Changes in functional and taxonomic diversity under climate and land-use changes - a 170 years perspective

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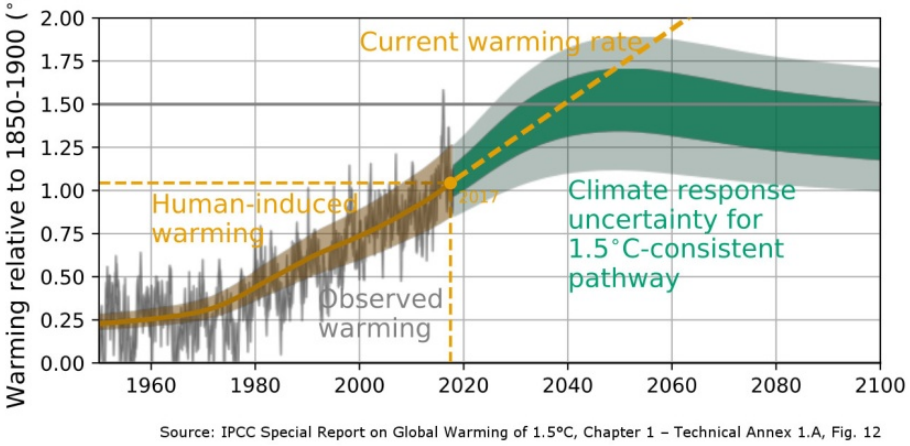
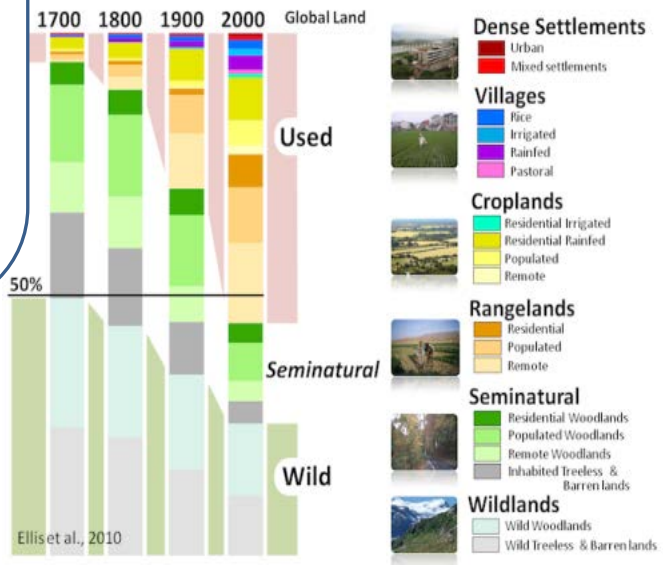
Recent changes in climate and land-use

Changes in climate and land-use are widespread globally



IPCC special report (2018)

