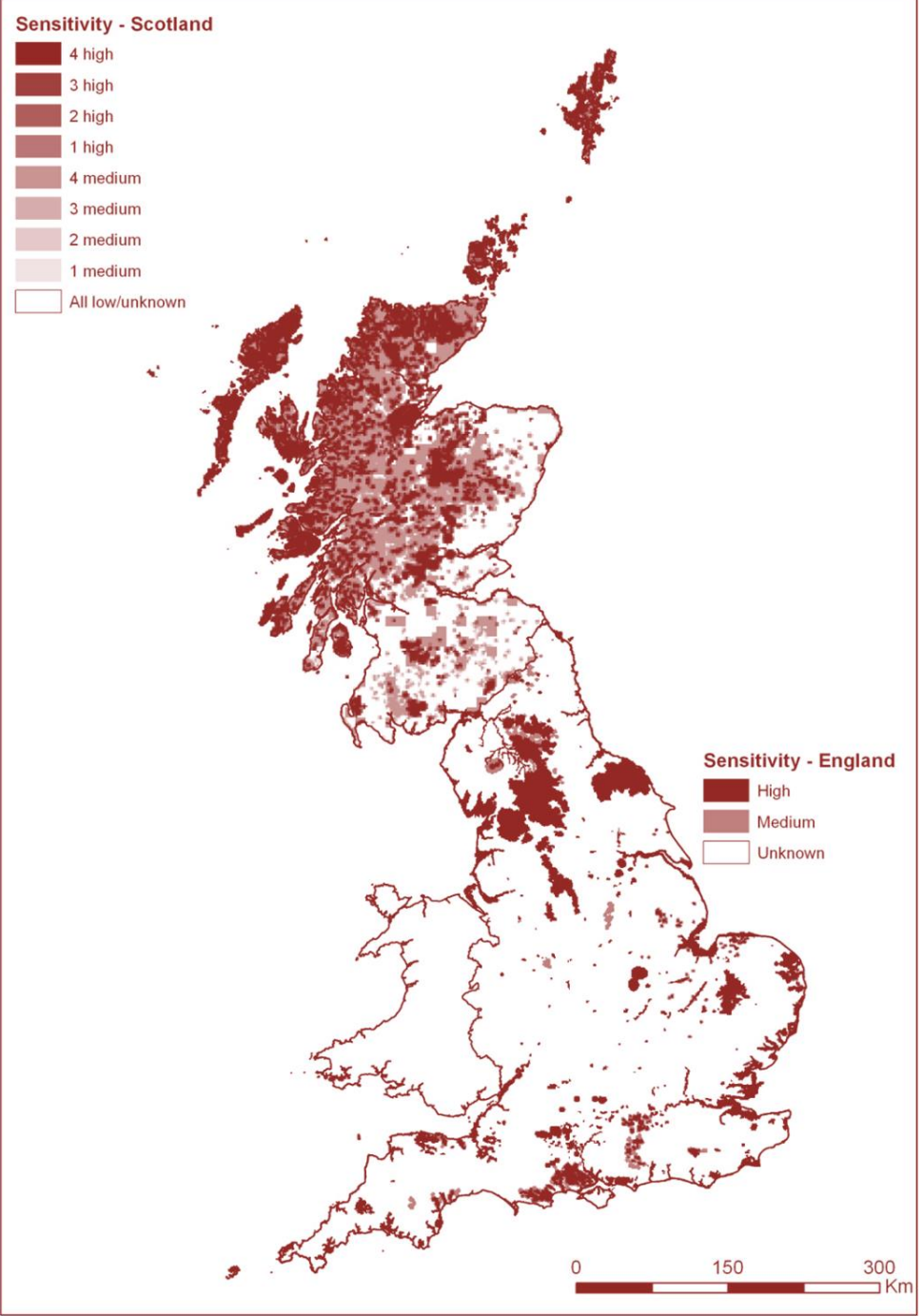
# Impacts on species



# Impacts on species







Edmund Fellowes / BTO

# Key questions


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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

