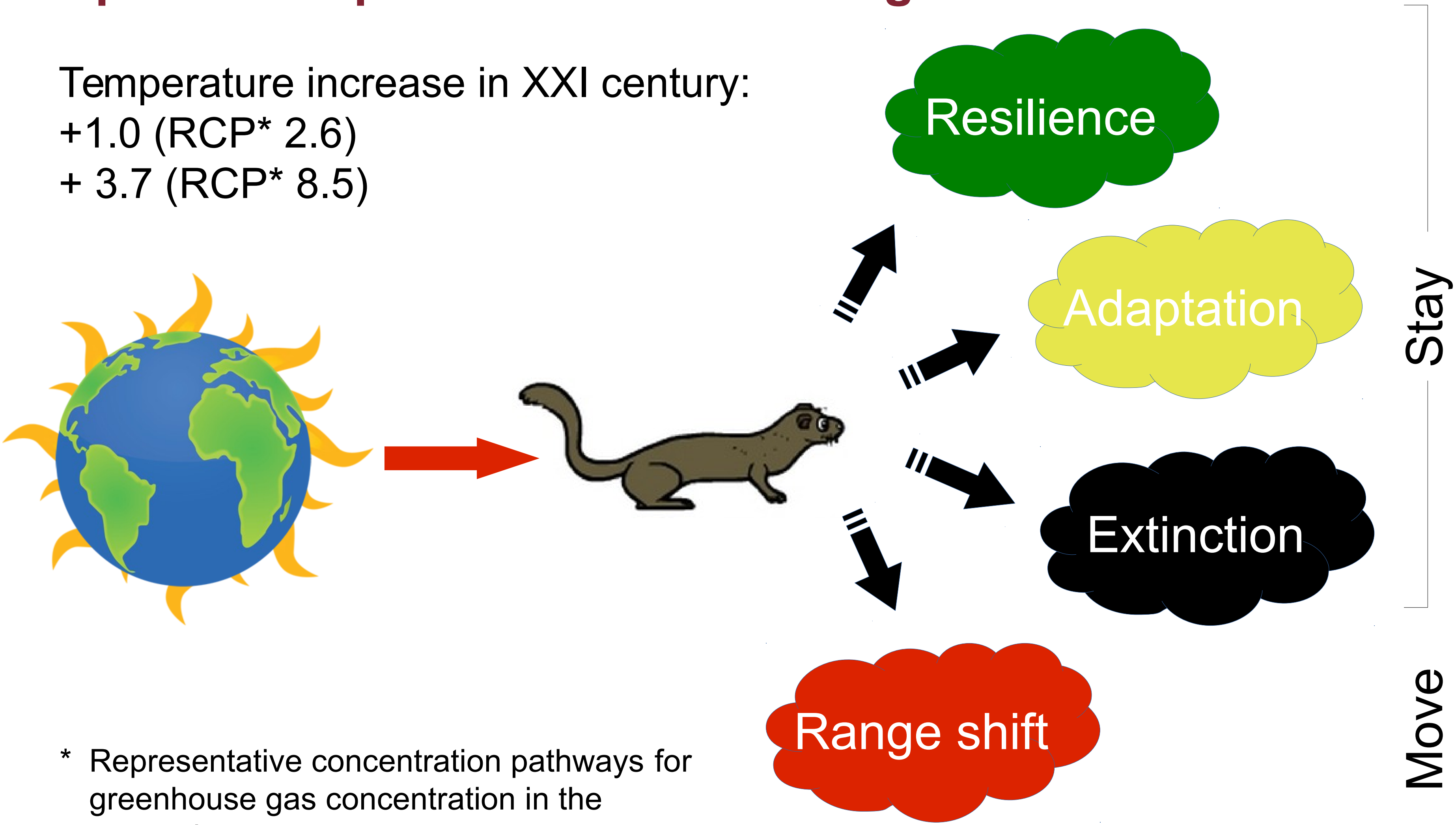
Carlo Rondinini

Mammal species' resilience to climate change and tools for conservation priority setting

Bern Convention - Select group of experts on biodiversity and climate change, Rome 28 April 2015

