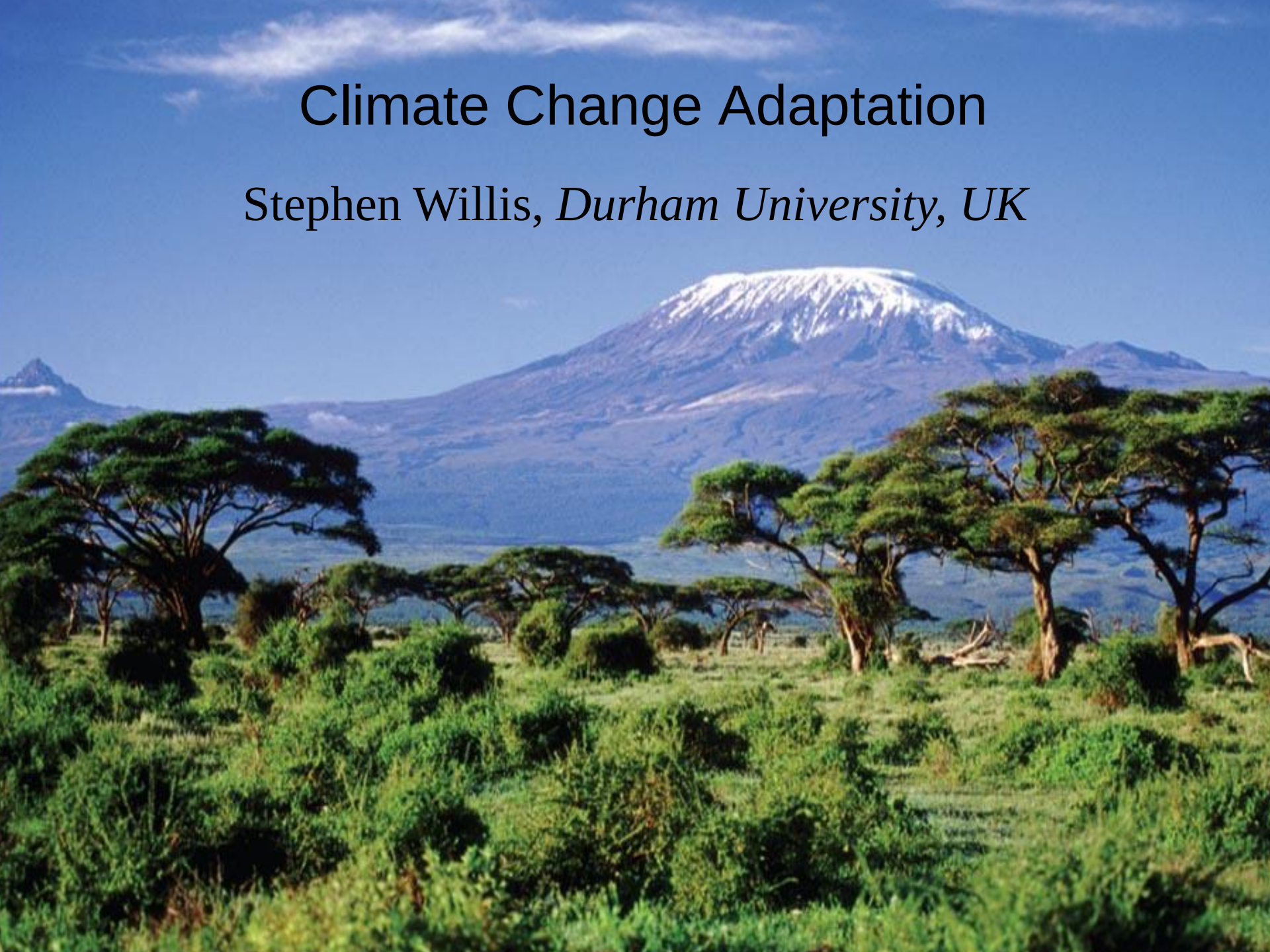
Climate Change Adaptation

Stephen Willis, *Durham University, UK*



Modelling range shifts

	Europe	Africa	RR spp.
Mean range size change	-20%	-4%	+7%
% spp. lose range	78%	62%	60%
% spp. >50% range loss	25%	24%	44%
Mean range shift (km)	301	596	144
Mean range overlap	42%	50%	47%
% spp. <10% overlap	12%	11%	20%
% spp >90% overlap & <10% range loss	2%	14%	18%

Incorporating life-history traits

- Climate is not the only determinant of species ranges
- So, exposure to CC is just one component of vulnerability to CC impacts
- Need to consider *sensitivity* and *adaptive capactiy*

Incorporating life-history traits

Sensitivity:

- The potential for species to cope with CC *in situ*
- Assessed by scoring traits such as habitat/microhabitat specialisation, narrow environmental tolerances, potential for disruption of environmental triggers, interspecific interactions, & rarity

Adaptive capacity:

- Extent to which species is capable of mitigating the impacts of changes in their immediate environment through dispersal and/or microevolutionary change
- Assessed by scoring dispersal ability, dispersal barriers, low genetic diversity, long generation time and low reproductive output

