SENCKENBERG
world of biodiversity

Moving from biodiversity to functional diversity (also at large spatial scales)

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Establishment of Future Earth and IPBES

- **Future Earth**: Network: Global biodiversity monitoring, prediction and reporting
- **IPBES**: Fast-track assessment of scenarios and modelling of *biodiversity and ecosystem services*

- **Furture Earth**: Transdisciplinary research: *co-design, co-productions of science* together with non-scientific knowledge holders

Framework for linking scenarios, biodiversity and ecosystem services

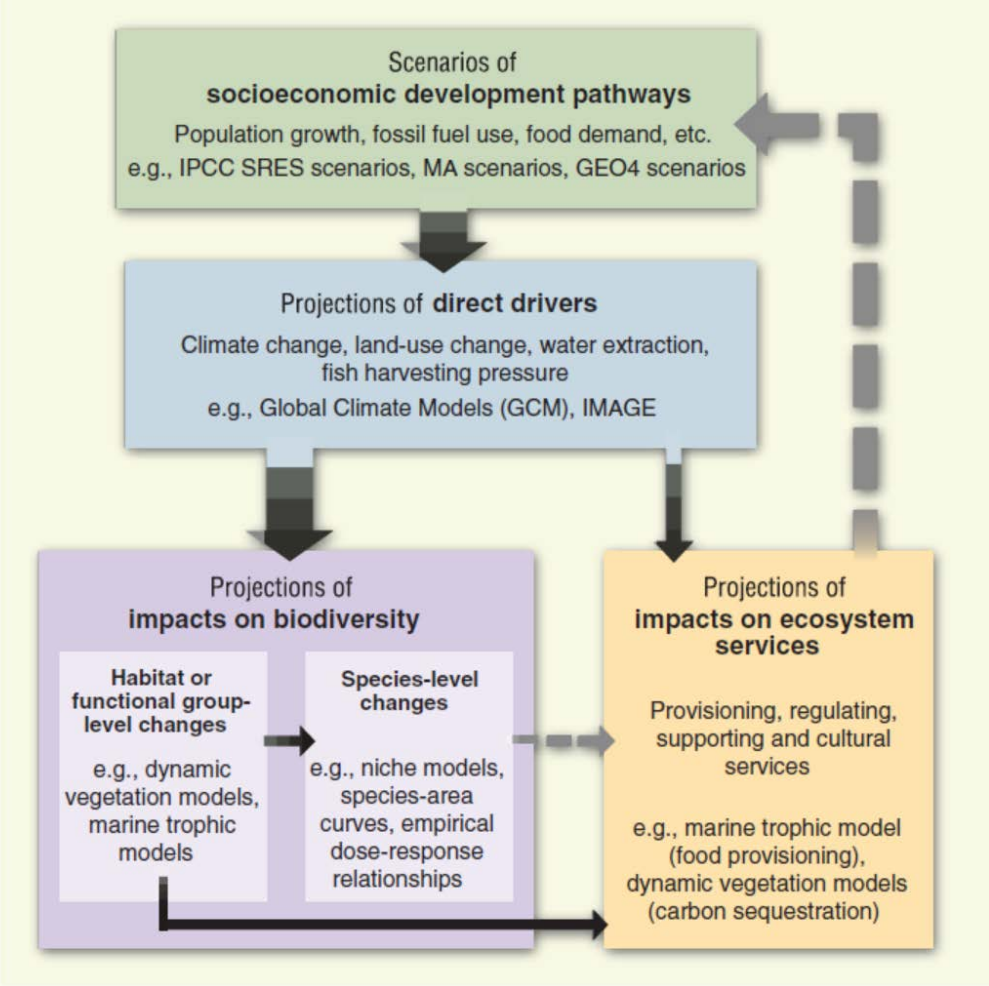

Fig. 1: Overview of methods and models commonly used for constructing biodiversity scenarios

Pereira et al. 2010 *Science*

Comparison of model types

Type of model	Examples	Represention biodiversity	Representation ecosystem functions	Representation ecosystem services = demand
Statistical biodiversity models	Species distribution models, species richness models, PREDICTS	**Strong** for specific components	Weak	Very weak

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Ecosystem service models	INVEST ARIES	Very weak	**Strong** for specific components	**Strong** for specific components

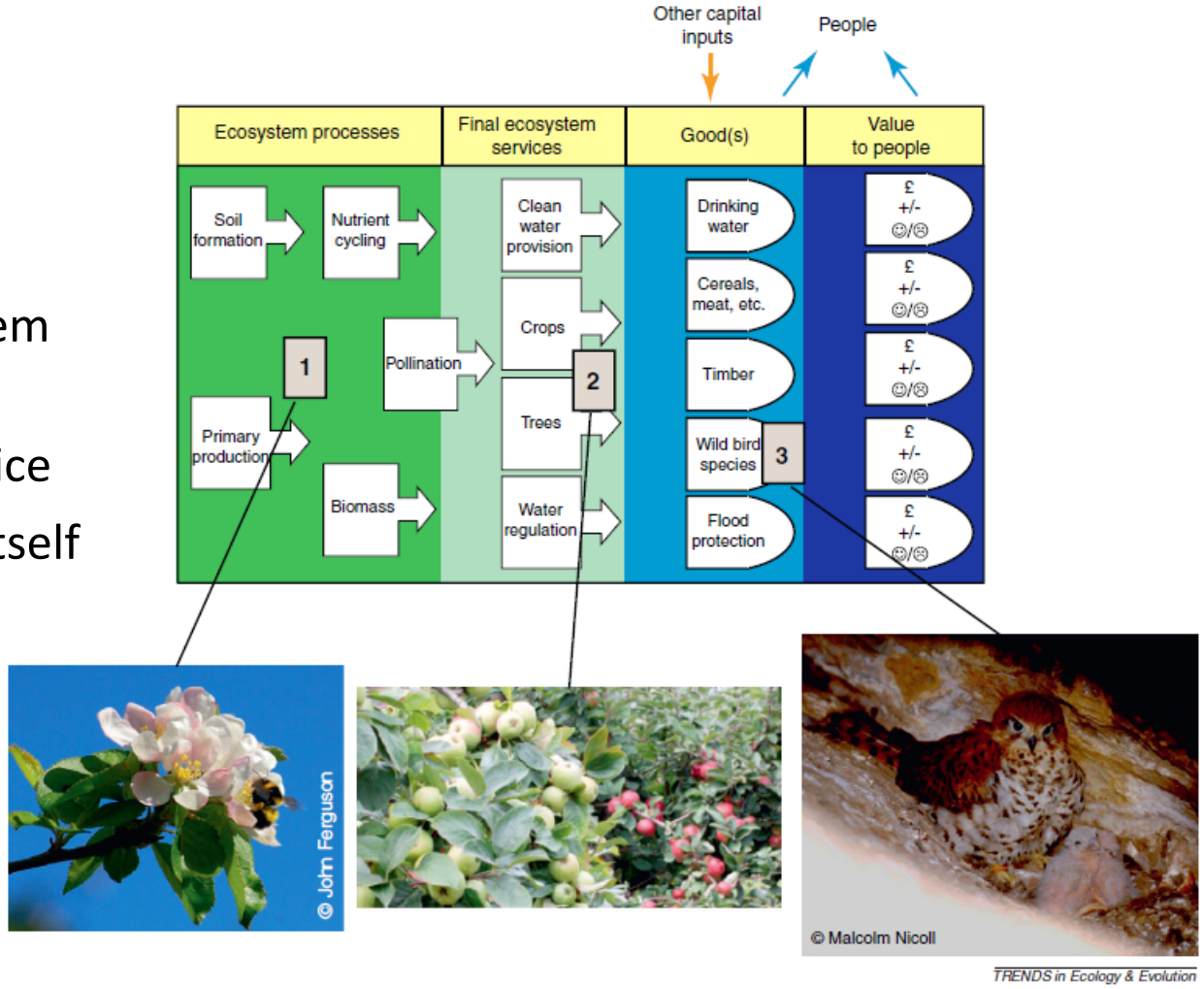
Relationship between biodiversity and ecosystem services