**Cambridge Conservation Initiative**

*transforming the landscape of biodiversity conservation*



**BTO**  
Looking out for birds



giving  
nature  
a home



UNIVERSITY OF  
CAMBRIDGE

# Sensitivity

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

# Sensitivity

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- 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



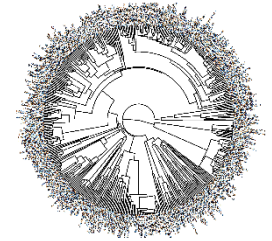
Study data



Trait data



Phylogeny



+

+

+



Trait-based modelling



Predictions to all species based on trait relationships

# Exposure

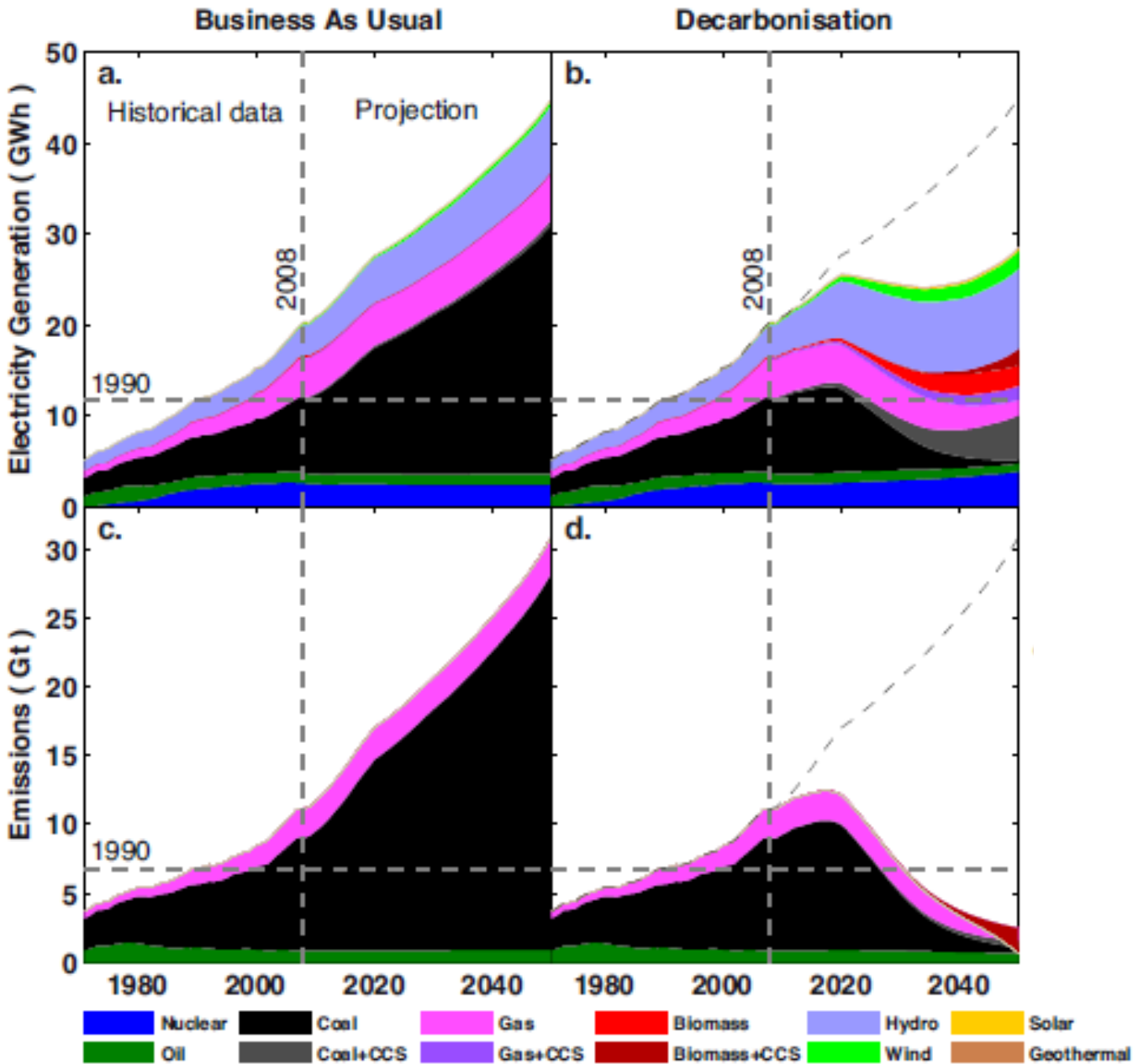
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- 4CMR macro-economic models used to assess future energy mixes for 3 scenarios ('business as usual', 'medium ambition', 'high sustainability'), 3 time periods (2015, 2030, 2050) and four renewables (wind, solar, hydro, bioenergy).
- Overlap between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