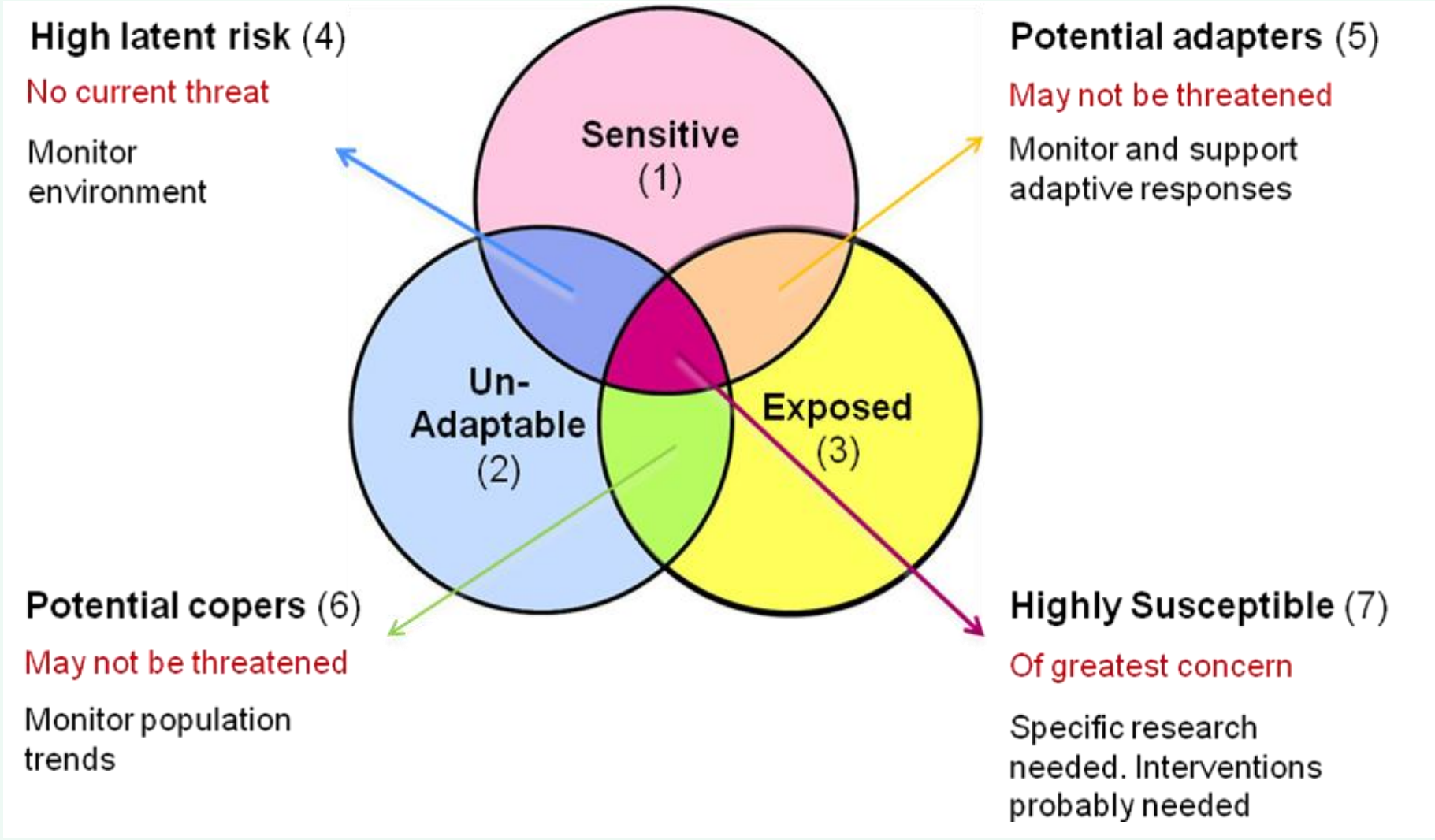
Incorporating life-history traits

Exposure:

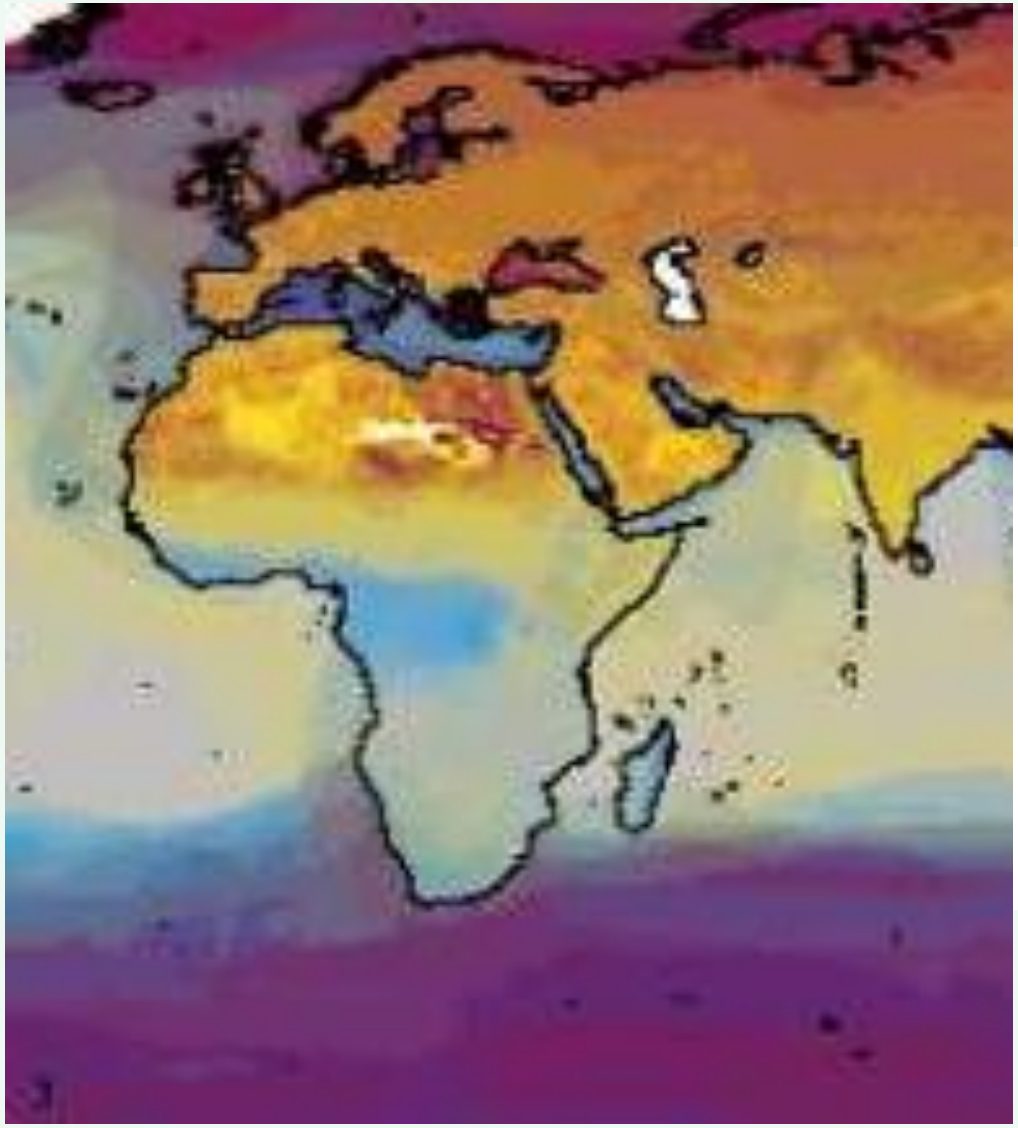
- The degree of environmental change expected based on sea level rise and projected changes in monthly temperature and precipitation (means and variability) across species' ranges

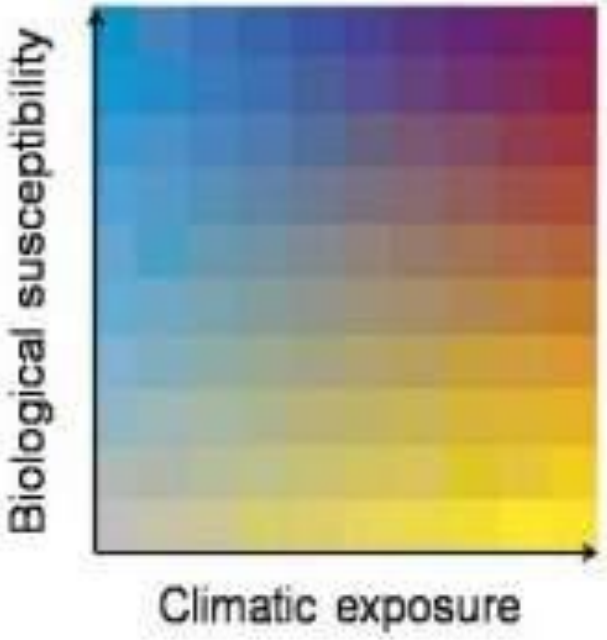
- Score each species for each trait. Upper quartile of scores defined as 'high'
- Species scoring high for exposure, sensitivity & 'unadaptiveness' = highly susceptible