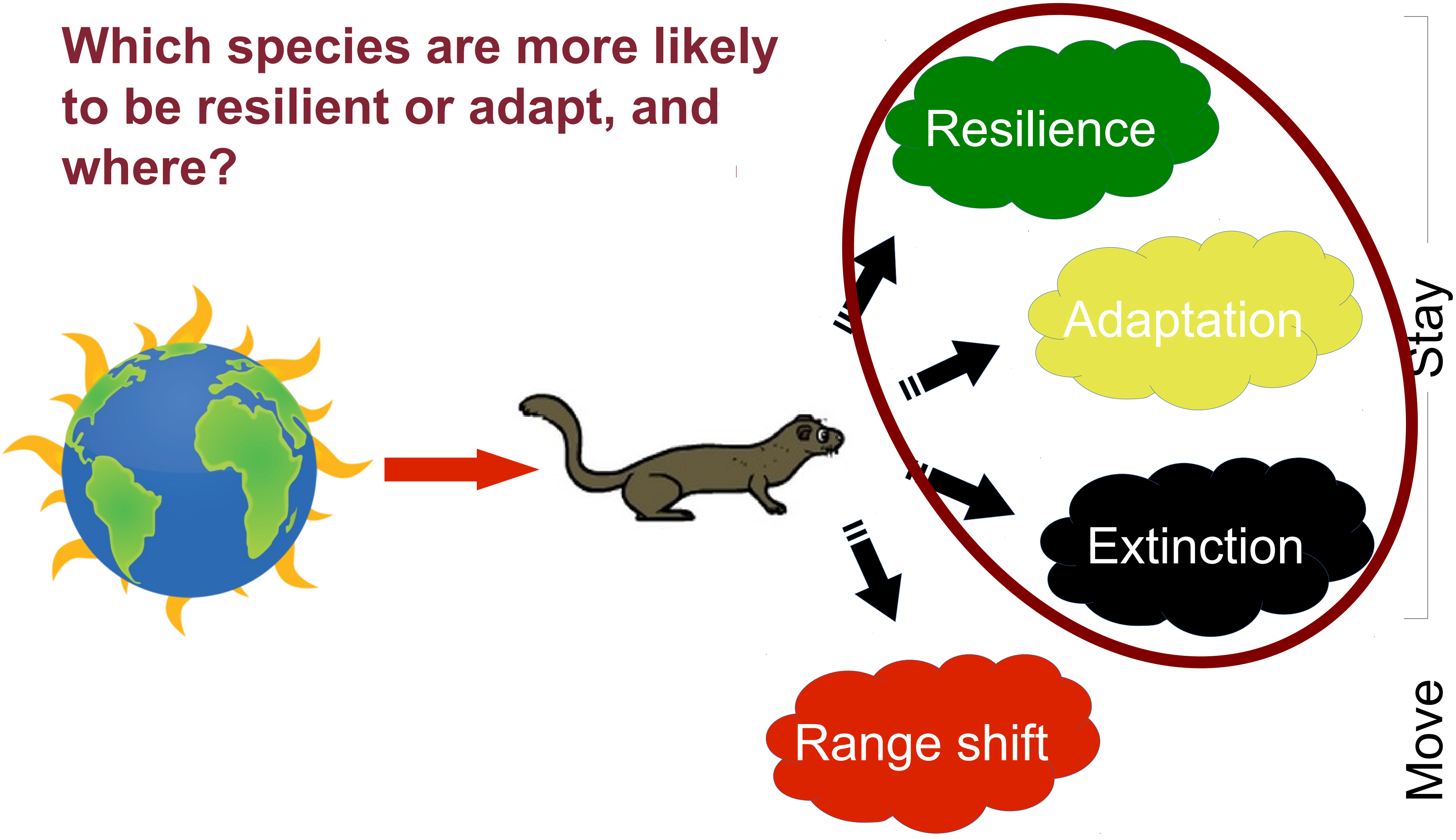
Species' response to climate change

Temperature increase in XXI century:
+1.0 (RCP* 2.6)
+ 3.7 (RCP* 8.5)



* Representative concentration pathways for greenhouse gas concentration in the atmosphere

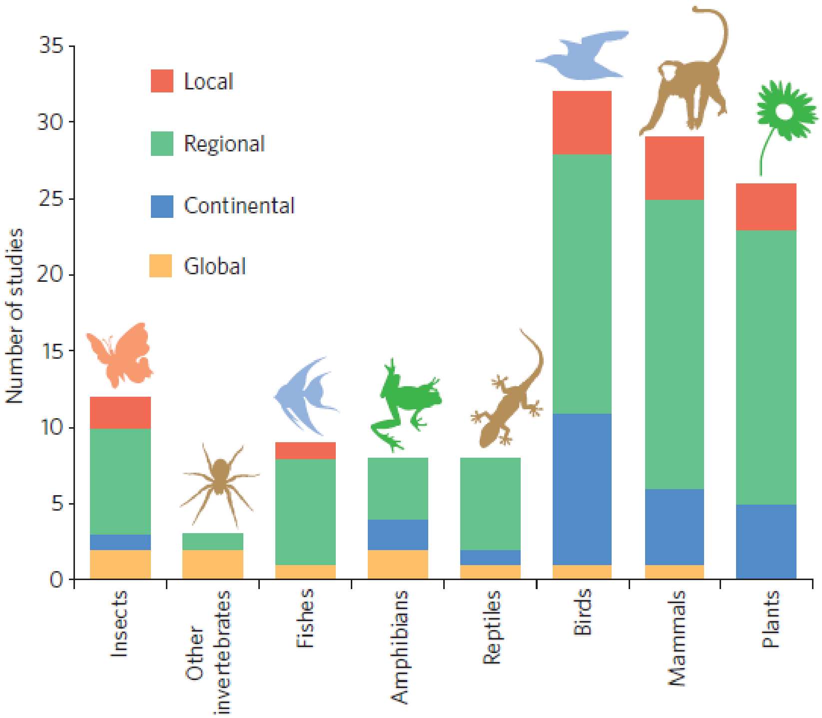
Which species are more likely to be resilient or adapt, and where?