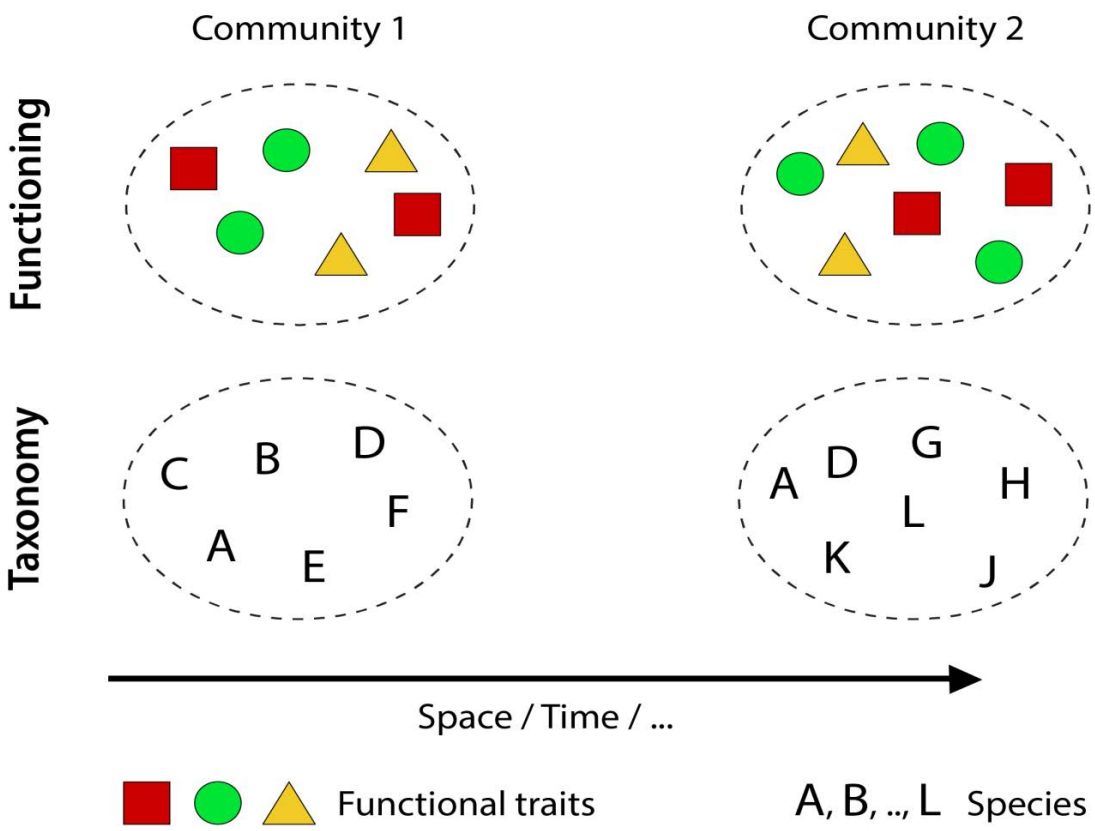


Ellis et al., 2010

Separate and synergic effects on biological diversity

Multiple facets of biological diversity: TD *vs* FD

Studies on biodiversity loss mainly focus on Taxonomic diversity (TD)

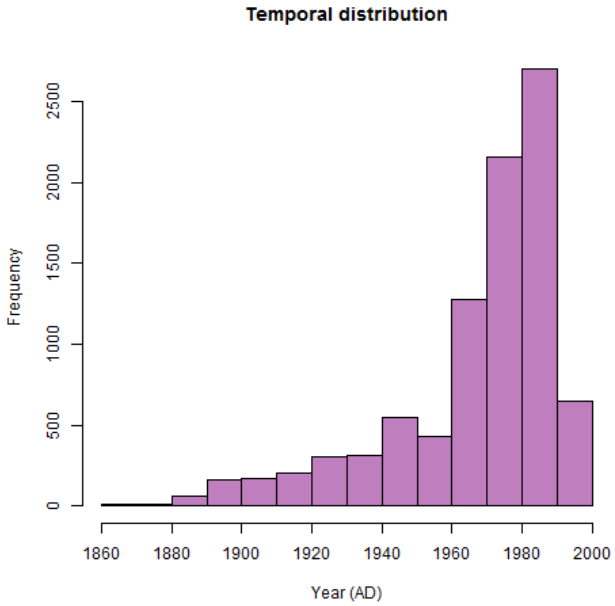


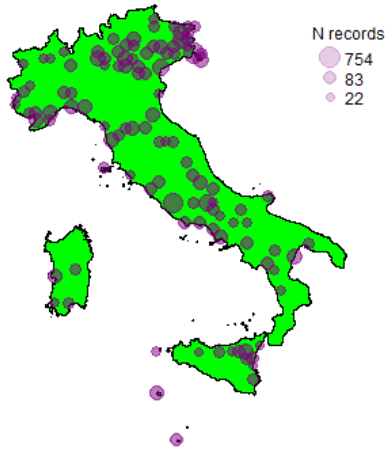
Replacement of species identity *vs* Replacement of species function

The temporal dimension of diversity

Long-term studies on biodiversity trends are hampered by the lack of information on past species distribution

ClimCKmap (*Marta et al.*) : **8,445** species **268,977** records **1680-2006 CE**