Incorporating life-history traits



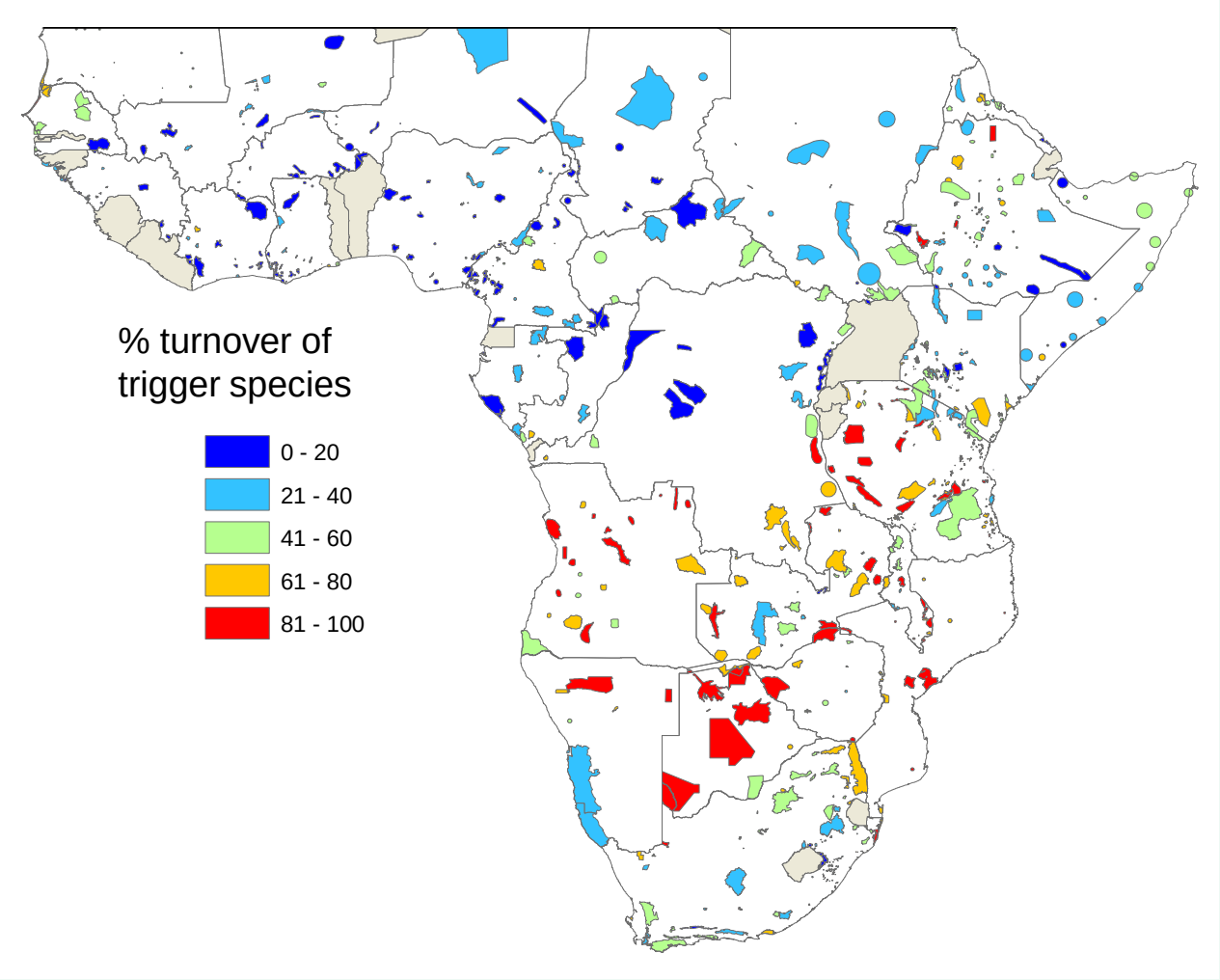
Incorporating life-history traits





Assessing impacts on IBA network

- Fynbos, Afrotropical Highlands, Namib-Karoo: lose most
- Sudan/Guinea Savanna, Sahara-Sindian biomes: gain most

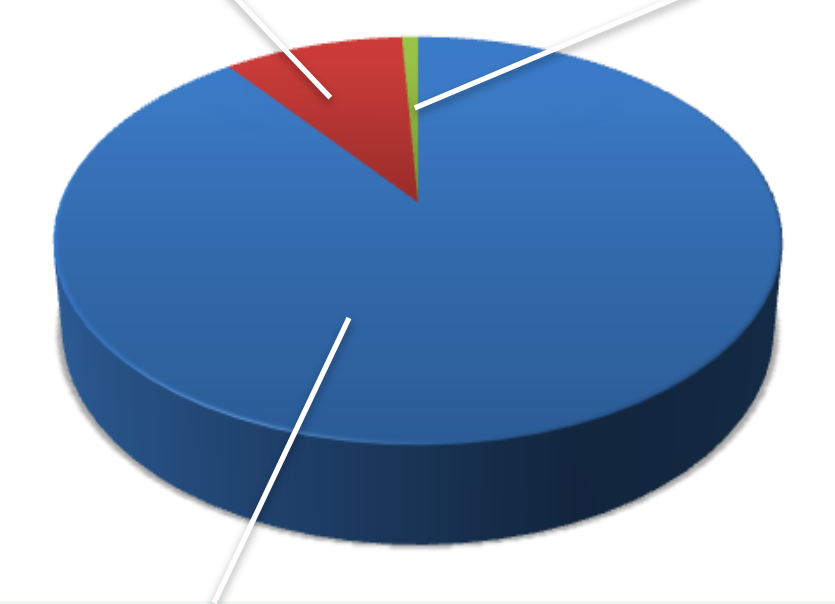


The Future Role of Protected Areas

➢ Persistence of individual priority species by 2085 within IBAs for which they trigger designation

Retain suitable climate space somewhere within the network
62-93 species (8-11%)

Lose all suitable climate space from within the network
7-8 species (0.9-1%)



Retain suitable climate space in ≥ 1 IBA in which they currently trigger designation
714-746 species (88-92%)

- Indicates remarkably high persistence of priority species (i.e. network robustness)

What do these results mean for individual site-managers?