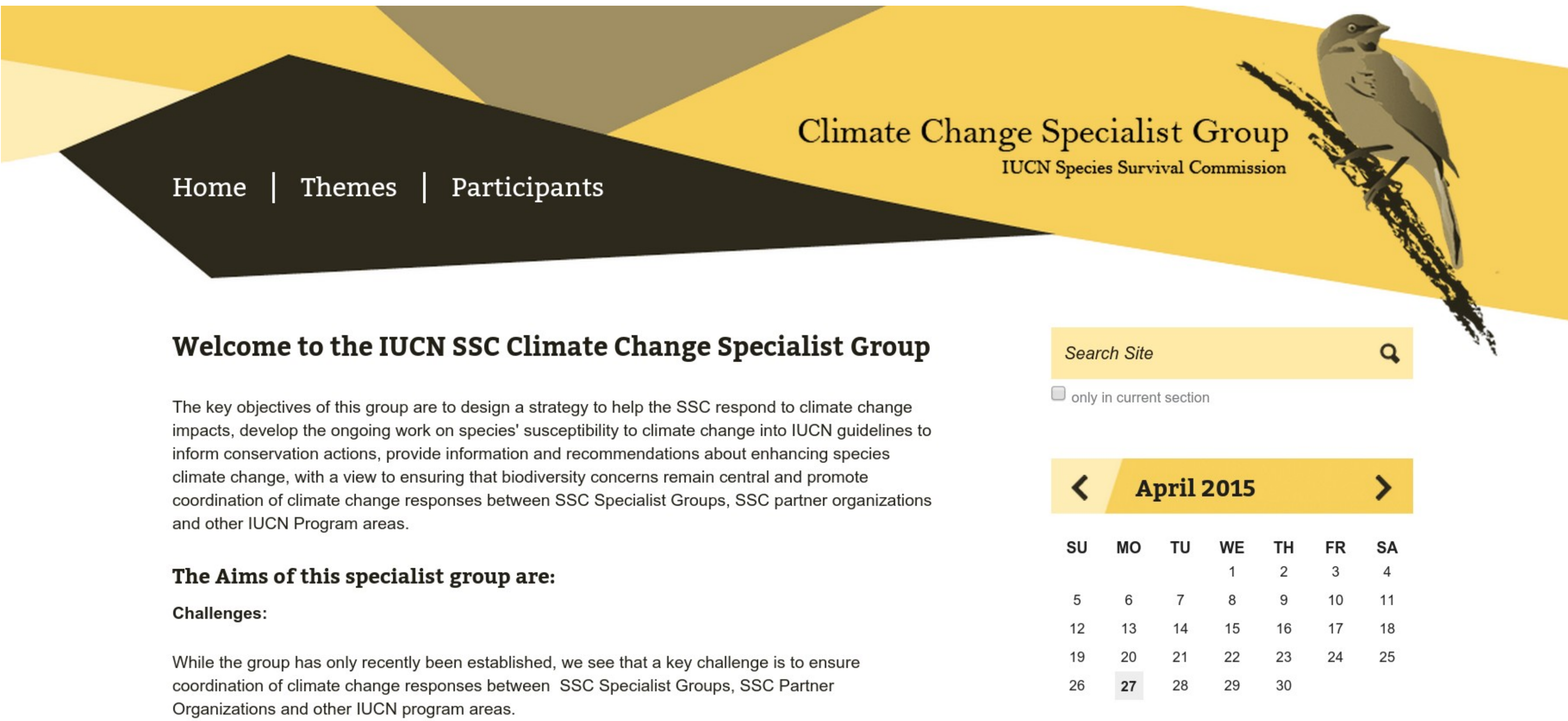
Guidance on modelling species vulnerability to climate change (Pacifici et al. *Nature Climate Change* 2015)

Mechanistic: Greatest power to assess extinction probability
Correlative: If only occurrence data available
Trait-based: Regional assessments, no occurrence data

Use **combined approaches**

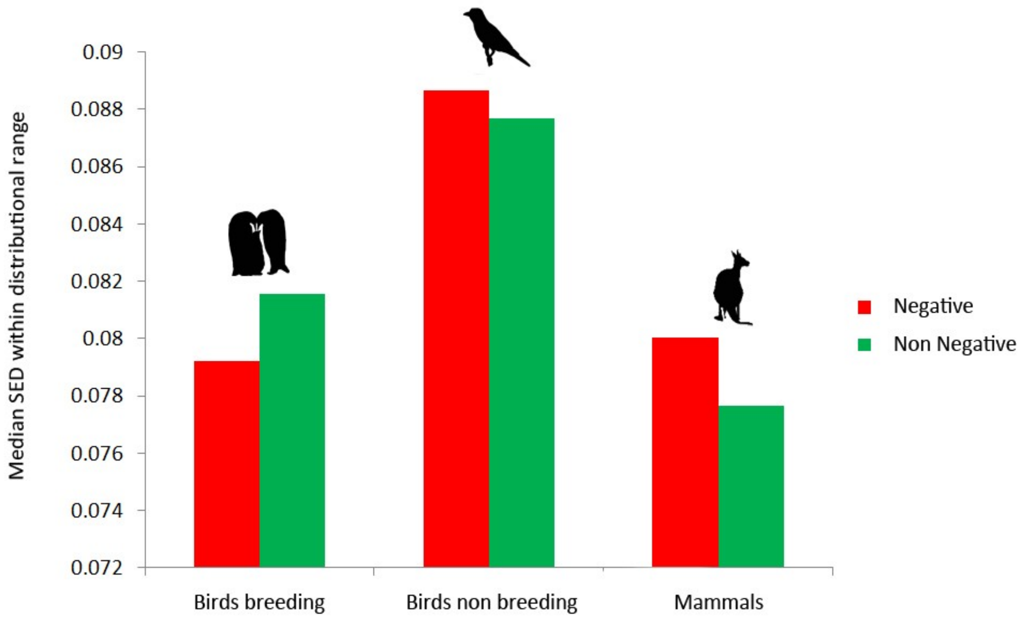


… feeding into the Guidelines on climate change vulnerability assessment by the IUCN-SSC Climate Change Specialist Group



Identify traits that make species sensitive to climate change (in preparation)