# Exposure



Mecure *et al.* (2014)  
Energy Policy



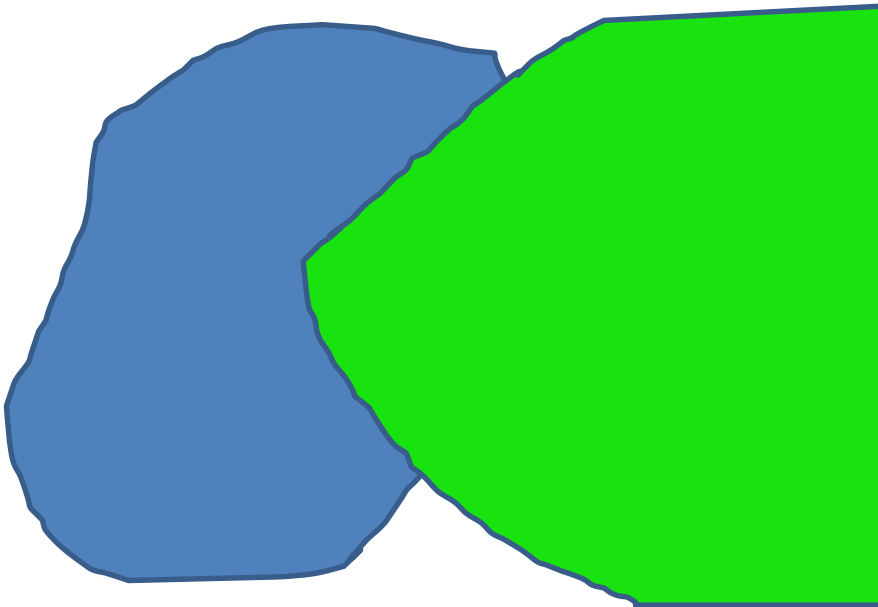
# Vulnerability

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- Vulnerability = sensitivity x exposure



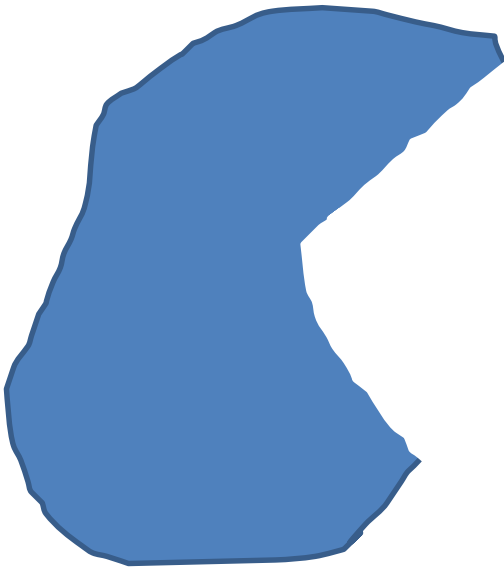
# Vulnerability

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- Vulnerability = sensitivity x exposure