Conservation Biology

Contributed Paper

Toward a Management Framework for Networks of Protected Areas in the Face of Climate Change

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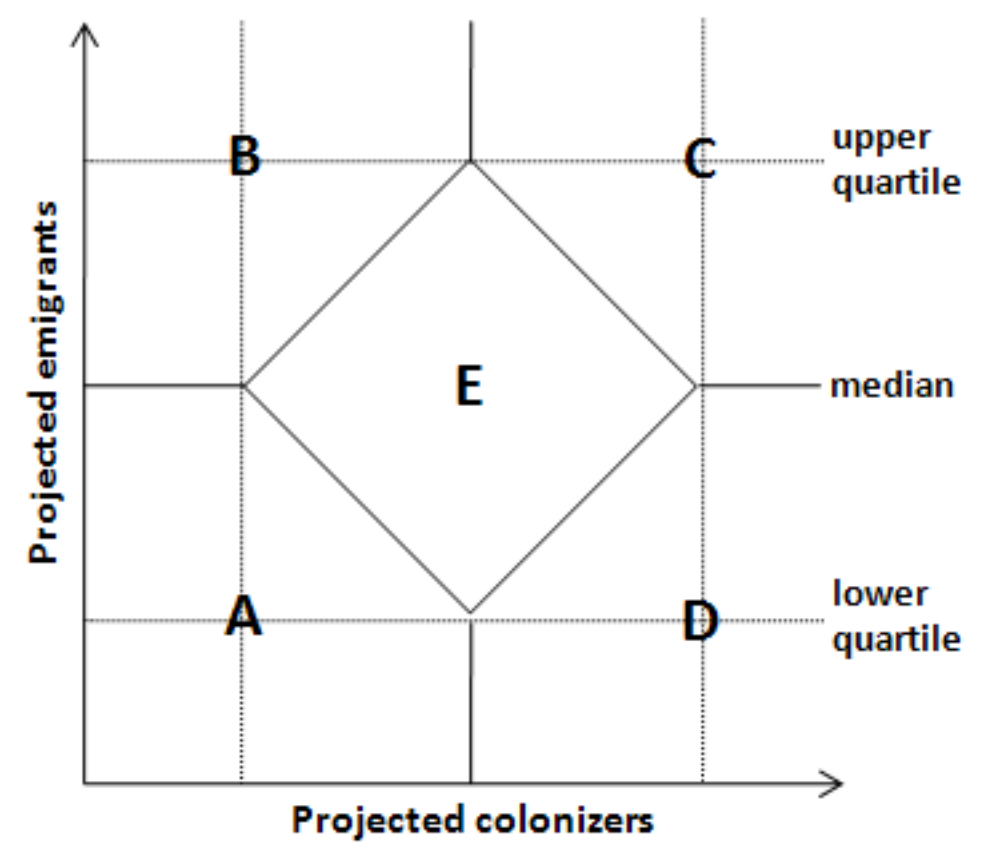
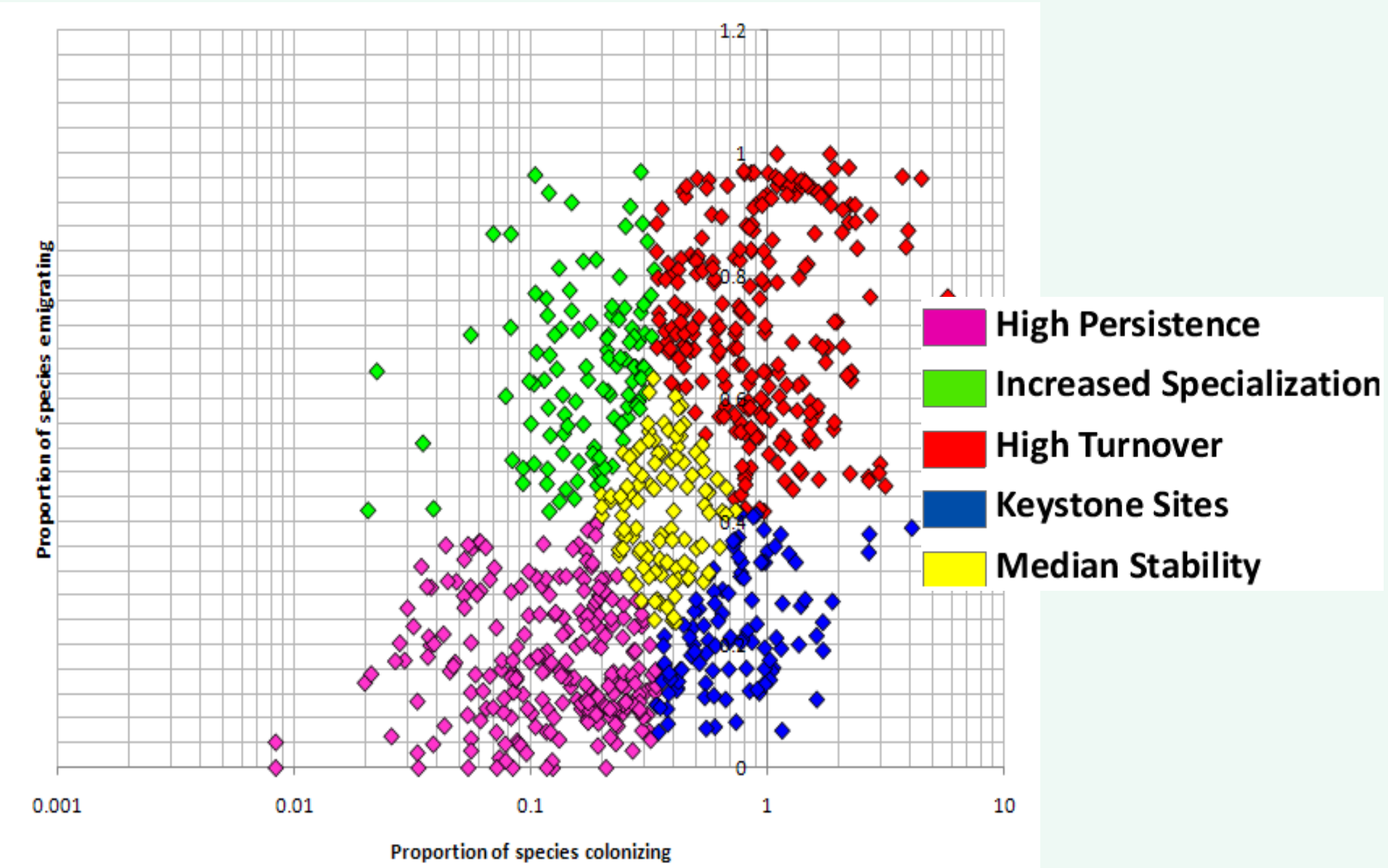
➢ Translating models into adaptive management

• Method for categorizing PAs based on the projected numbers of emigrants and immigrants.