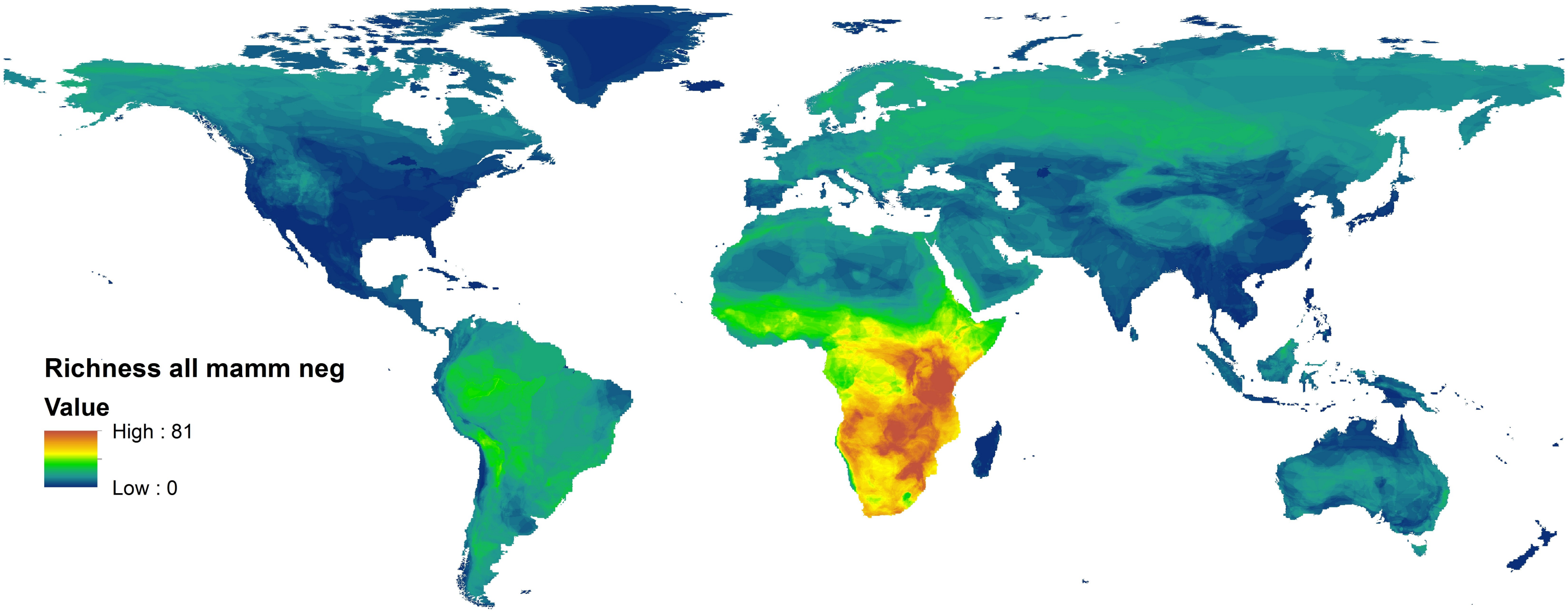
1) Traits are often used to flag species sensitive to climate change
2) But do traits predict past observed impact?
3) Meta-analysis to answer the question



Coarse filter 1: sensitivity * exposure * hazard (in prep)

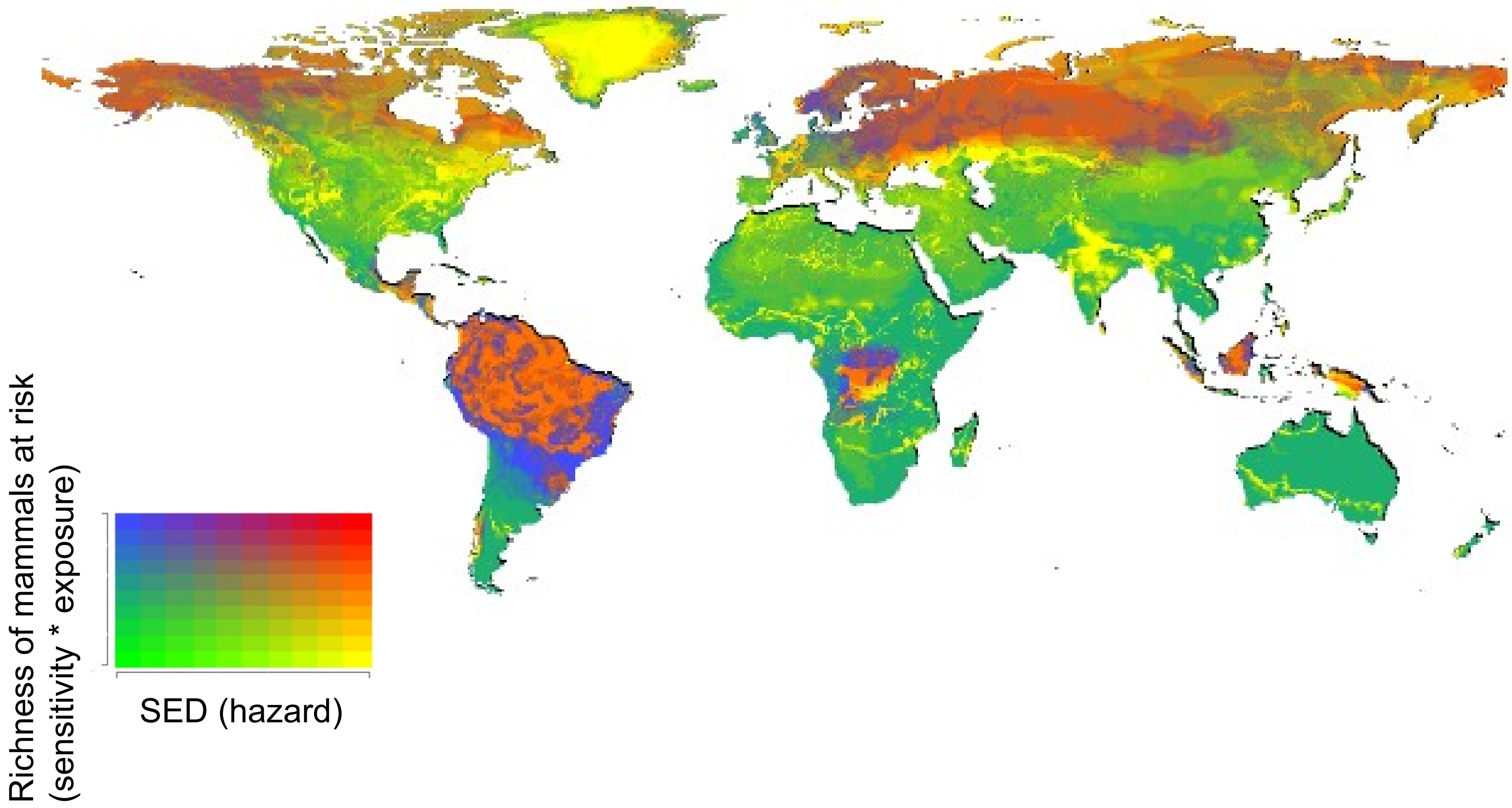
1) Map mammals sensitive and exposed to change (current modelled distributions)
   - Sensitivity: life-history traits from meta-analysis
   - Exposure: narrow ranges (geographic, climatic) from meta-analysis
2) Overlay with expected climate change
   - Hazard: standardized Euclidean distance between current and future climate (2010-2050 from rcp8.5)
3) Identify hotspots of species at risk