Biodiversity as:

1 Regulator of ecosystem processes

2 Final ecosystem service

3 Good with value by itself



Mace et al. 2011 *TREE*

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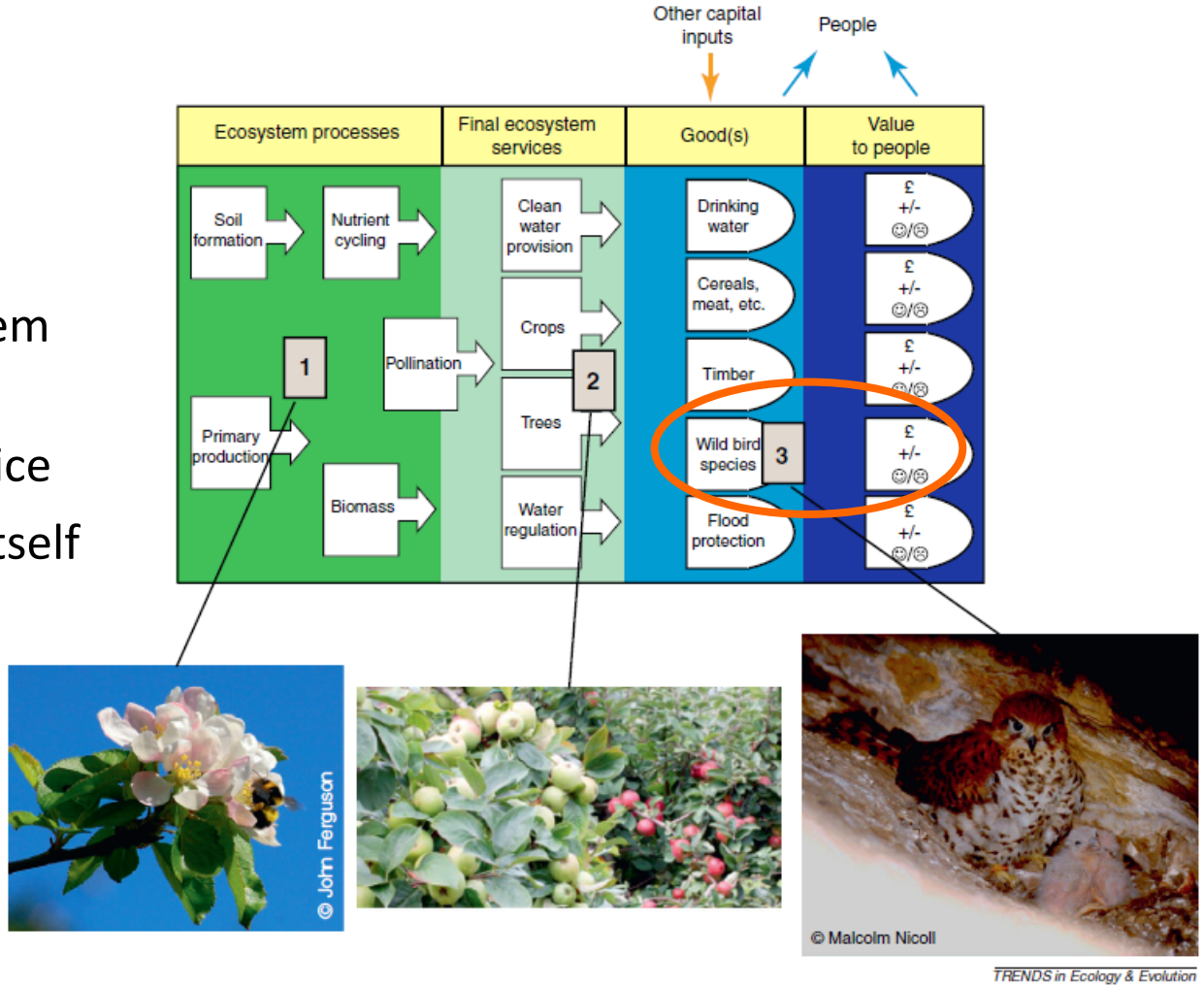
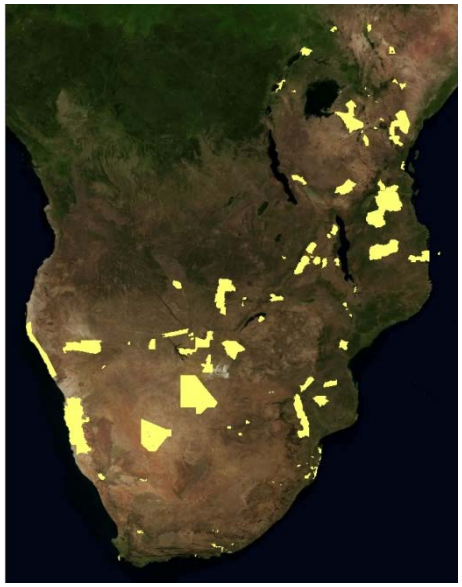


