FET: Functional Ecology of Trees database

A global database project on plant and ecosystem traits with an initial focus on temperate and boreal forests

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FET is a joint initiative of

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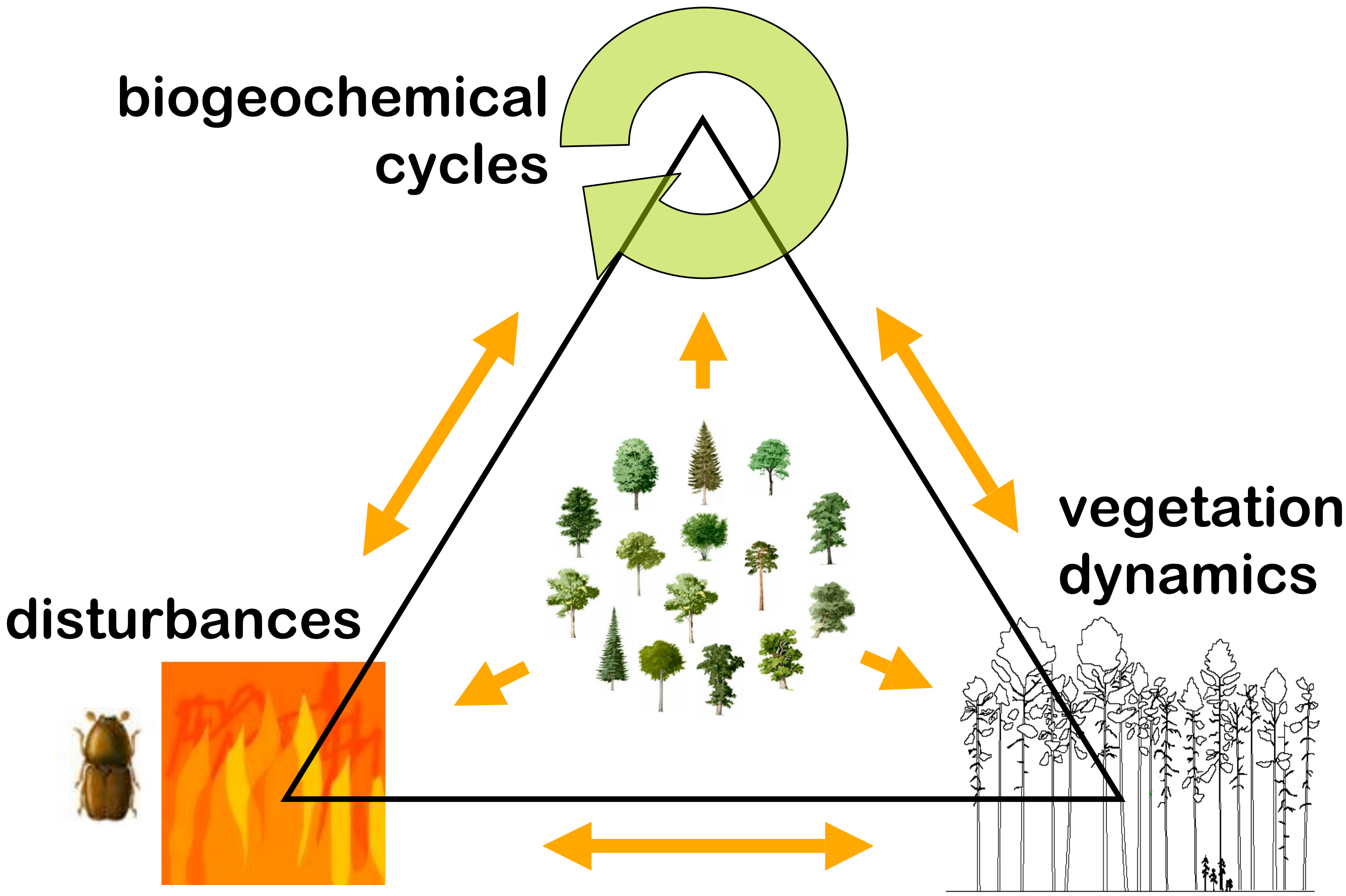
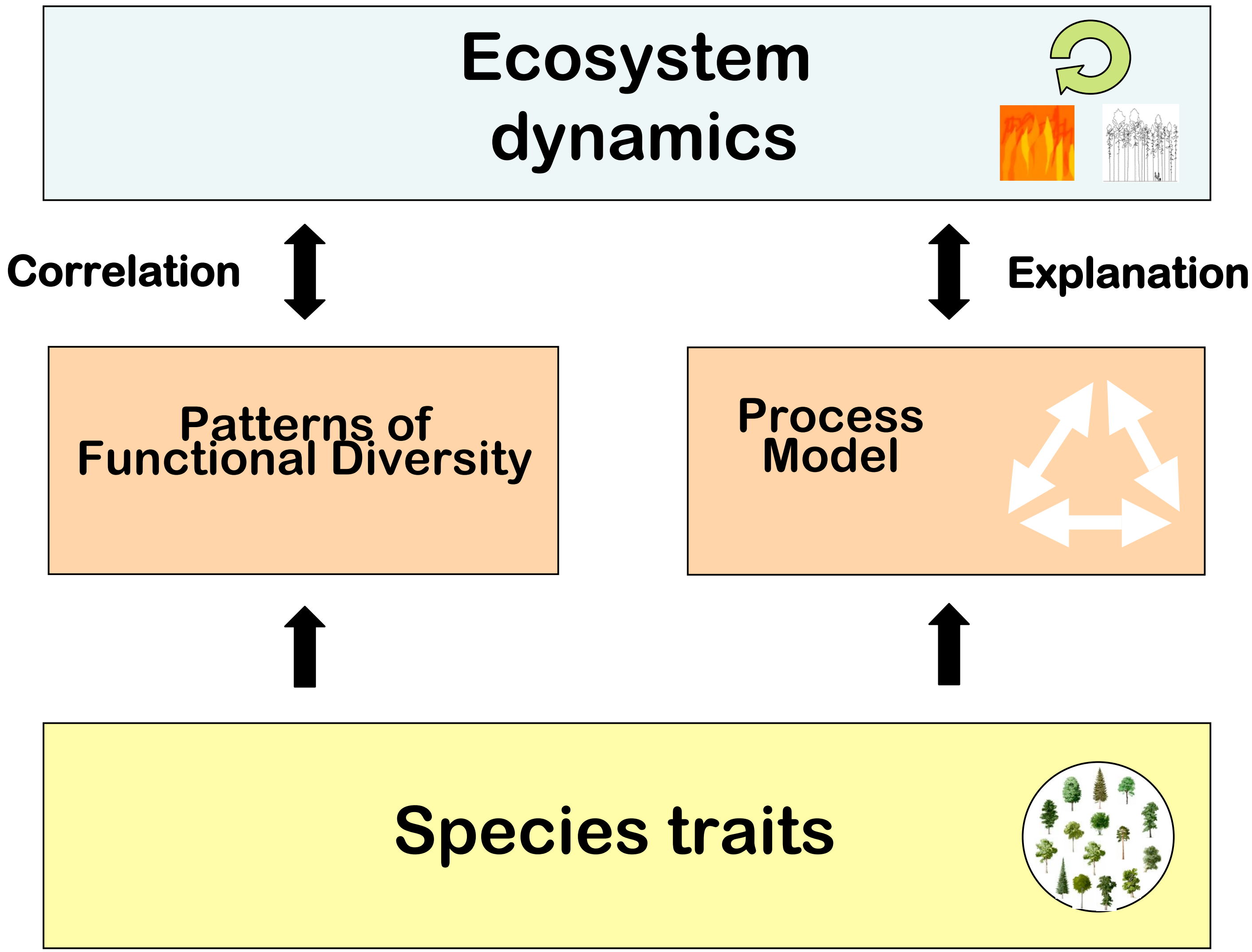
SNWG
Organismic Biogeochemistry