Coarse filter 1: sensitivity * exposure

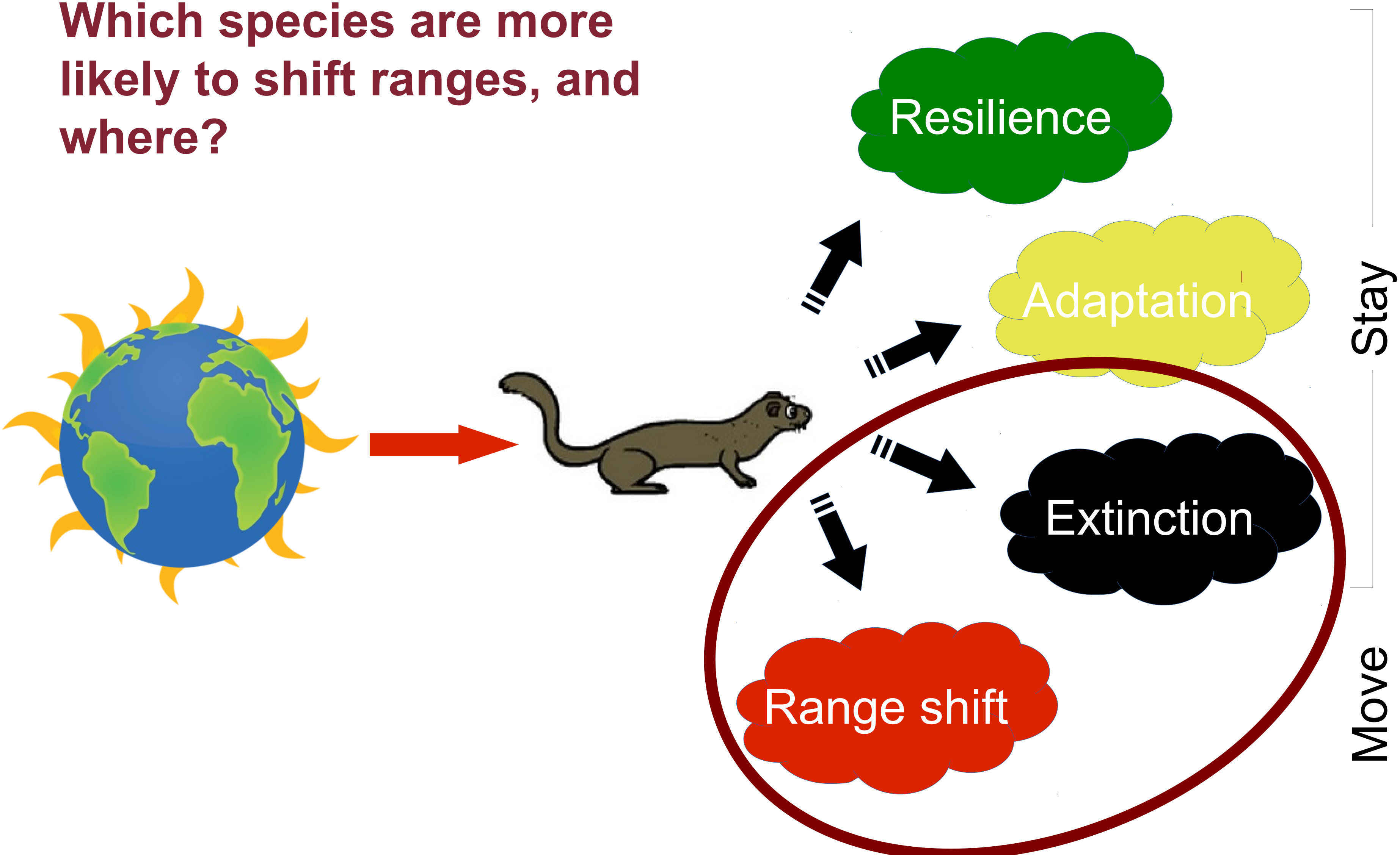


Sensitivity: body mass, dispersal distance, generation length...
Exposure: climate seasonality, altitude min and range, EOO...

Coarse filter 1: sensitivity * exposure * hazard



Which species are more likely to shift ranges, and where?



Species' velocity (Rondinini & Visconti contribution to IPCC AR5, 2014)

