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

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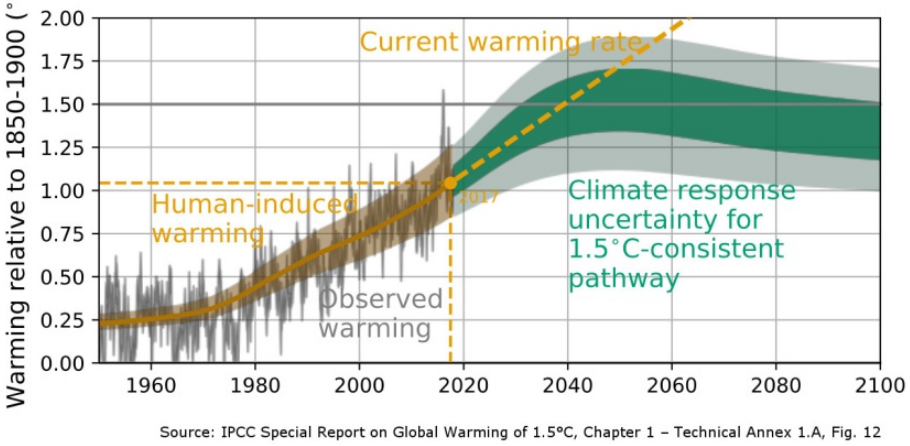
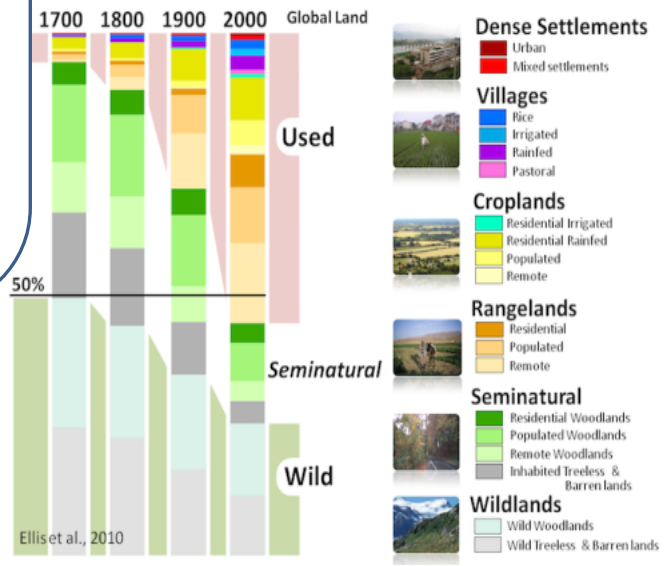
# Recent changes in climate and land-use