6 taxonomic groups (3 amphibians *vs* 3 terrestrial) and **631** species

9,009 records / **272** cells * years / **6** functional traits

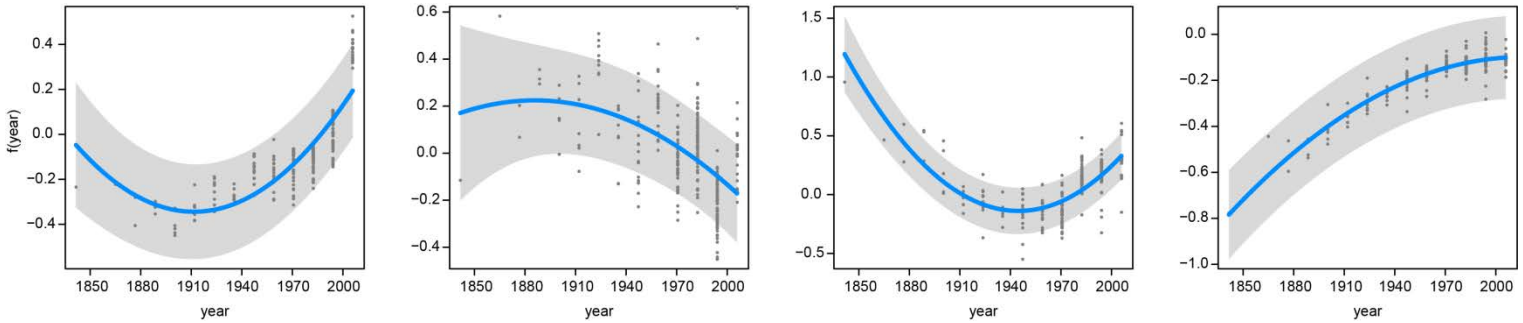
ad-hoc estimated **temperature** and **precipitation** data

Aims

Effects of land-use and climate changes on biodiversity

CLIMATE | **LAND-USE**

temperature | precipitation | wilderness | population



Taxonomic (TD) vs Functional (FD)