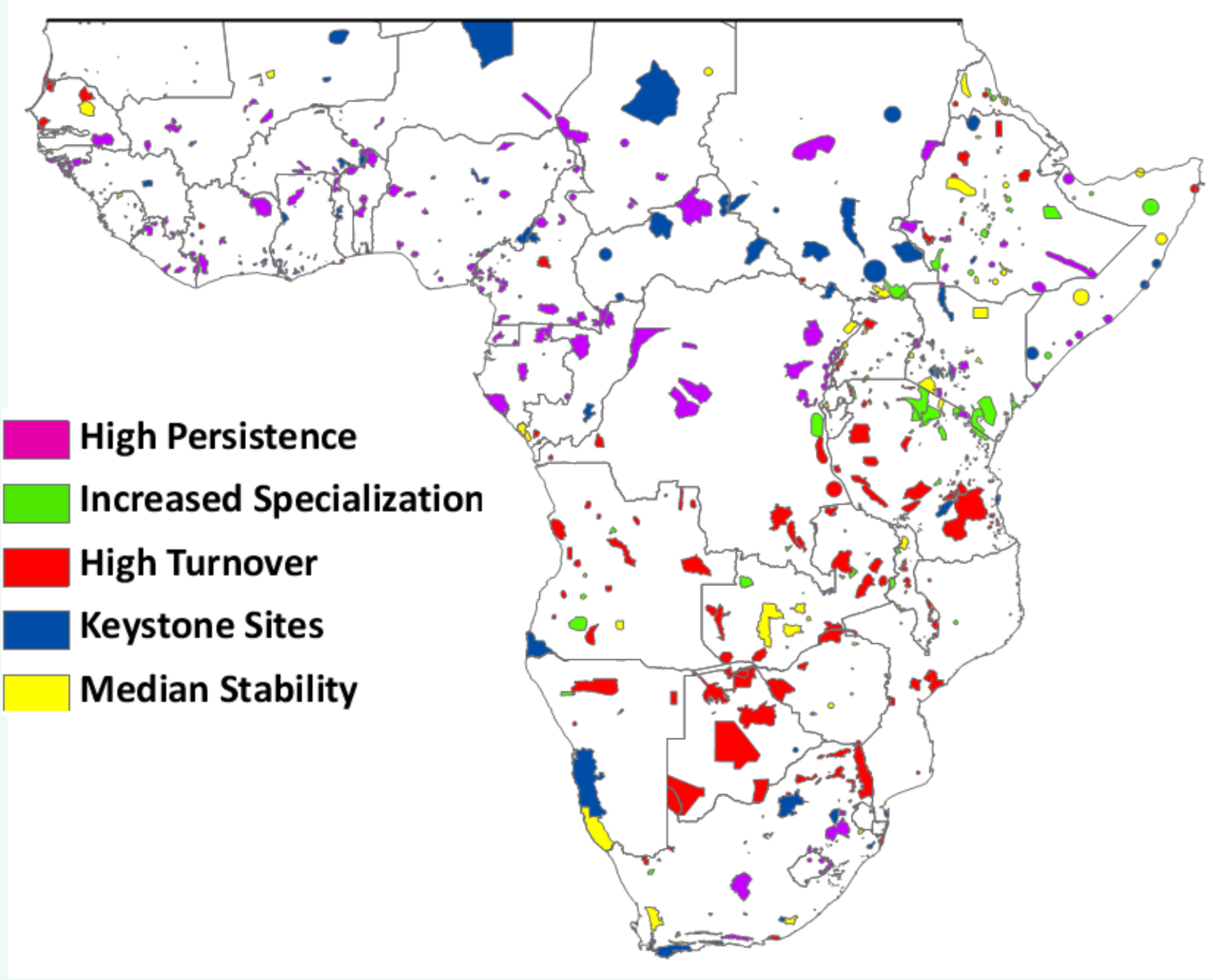


Hole *et al.* (2011) *Cons Biol*

➢ Reserve Categorization



➢ IBA Categorization



Assessing impacts on IBA network

Identify management options for different categories

e.g. habitat management, restoration and creation aimed at maximising extent & suitability of microhabitats & habitats for potential colonists/emigrants/persistent species

e.g. management of disturbance regimes (fire, flood, grazing etc) to inhibit/facilitate ecological succession depending on needs of emigrants/colonists

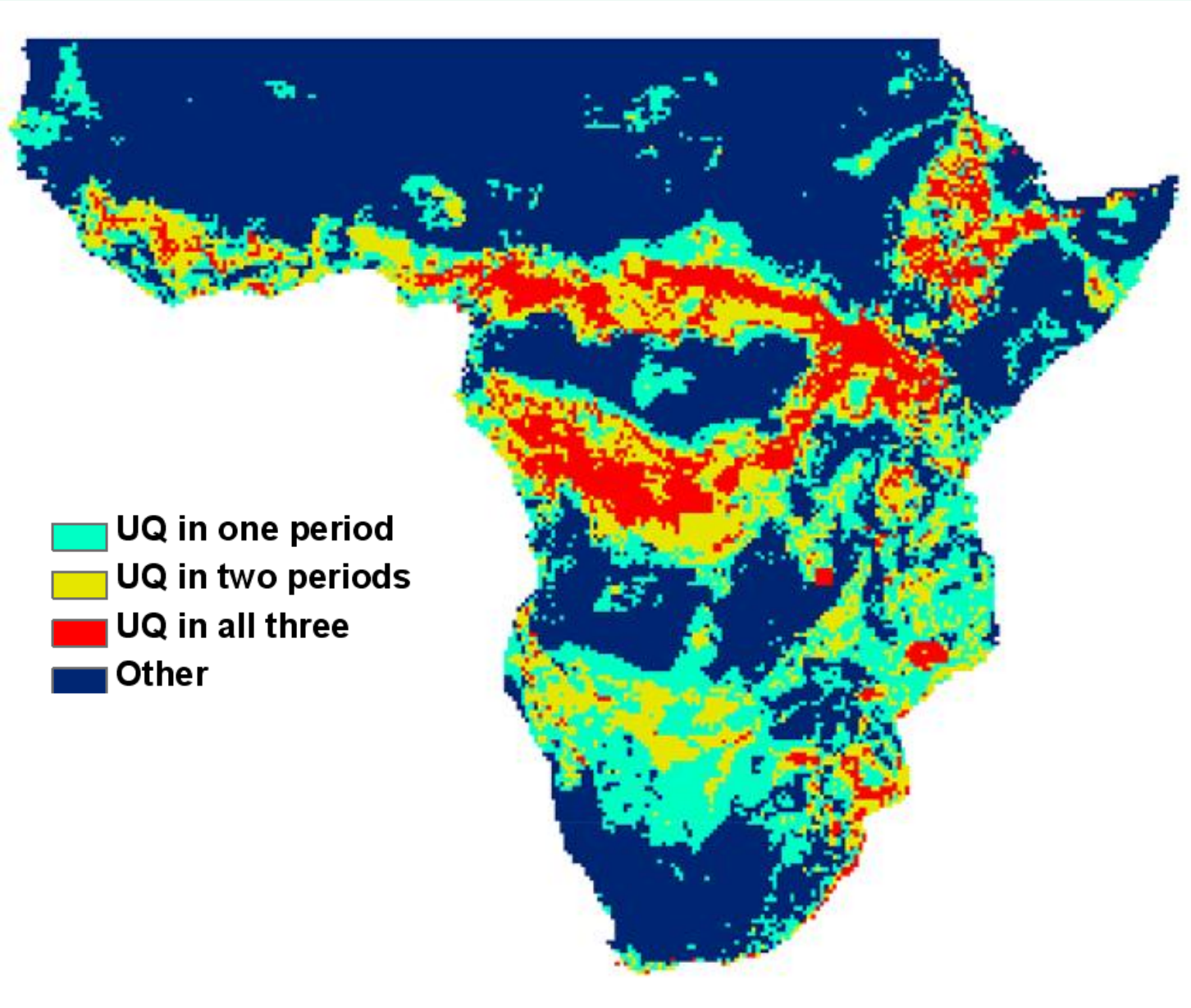
e.g. site expansion to capture adjacent habitats suitable for potential colonists/emigrants/persistent species