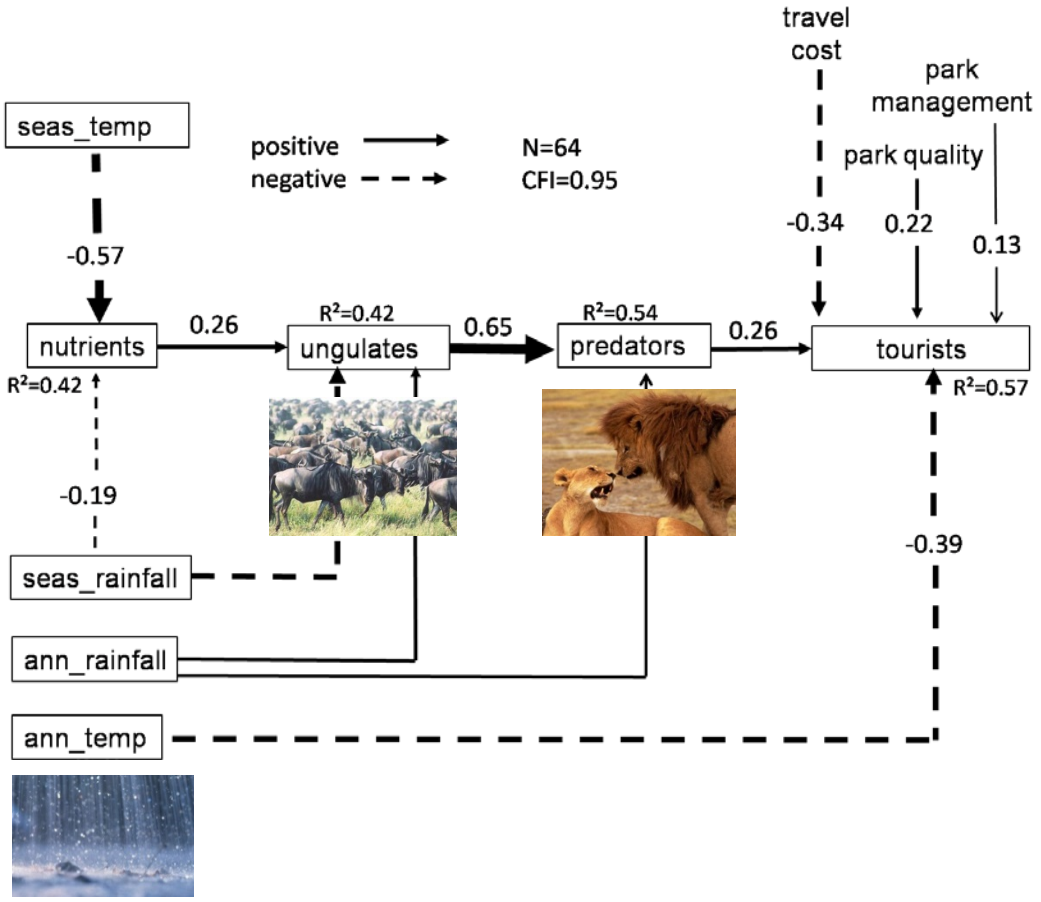
Mace et al. 2011 *TREE*

Relationship climate, ecosystems, biodiversity, wildlife tourism

Biodiversity strong influence on ecosystem services = number of tourists



64 savannah National Parks



Grünewald et al. *in review*

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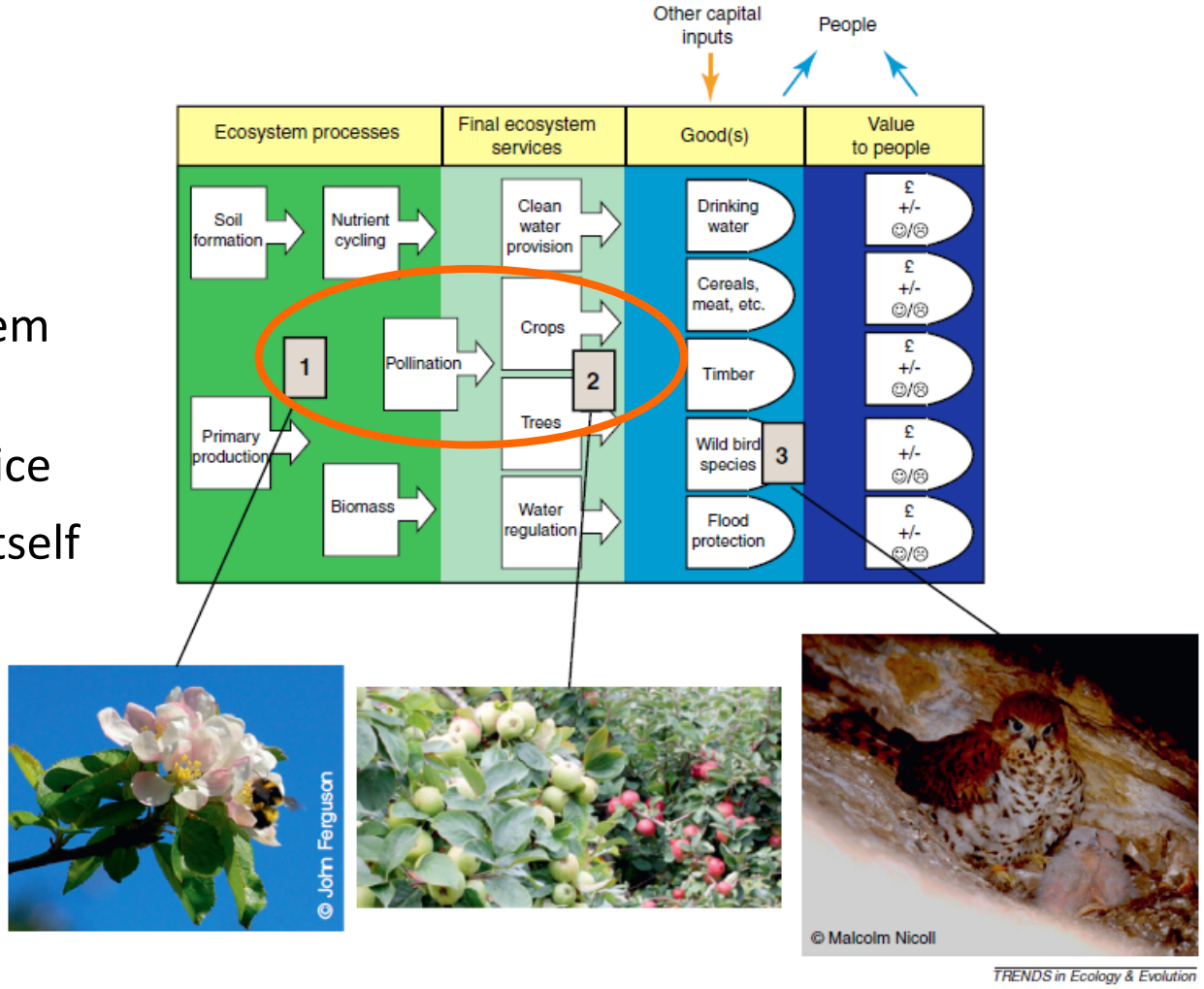