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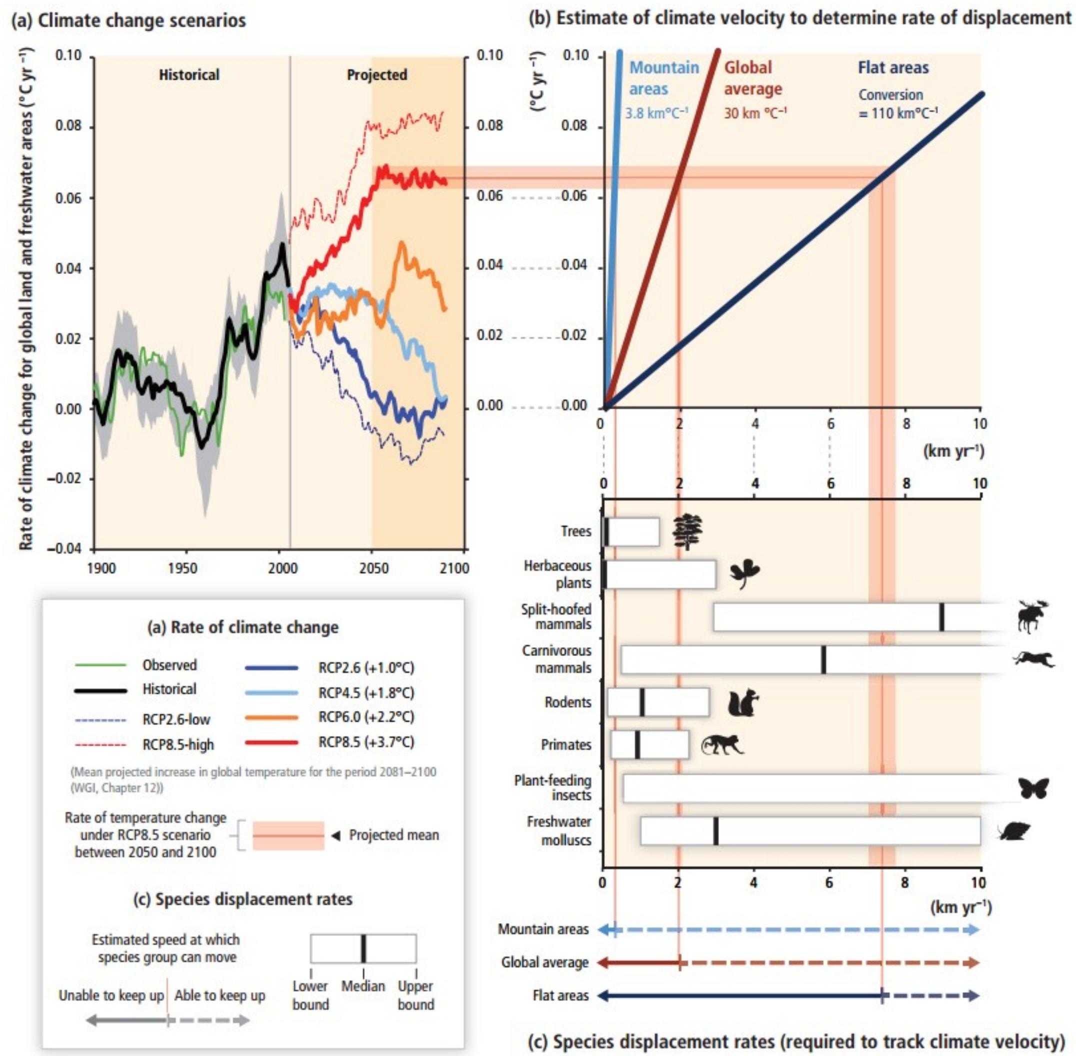
Range shift

Species' velocity (IPCC AR5)

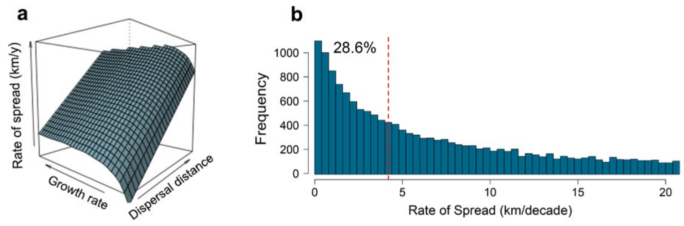
Race against climate change (allometric dispersal / age at first birth)

Most mammals would not disperse fast enough

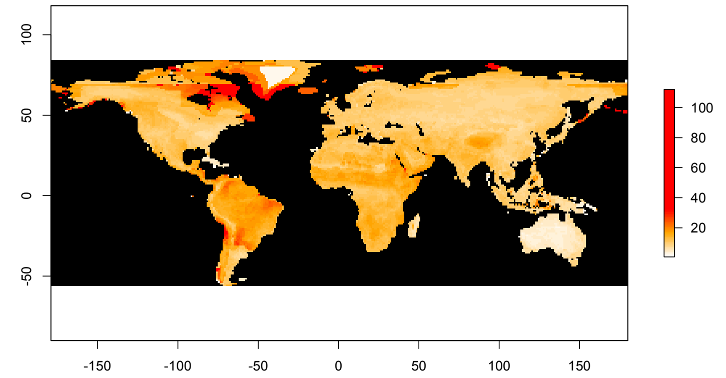


Coarse filter 2: dispersal capability * hazard (draft)

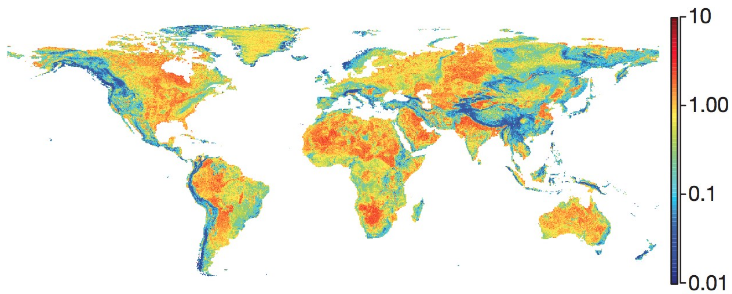
1) Predict species velocities to shift their range using mechanistic models (Santini et al. *in prep*)