Temporal changes in α diversity

α *D ~ climate + land-use + 1|cell*

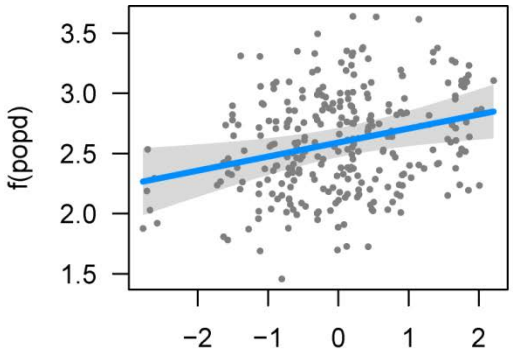
Temporal β diversity

β *D ~ climate **trend** + land-use **trend***

Temporal changes in α diversity

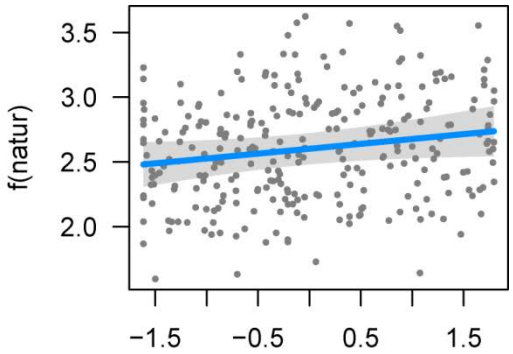
Taxonomic diversity

population



sampling bias

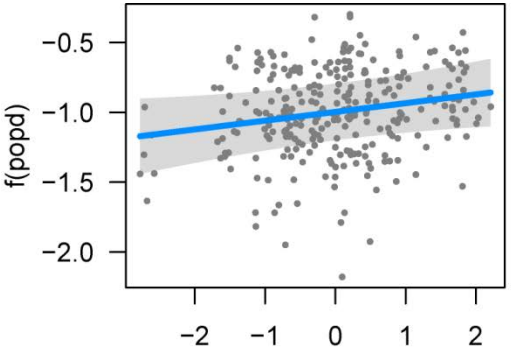
wilderness



habitat increase

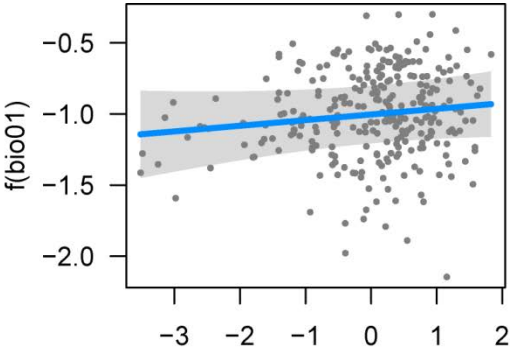
Functional diversity

population



sampling bias

temperature

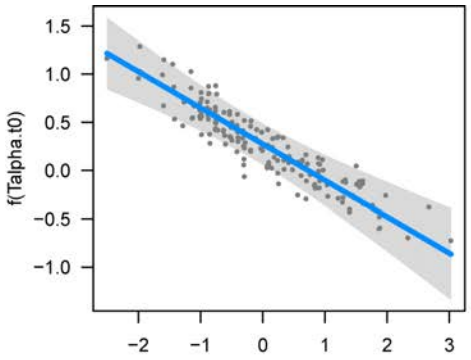


“tropicalization”

Temporal β diversity

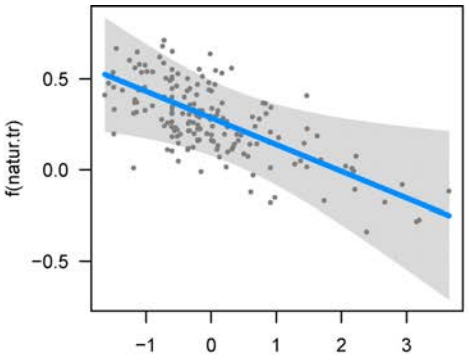
Taxonomic diversity

baseline αD



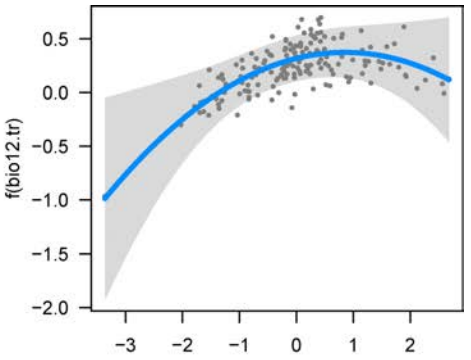
resistance

wilderness



stress reduction

precipitation



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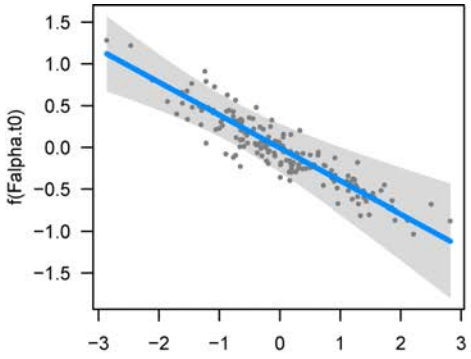
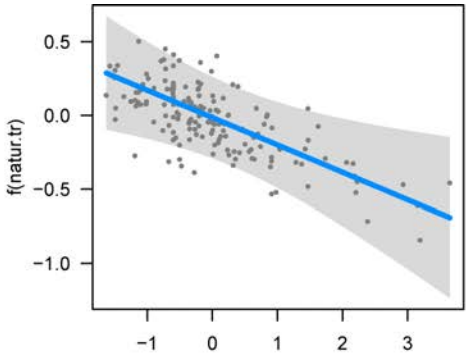
Functional diversity

baseline αD



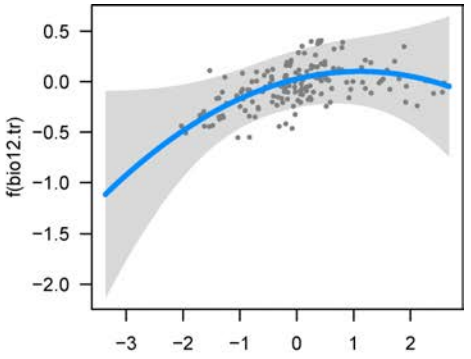
resistance

wilderness



stress reduction

precipitation



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Concluding remarks

Data generally supported our hypotheses at both the α- and the β- levels

α level

- ✓ increasing diversity following population density: **sampling bias**
- ✓ evidence for positive effects of **rewilding** and increasing **temperatures** on αTD and αFD, respectively

β level

- ✓ **resistance** of structured communities
- ✓ evidence for a "**stress reduction**" hypothesis
- ✓ **precipitation** showed an effect opposite to the expected one