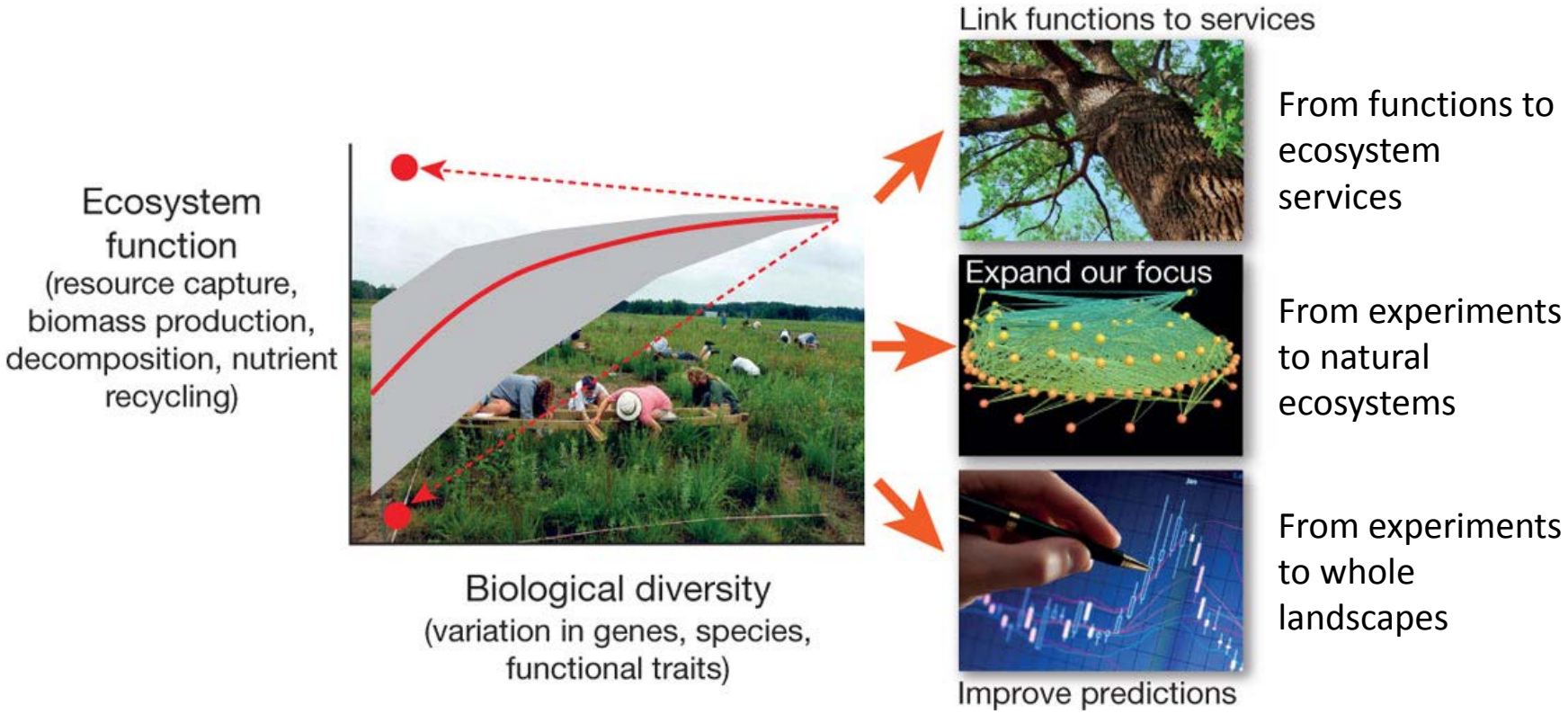


Mace et al. 2011 *TREE*

Consensus on relationship biodiversity – ecosystem functioning



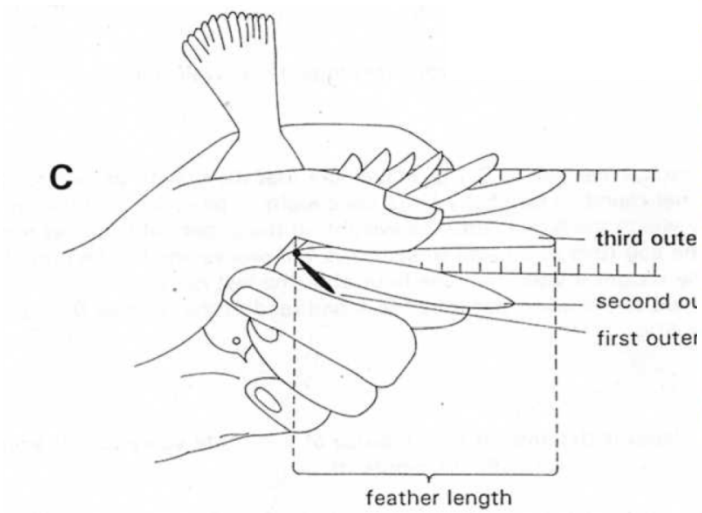
Conceptual diagram summarizes what we know about the shape of the biodiversity-ecosystem functioning (BEF) relationship based on summaries of several hundred experiments.