50% loss of range extent

# Outputs

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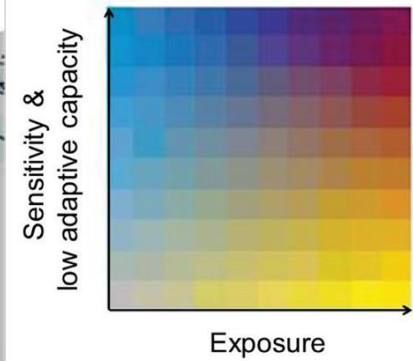
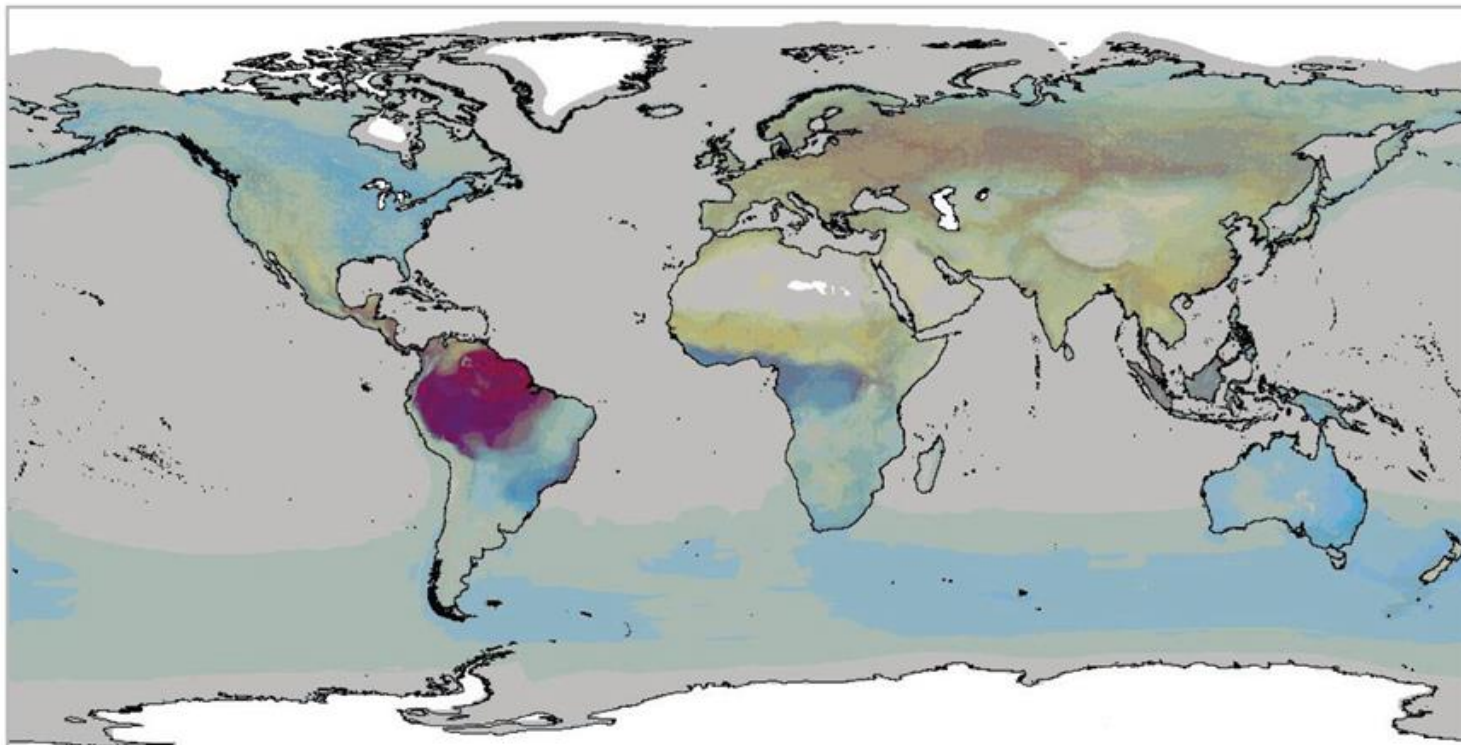
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- Paper of species' sensitivity to collision rates with turbines.
- Species assessments incorporated within Species Information Service.
- Hotspot maps of vulnerability to different renewable energies.
- Paper summarising potential global assessment 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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- This research is funded by the Cambridge Conservation Initiative, thanks to the generosity of the Arcadia Fund.
- It is steered by an advisory group consisting of Sue.O'Brien, Wendy Foden, Colin Galbraith, Mark Wright, James Watson & Aida Kowalska.