Assessing impacts on IBA network

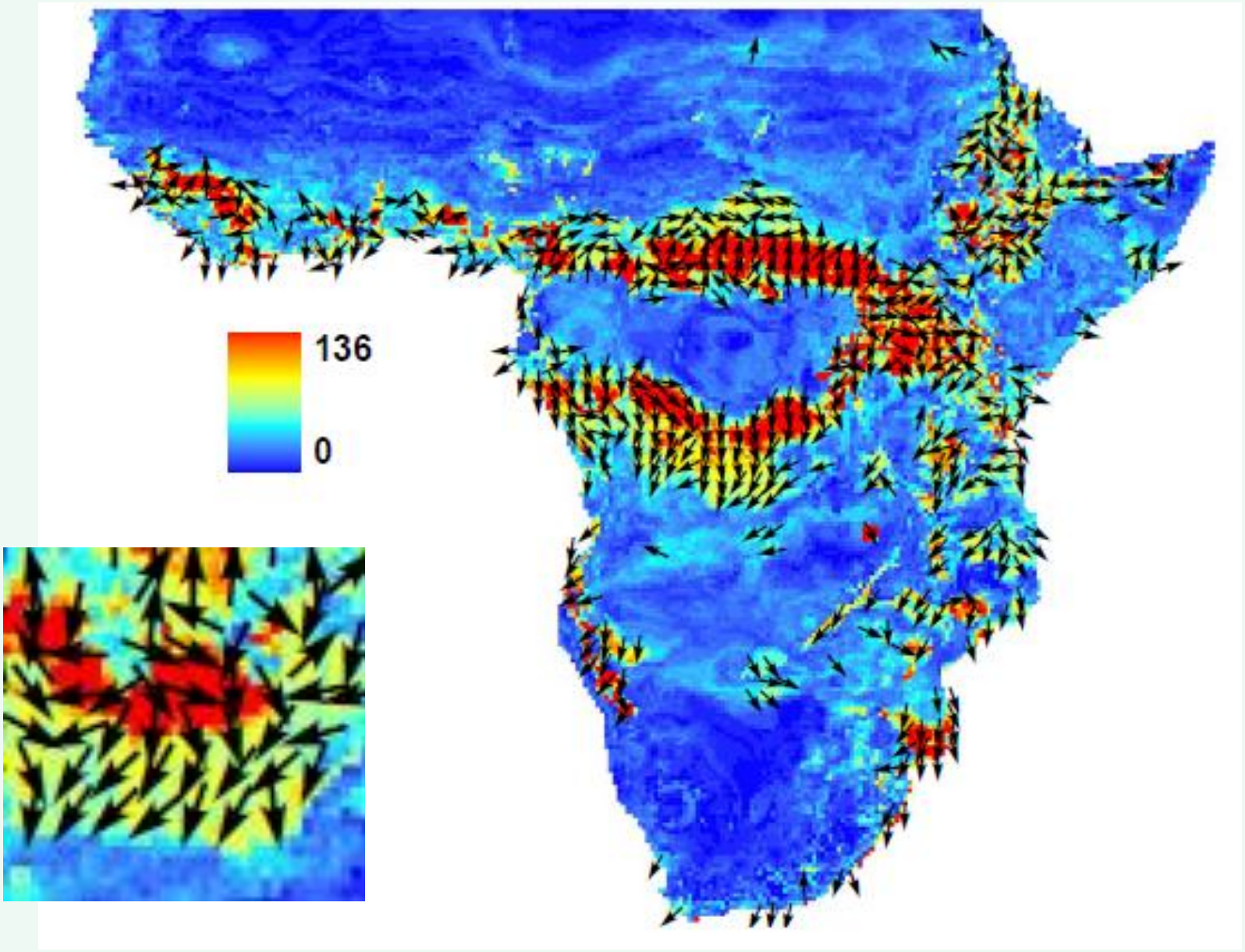
Management options for different categories

	Emigrating	Colonizing	Persisting	Habitat management	Disturbance regime management	Translocation	Area additions	Matrix management
High Persistence	L	L	H	P	Natural		Refugia	
Increasing Special-ization	H	L	L	E	Arrest succession	E		E
High Turnover	H	H	L	E+C	Balance	E+C	y	E + C
Increasing Value	L	H	H	E+C	Balance	C	y	C
Increasing Diversifi-cation	M	M	M	?	?	?	?	?

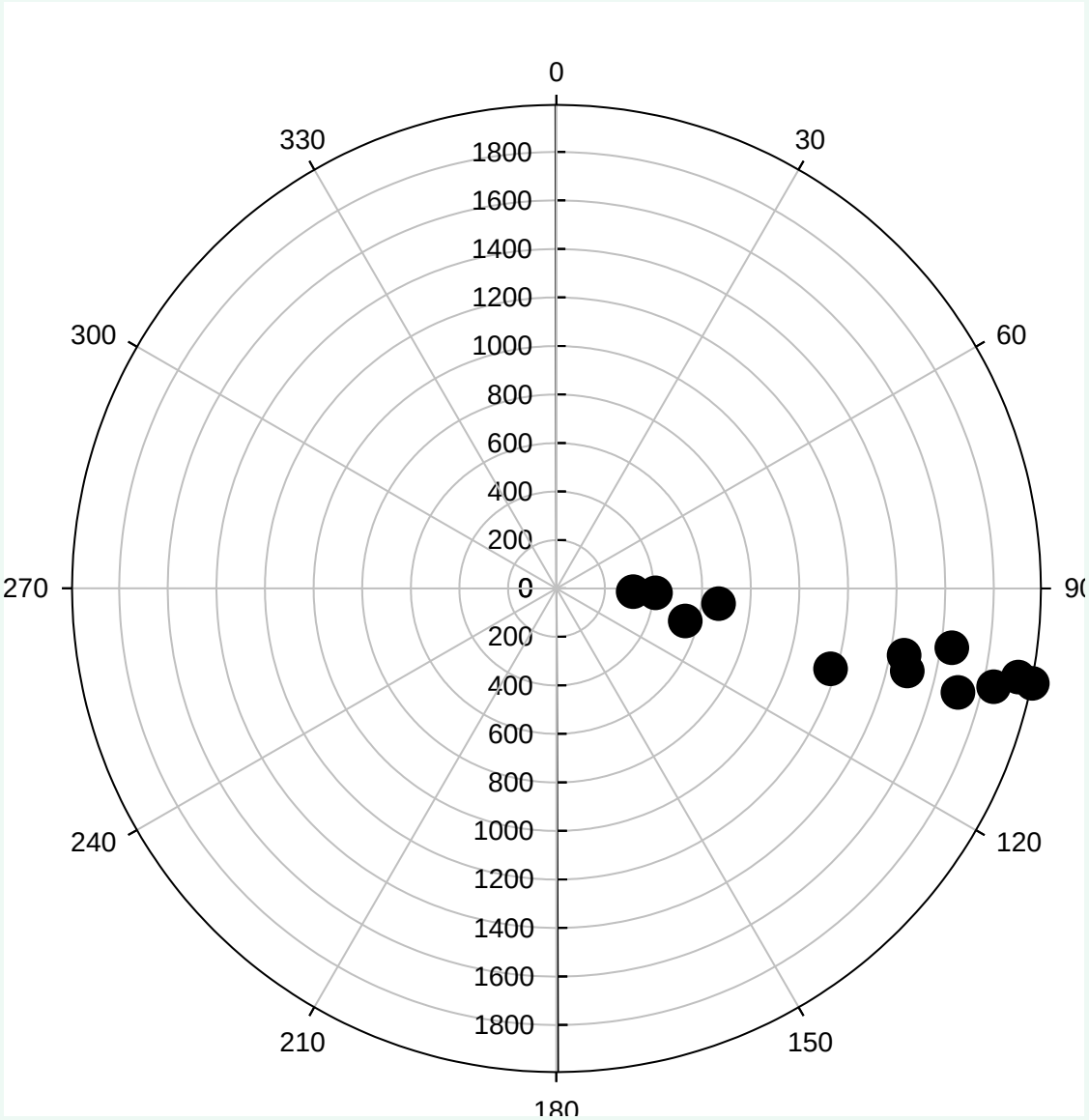
- Projected species ‘movement’