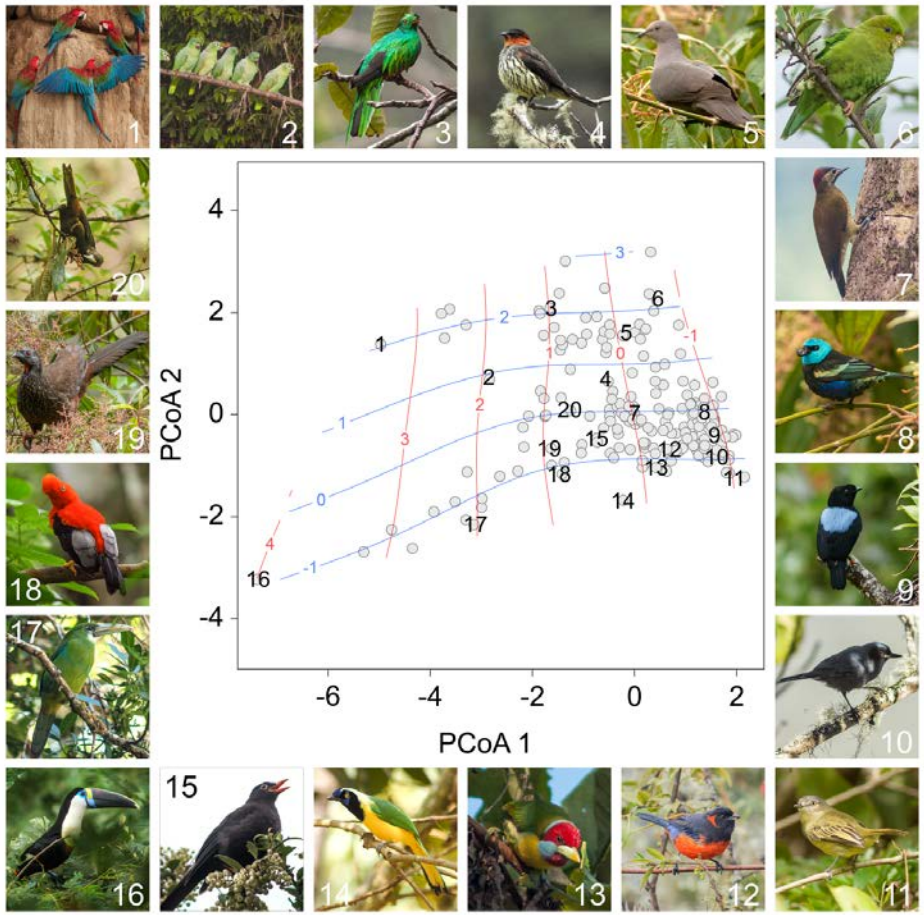
Cardinale et al. 2012 *Nature*

From biodiversity to functional trait space

For example,
ecomorphological traits of birds

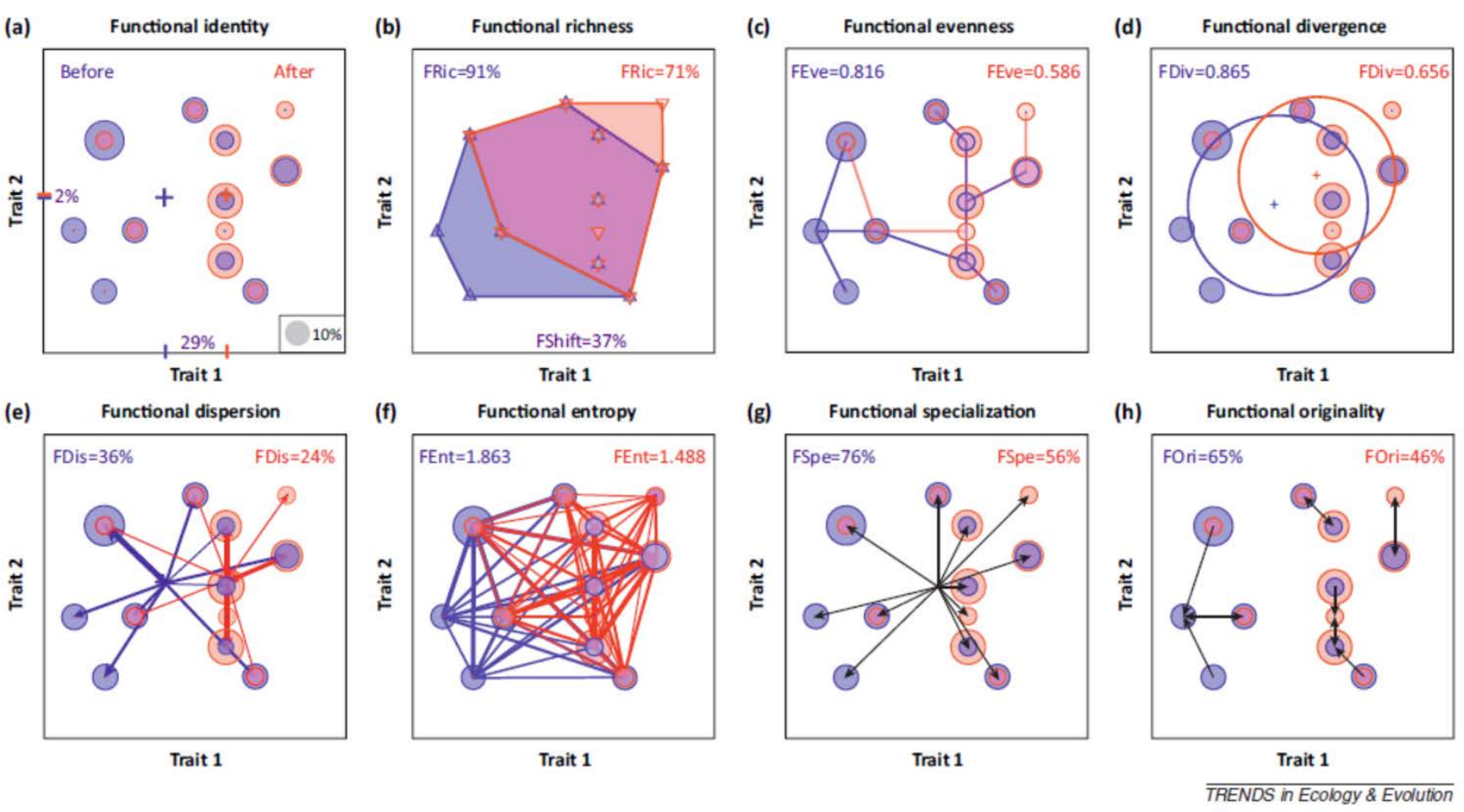
- Beak traits
- Wing and tail traits
- Tarsus, toe and claw traits