The signature of species and species diversity in local and global biogeochemical cycles

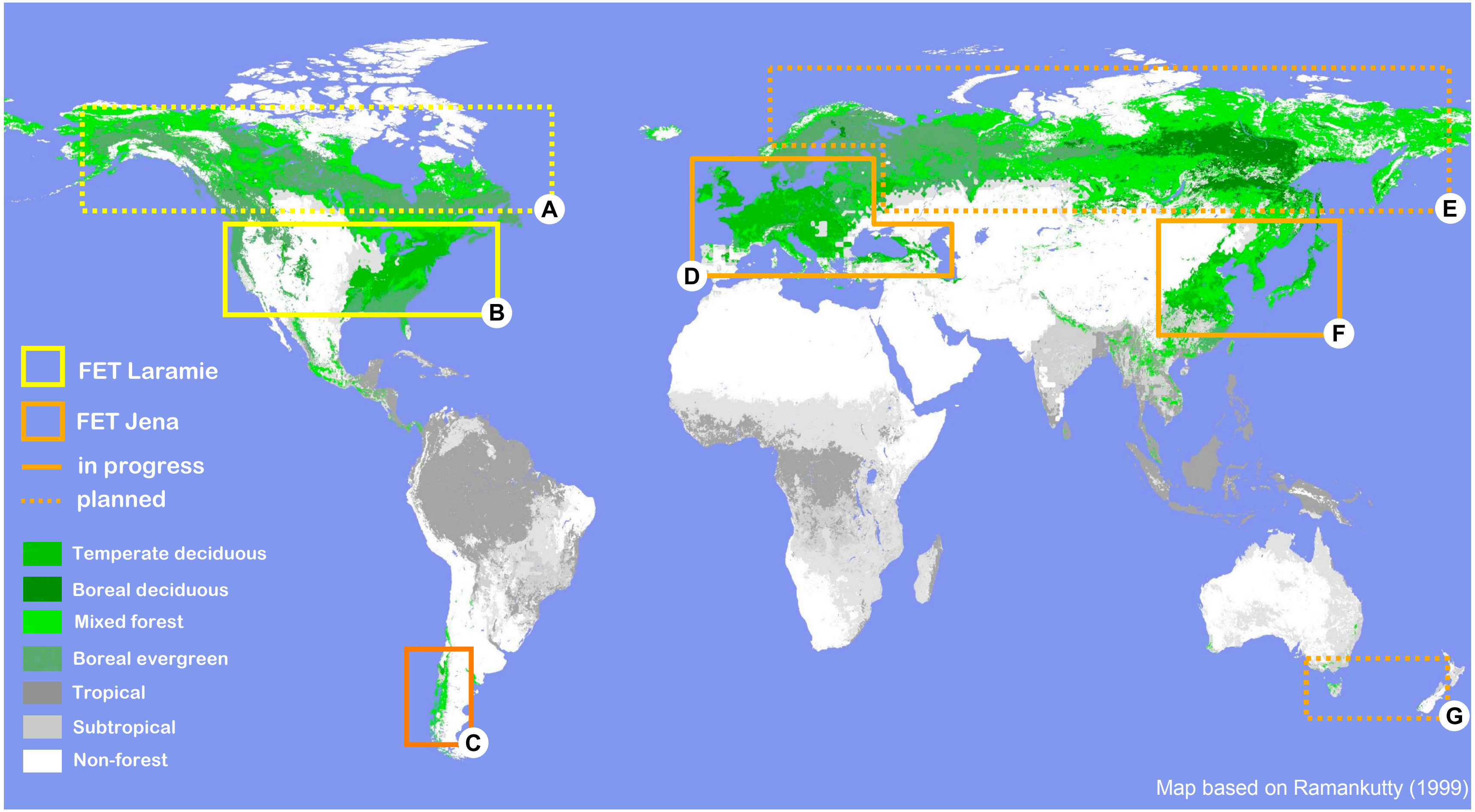
Triangle of Ecosytem Dynamics



Conceptual Framework



Current Focus Regions



Ⓐ boreal North-America
Ⓑ temperate North-America
Ⓒ temperate South-America

temperate Europe Ⓓ
boreal Eurasia Ⓔ
temperate Asia Ⓕ
temperate Australia/New Zealand Ⓖ

Intentions of FET

- Bioclimatic variation and limits of traits
- Biogeography of functional diversity
- Cross-categorial trait correlations
- Acclimation of traits
- Bottom-up redefinition of PFTs
- Model parameter estimation and data assimilation

List of traits to be addressed

Plant functional Traits

- **Tissue longevity**
- **Maximum stomatal conductance**
- Stomatal sensitivity
- **Maximum photosynthesis rate**
- **Maximum carboxylation rate**
- **Maximum electron transport rate**
- **Temperature dependency of Vcmax**
- **Temperature dependency of Jmax**
- **Temperature dependency of Rd**
- **Basal respiration rates**
- Growth respiration rates
- **Construction costs**
- **Nutrient concentration (N, P)**
- **TNC content**
- C,N,P-Retranslokation efficiency
- Tissue compound composition
- Phenology
- N, P-Uptake rates of fine-roots
- Frost tolerance
- Salt tolerance
- Maximum relative growth rate
- **Shade-tolerance**

Plant structural traits

- **Specific leaf area**
- Leaf dry matter content
- Leaf shape
- Maximum leaf length
- Leaf clumping
- **Wood density**
- Mean diameter of xylem vessels
- Xylem conduit area per stem area
- Xylem conductivity / cavitation
- Trunk taper
- Sapwood taper
- **Wood type**
- Maximum rooting depth
- Specific root length
- Fine root diameter
- Adventitious root growth
- **Maximum height**
- **Maximum diameter**
- Bark thickness
- H-D allometries
- Crown area-D allometries
- Leaf area-sapwood area-ratio
- Leaf mass-sapwood area-ratio
- **Mass allometries**
- Adult crown transparency
- Crown shape in the open