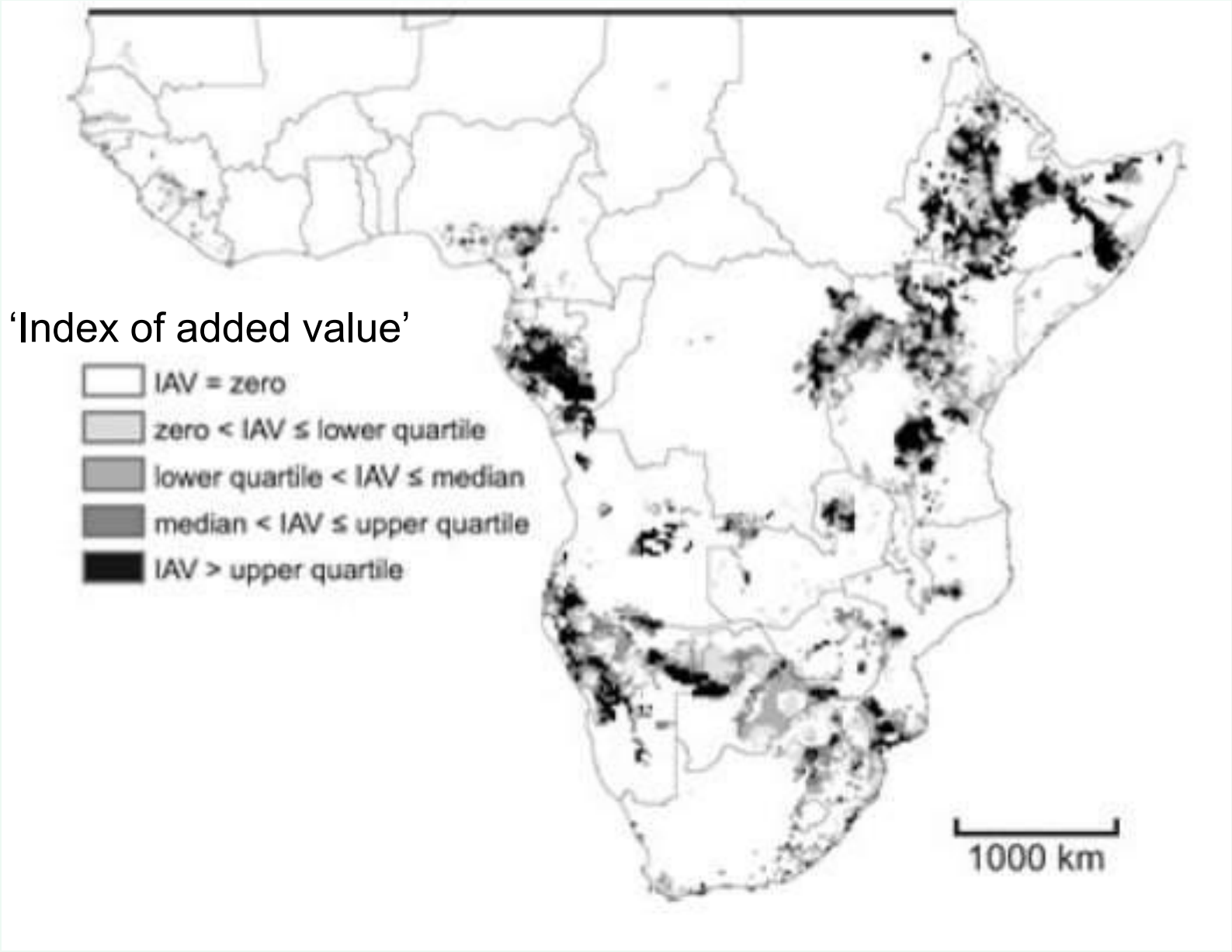
- Estimating direction of movement



Upper Guinea Forest endemic birds – range shift

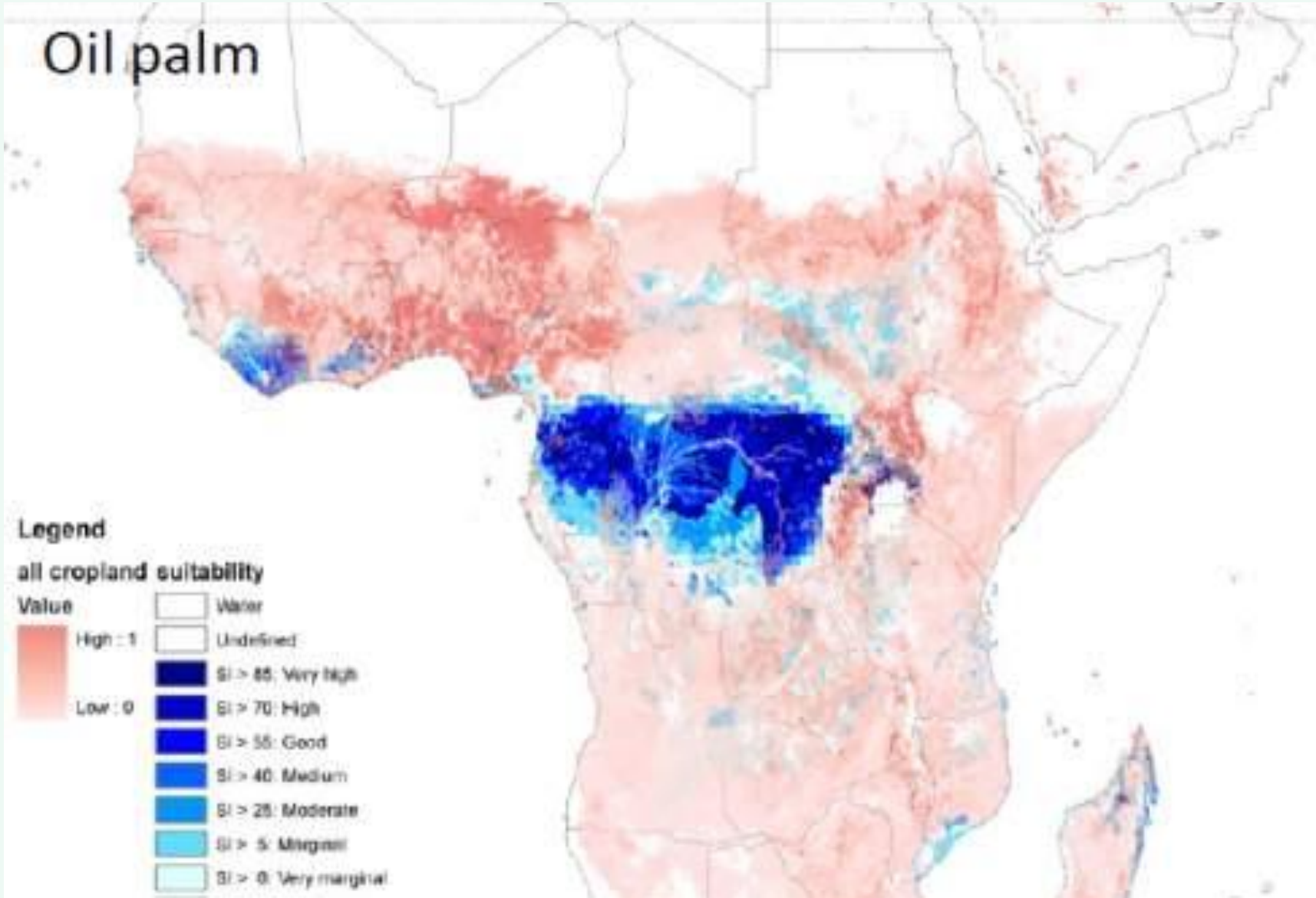


Fill gaps and facilitate movement of species

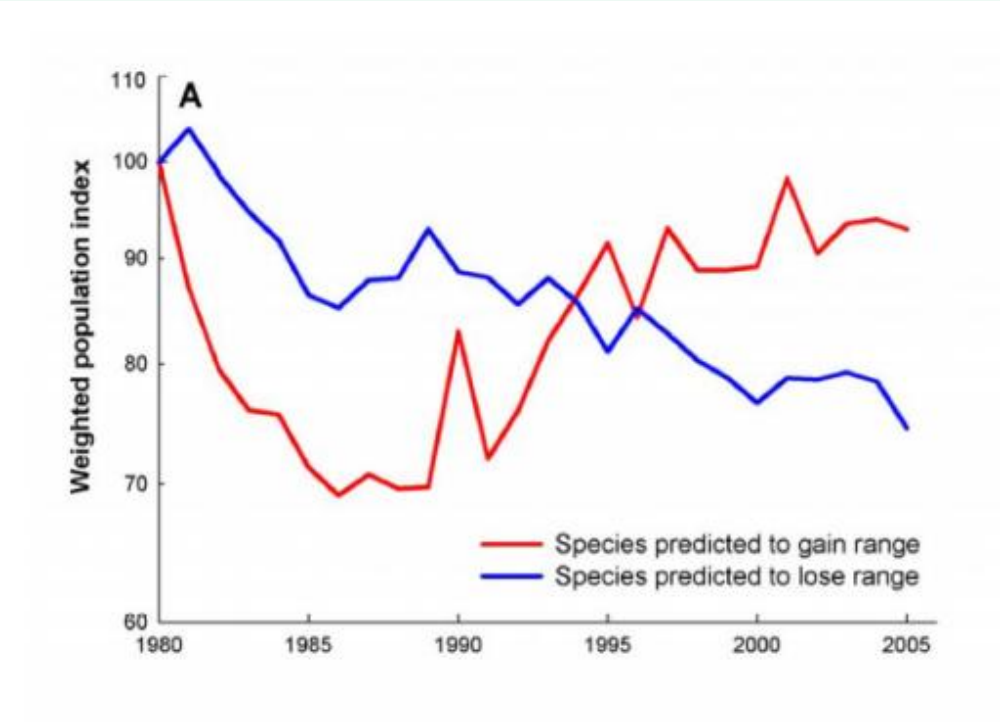


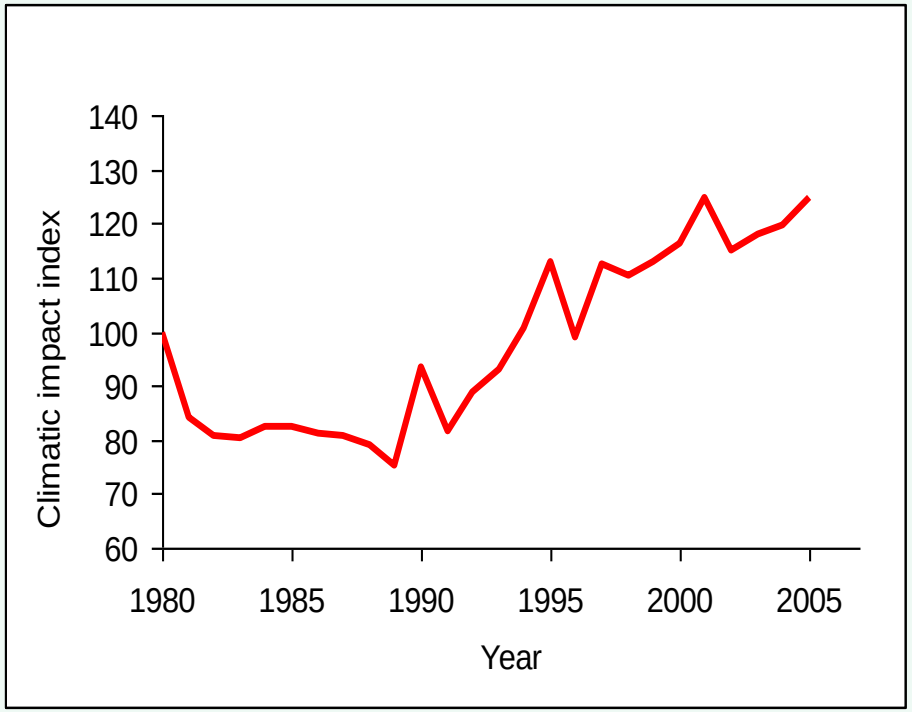
Mitigation impacts

- spatial patterns of crop expansion across the tropics



Monitoring & indicators





Climatic Impact Index for European birds
Gregory, Willis *et al*. (2009)

- Possible solution – translocating species

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