2) Map mammals' potential range shift velocities

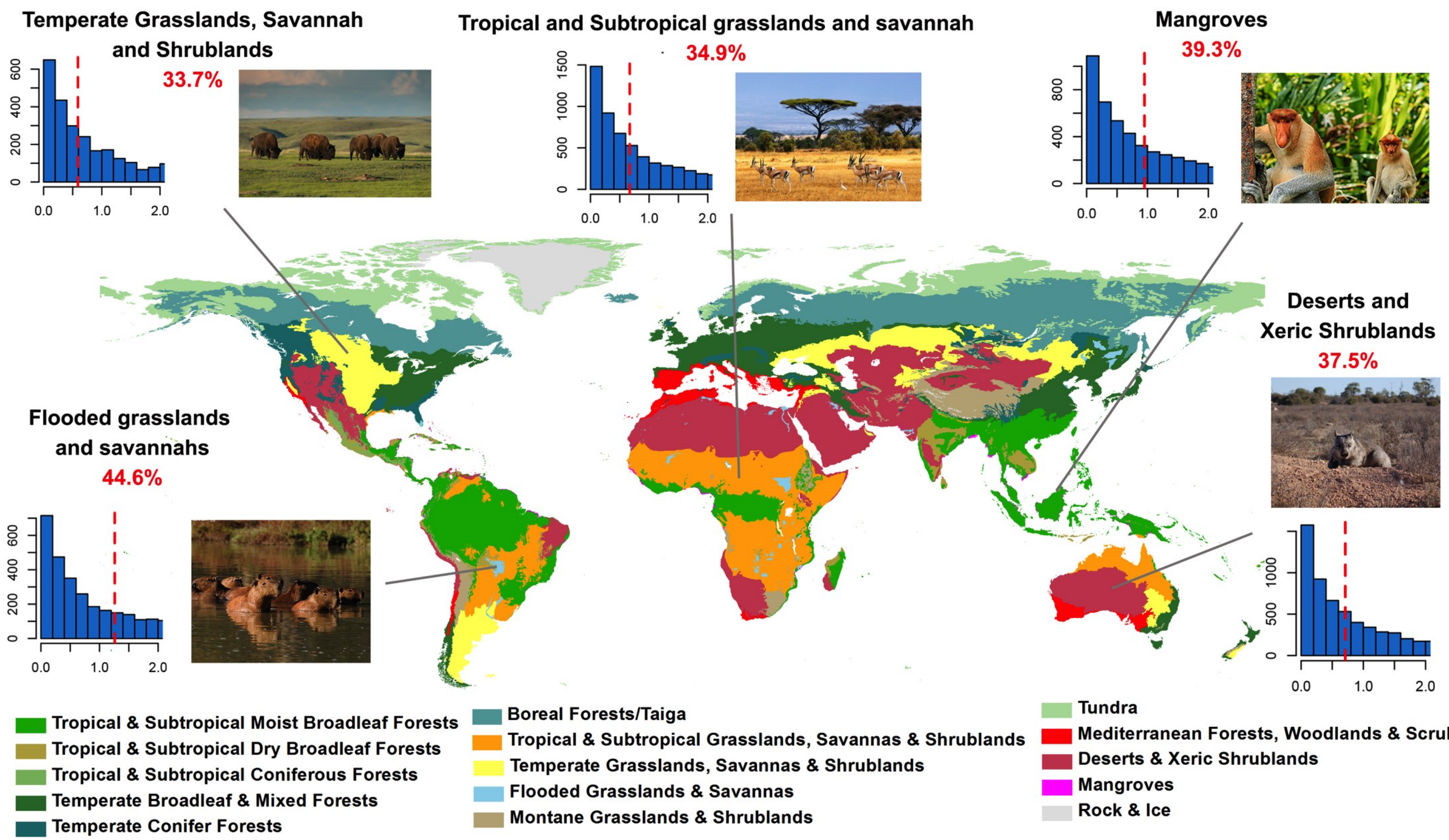


3) Overlay with climate velocity



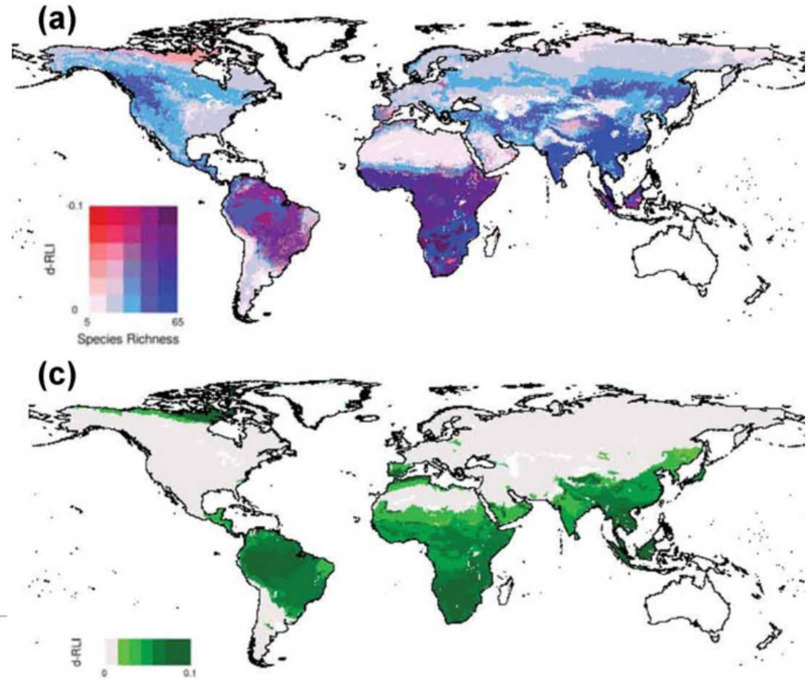
Coarse filter 2: dispersal capability * hazard

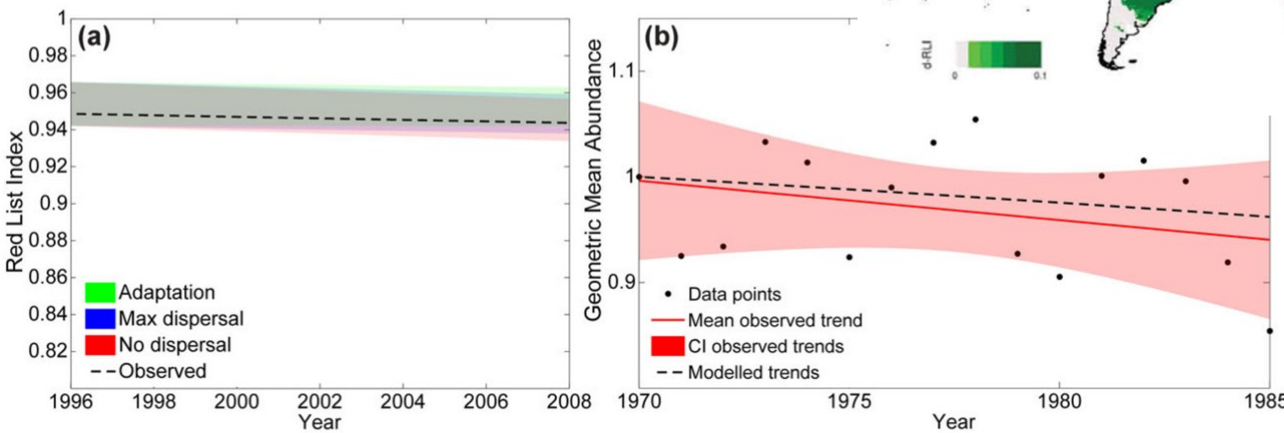
4) Identify hotspots of vulnerability



Global projections (Visconti et al. *Cons. Lett.* 2015)