Changes in climate and land-use are widespread globally




*IPCC special report (2018)*

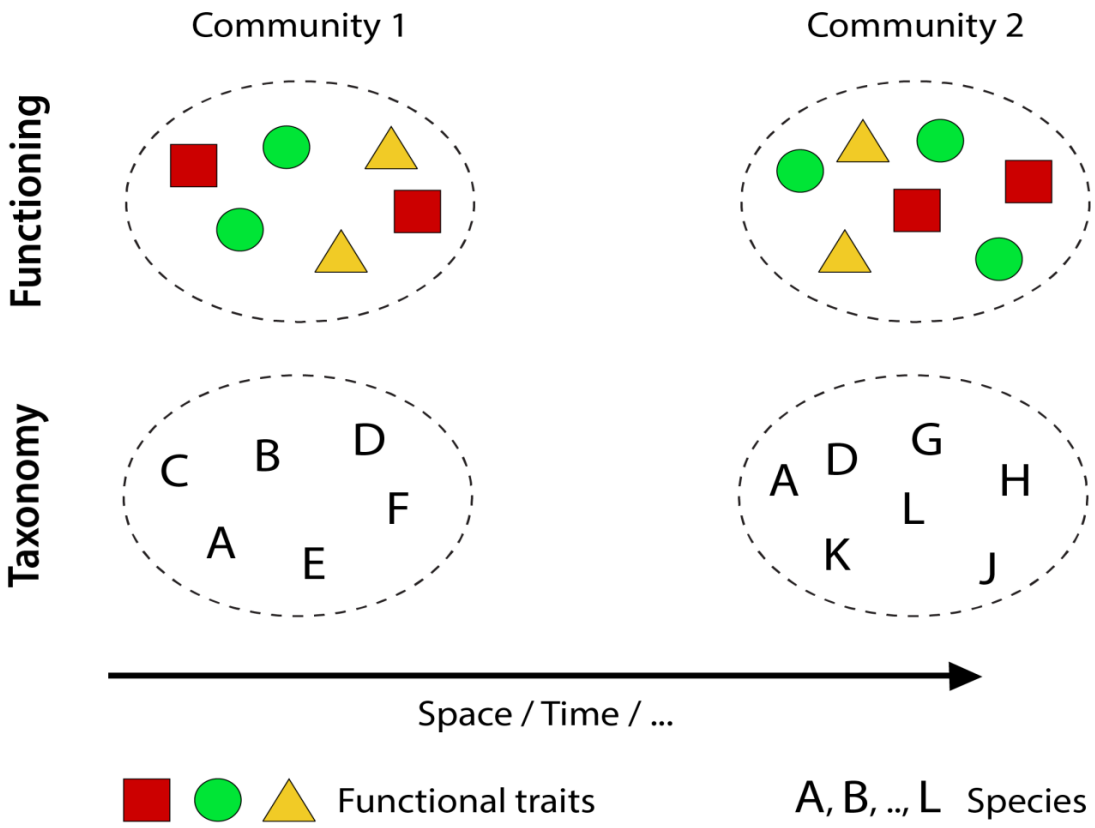



*Ellis et al., 2010*

**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)

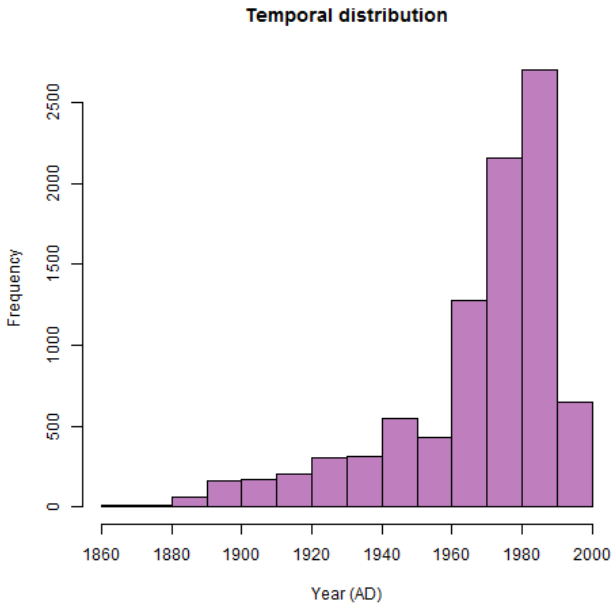


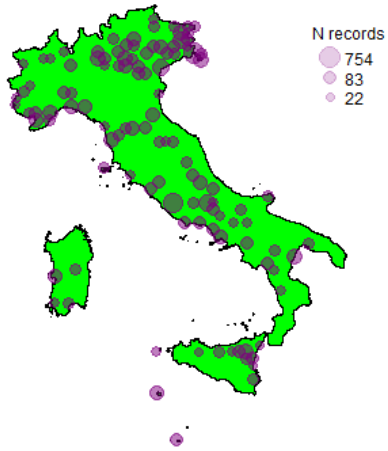

**Replacement of species identity *vs* Replacement of species function**

# 