Eck, S. et al. 2011. Measuring birds. Vögel vermessen. *Deutsche Ornithologen-Gesellschaft.*

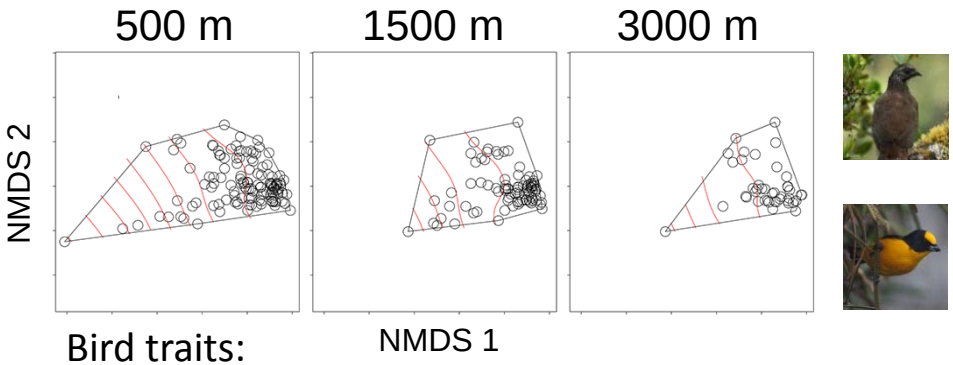
Impact of disturbance on functional trait space



Mouillot et al. 2013 *TREE*

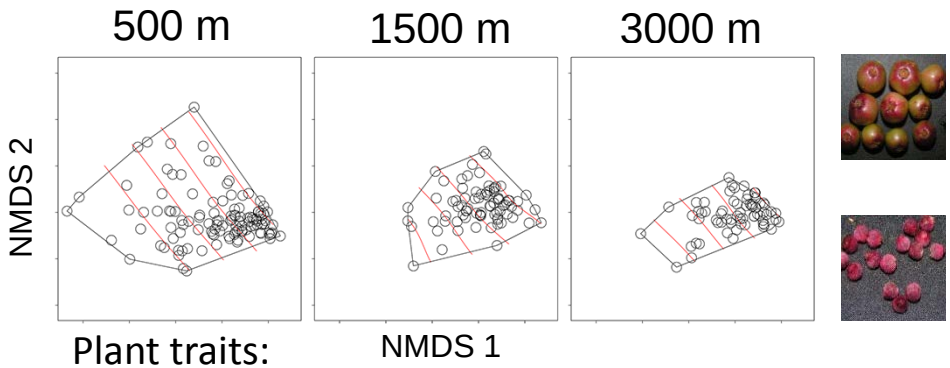
Impact of climate on functional trait space

Birds

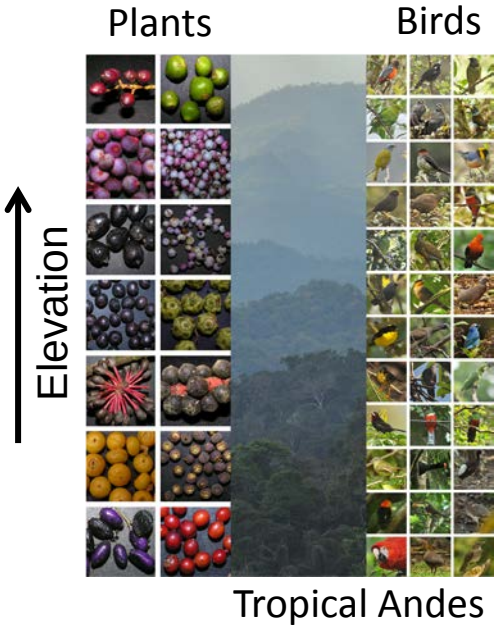


Bird traits:
beak length, beak width, body mass, wing pointedness

Plants



Plant traits:
fruit length, fruit diameter, crop mass, plant height

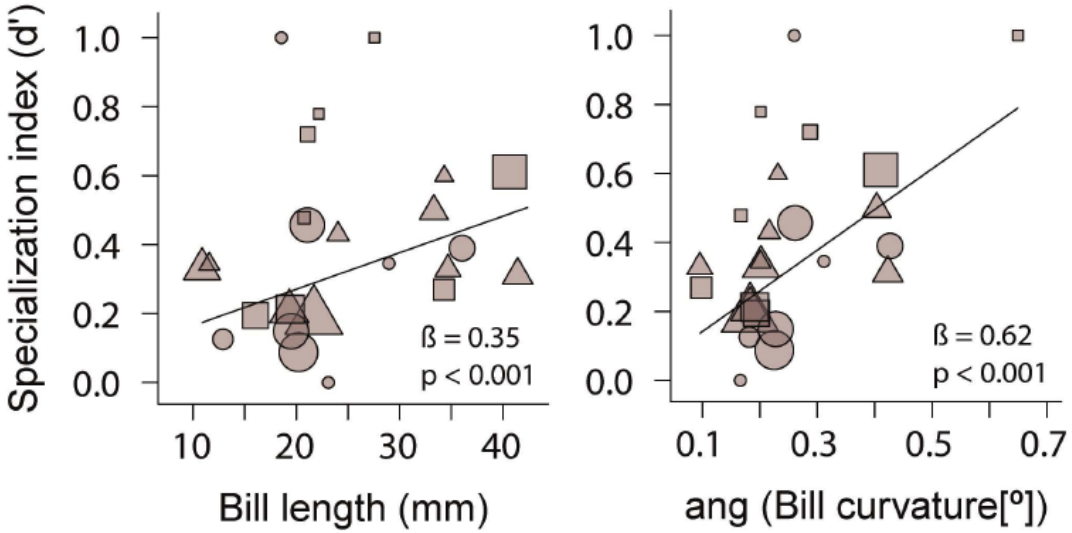


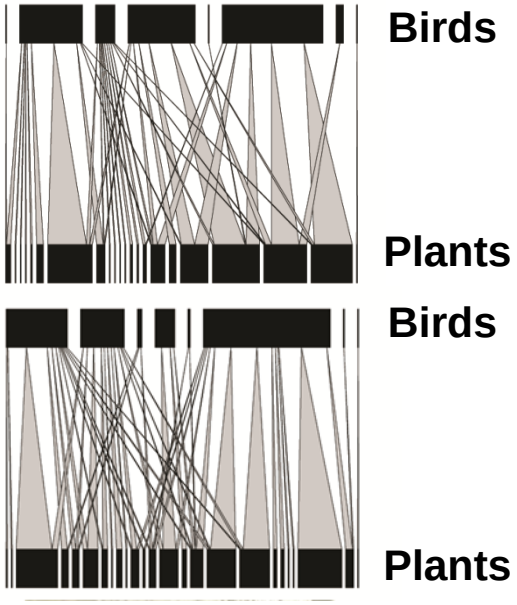
Tropical Andes

Higher or lower functional redundancy at low elevations/ in the tropics?