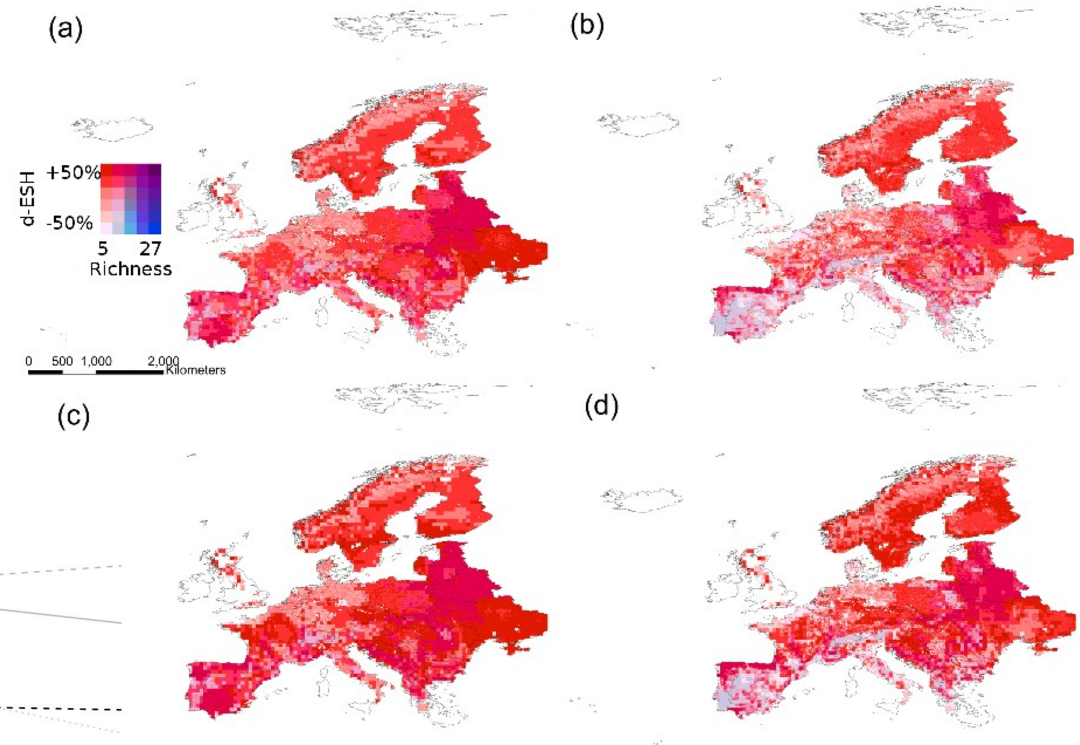
1) Species-specific relationships with land cover and climate
2) Projected land cover and climate change under contrasting socio-economic scenarios
3) Projected change in biodiversity indicators for large mammals: (a) RLI, (b) LPI

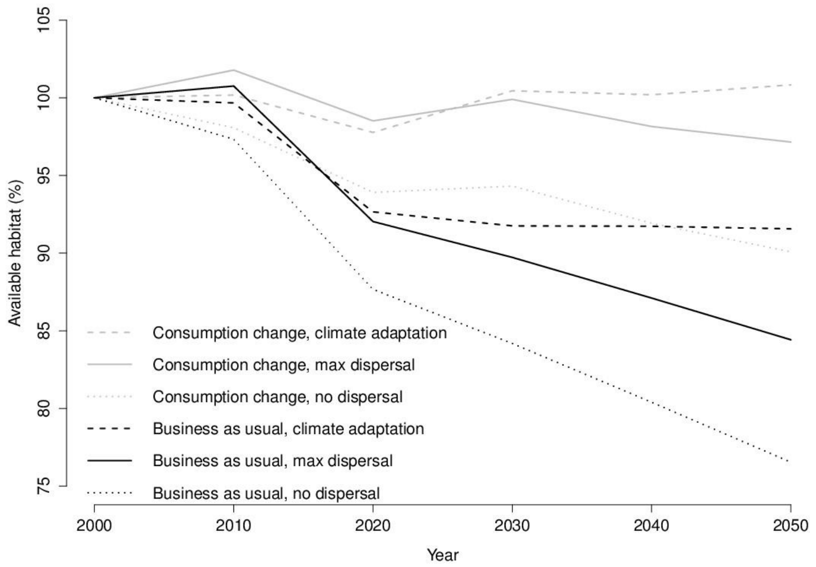




Europe projections (Rondinini et al. *Cons. Biol.* in press)

1) Same methods as in Visconti et al 2015
2) Projected change in habitat availability for large mammals





Dynamic conservation planning: where to place protected areas in the future to tackle climate change? (in minds)

1) Distribution of projected mammal habitat from Visconti et al. 2015 and Rondinini et al. in press
2) Dispersal from Santini et al. (2013)
3) Species sensitivity from ongoing work
4) Conservation targets (by species or overall, e.g. Aichi Target 11)
5) Heuristic algorithms
6) Step-by-step (sub)optimal placement of new PAs to minimize mammal habitat conversion

In summary...

1) Active development ongoing
2) Areas for immediate further investigation
   - Integration missing
   - Expansion to all vertebrates and other taxa
   - Natura 2000 / Emerald network?
3) Scope for joint research
4) Relevant also to EU 2020 strategy, Aichi Targets, other international commitments

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