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

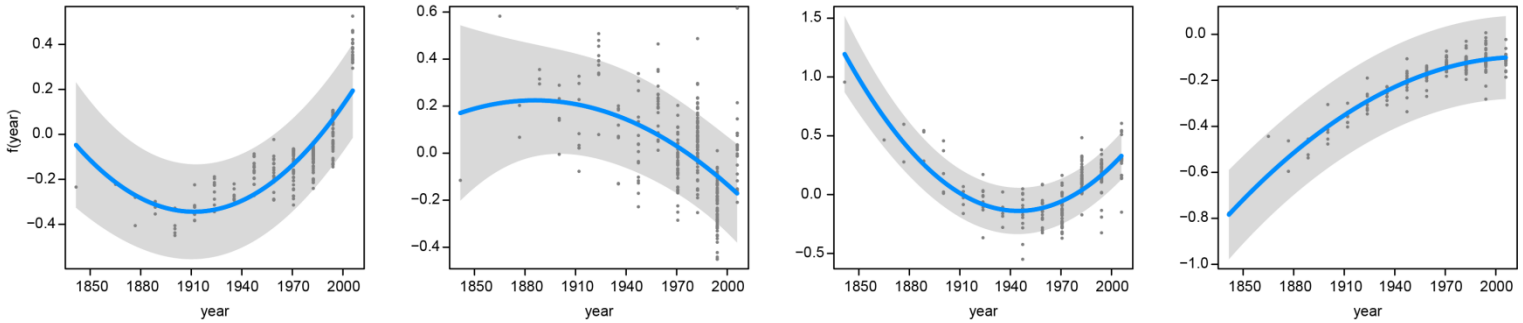
***ad-hoc*** estimated **temperature** and **precipitation** data

# 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

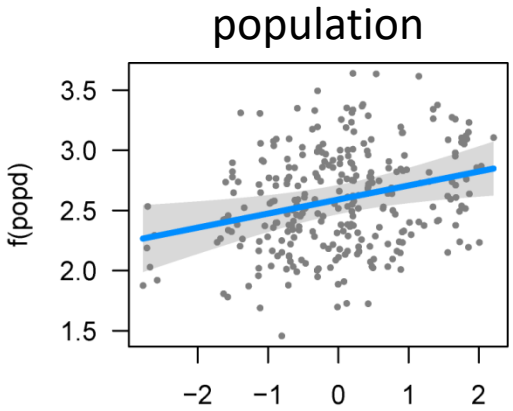
α *D ~ climate + land-use + 1|cell*

### Temporal β diversity

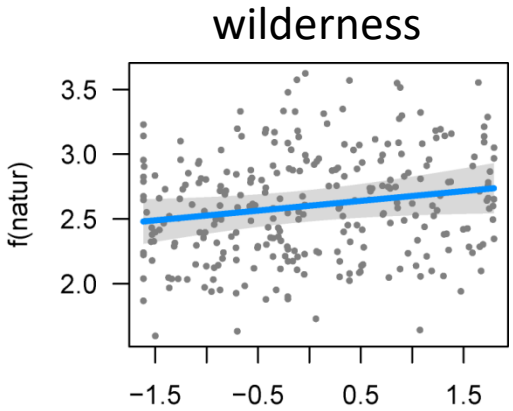
β *D ~ climate **trend** + land-use **trend***