Dehling et al. 2014 *Global Ecol Biogeogr*

Impact of traits on specialisation in interaction networks



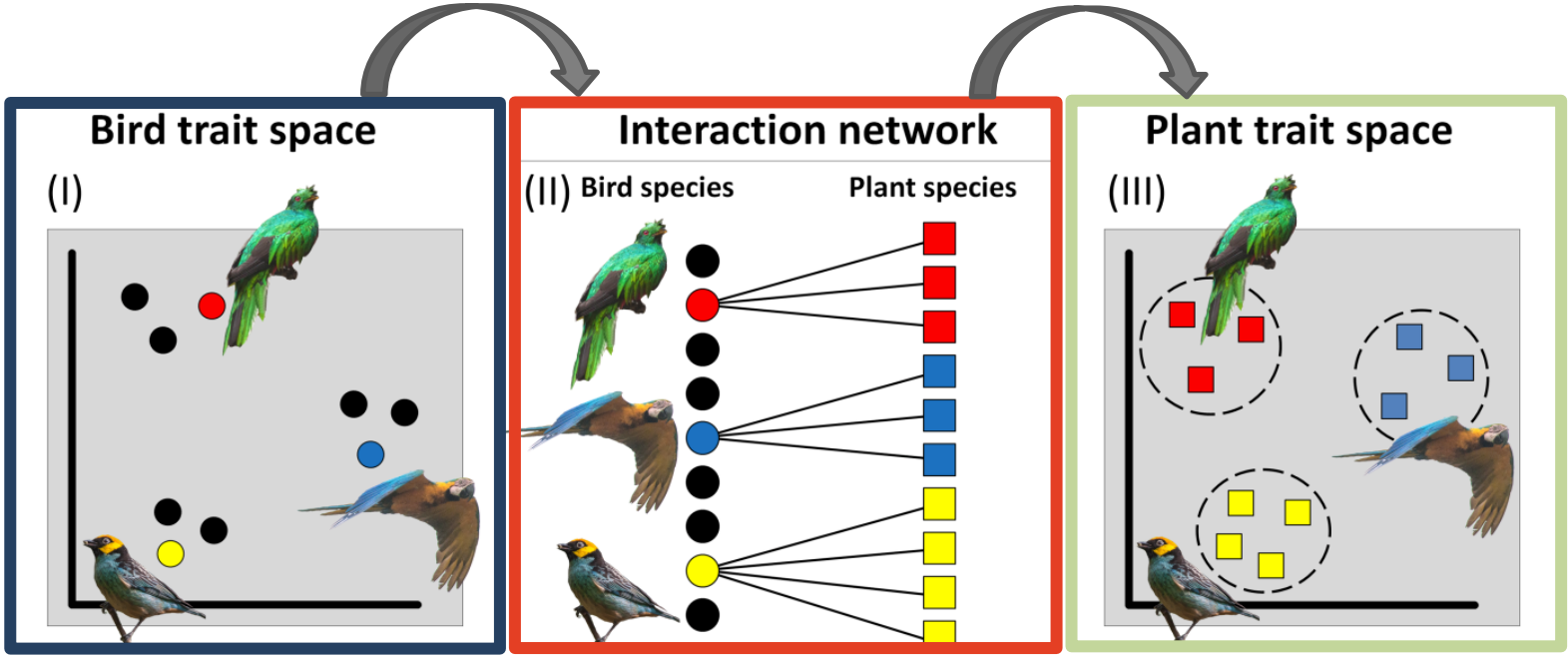


Specialization increases with morphological specialization

Maglianesi et al. 2014 *Ecology*

Traits and functional roles of species

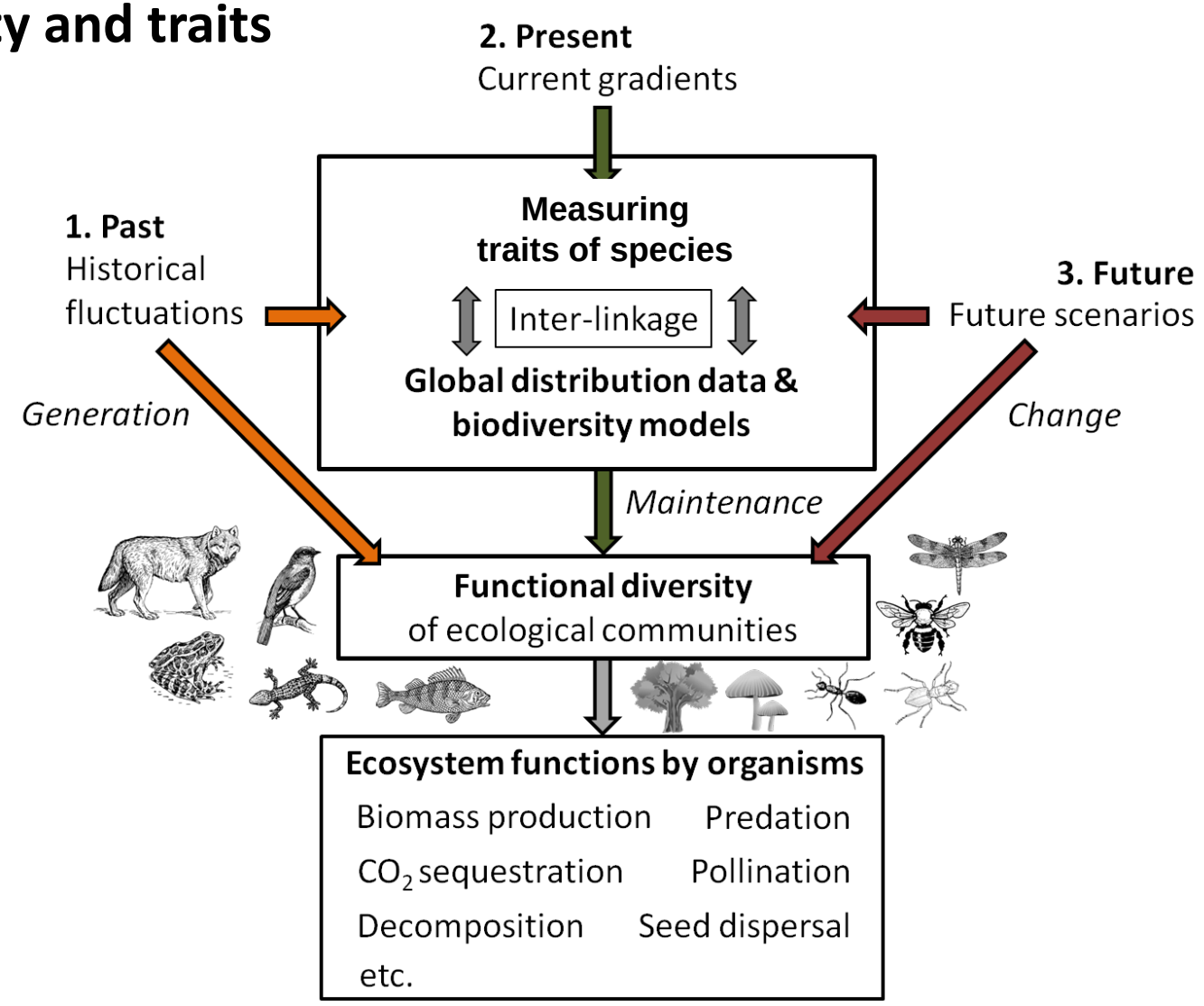
Morphology determines distinct functional roles of species



Correspondence:
beak size versus fruit size, body mass – crop mass,
wing pointedness – tree height

Dehling et al. *under review*

Linking biodiversity and traits



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  we need to link biodiversity to ecosystem functioning and ecosystem services

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- **Interesting problems, specific ideas:**

  biodiversity plus traits = functional diversity?

  - birds, mammals, amphibians, reptiles, fish, dragonflies, bees, dung beetles, plants, fungi
  - terrestrial, freshwater and marine realm
  - fossil and present-day species

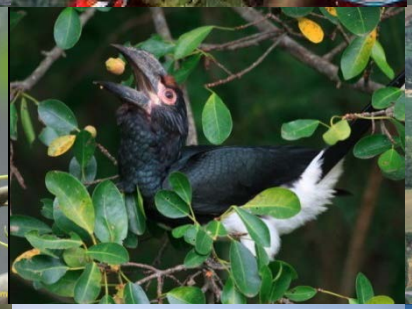








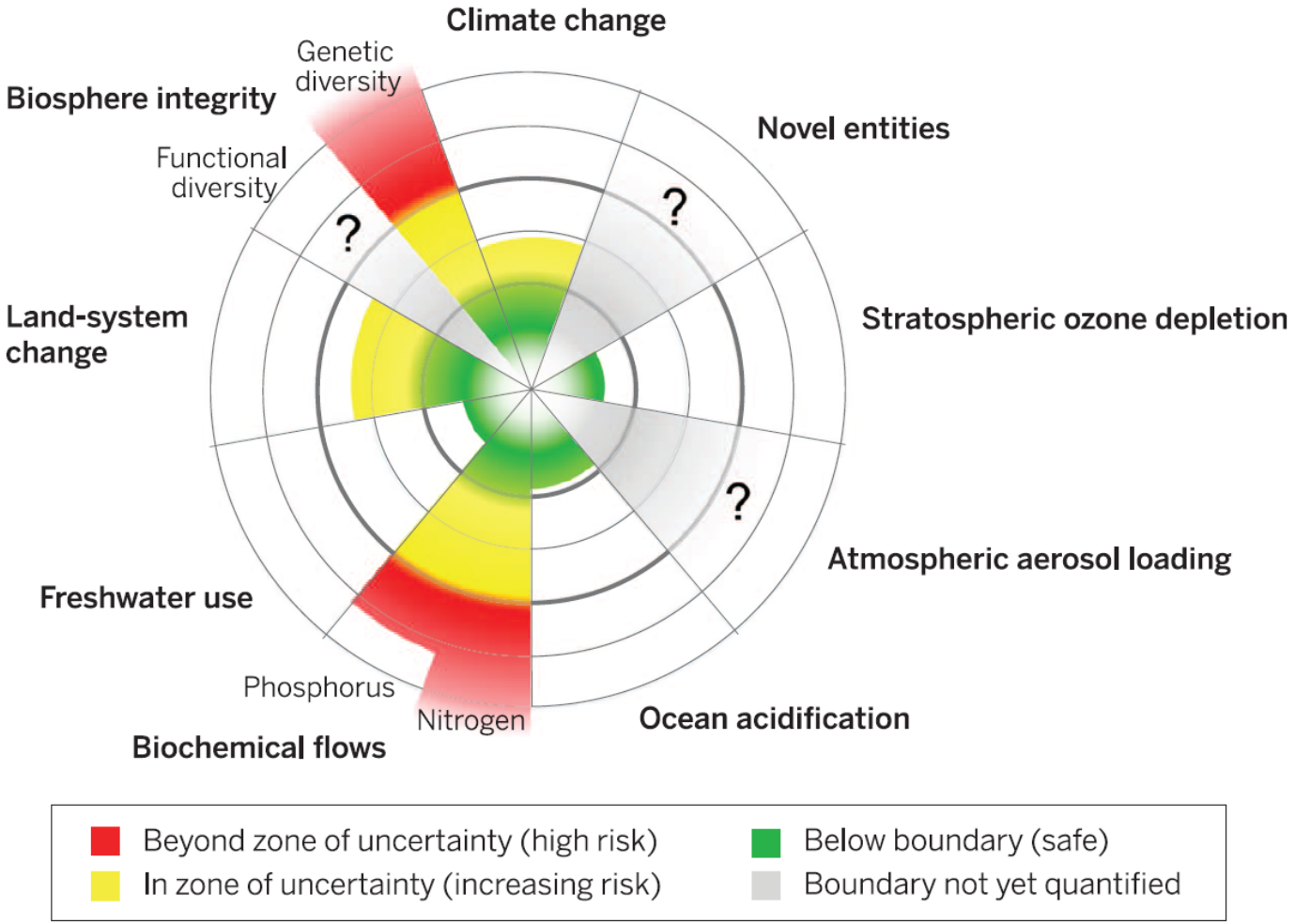







Planetary boundaries

Global Change:
We are leaving the „safe operating space for humanity“



Steffen et al. *Science* 2015