# Temporal changes in α diversity

## Taxonomic diversity

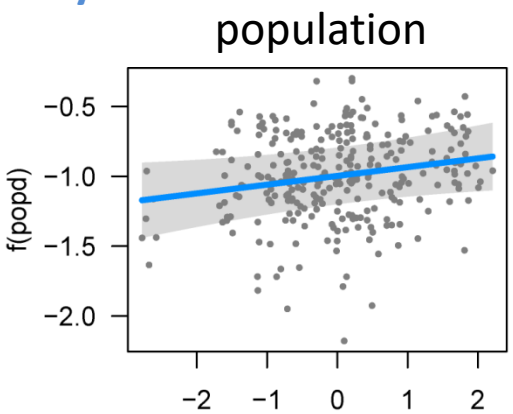



sampling bias

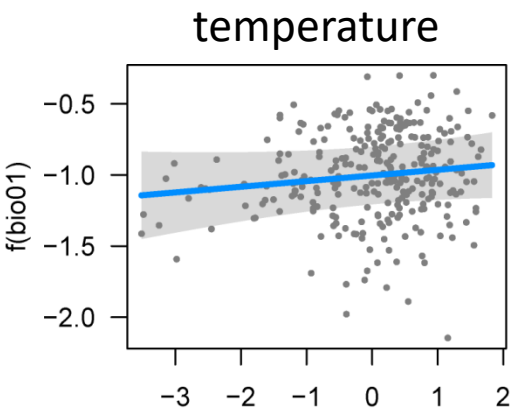



habitat increase

## Functional diversity




sampling bias

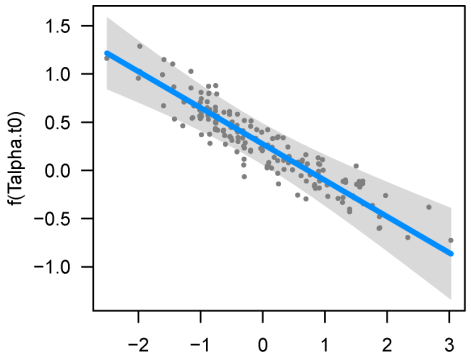



“tropicalization”

# Temporal β diversity

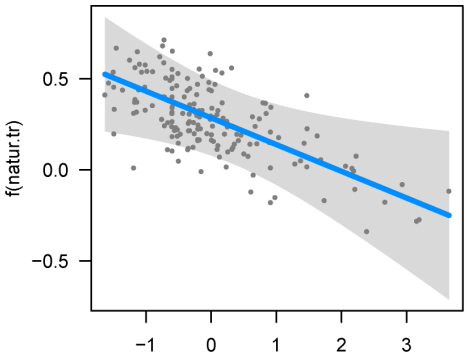
## Taxonomic diversity

baseline αD



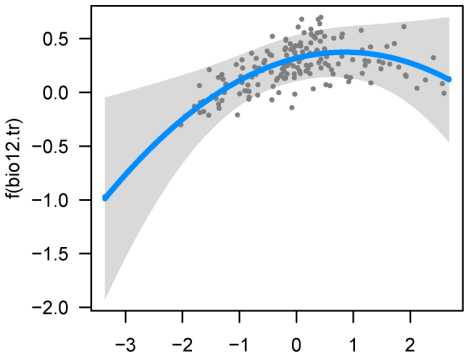

resistance

wilderness




stress reduction

precipitation

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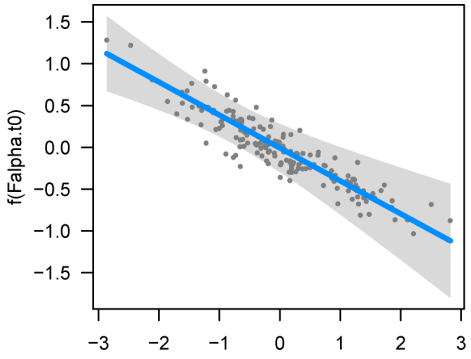
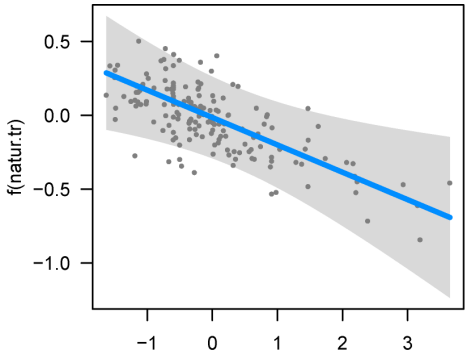
## Functional diversity

baseline αD



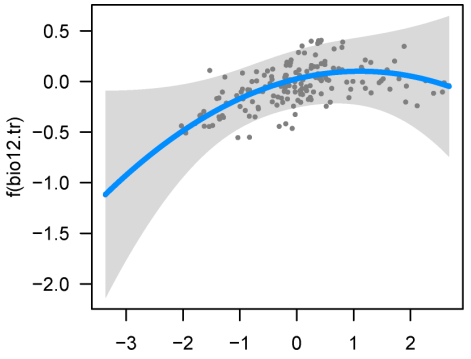

resistance

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