Demographic traits

- **Seed mass**
- Seed terminal velocity
- Seed longevity / seed bank
- Serotiny
- Time to reproduction
- **Dispersal distance**
- **Dispersal mode**
- Masting cycle
- Regenerative reproduction
- **Plant life span**
- RGR=f(light)
- Mortality=f(growth)

Ecosystem functional traits

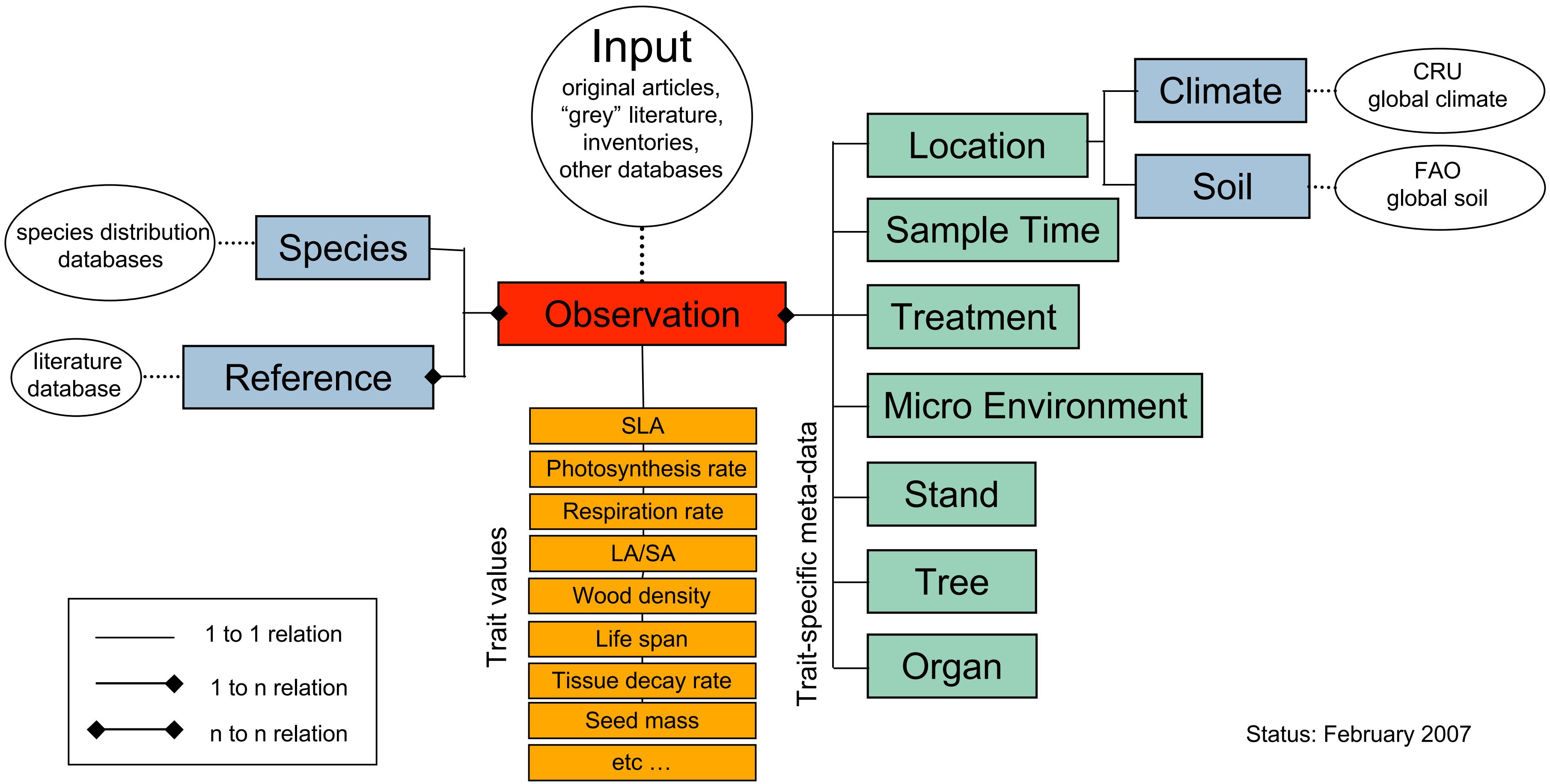
- Leaf decay rates
- **Coarse woody debris decay rates**
- Interception intensity
- Mykorrhizal association
- N-Fixation
- Basal isoprene emission rates
- Basal monoterpene emission rates
- General palatability
- Susceptibility to deer browsing

Work in progress

Design criteria

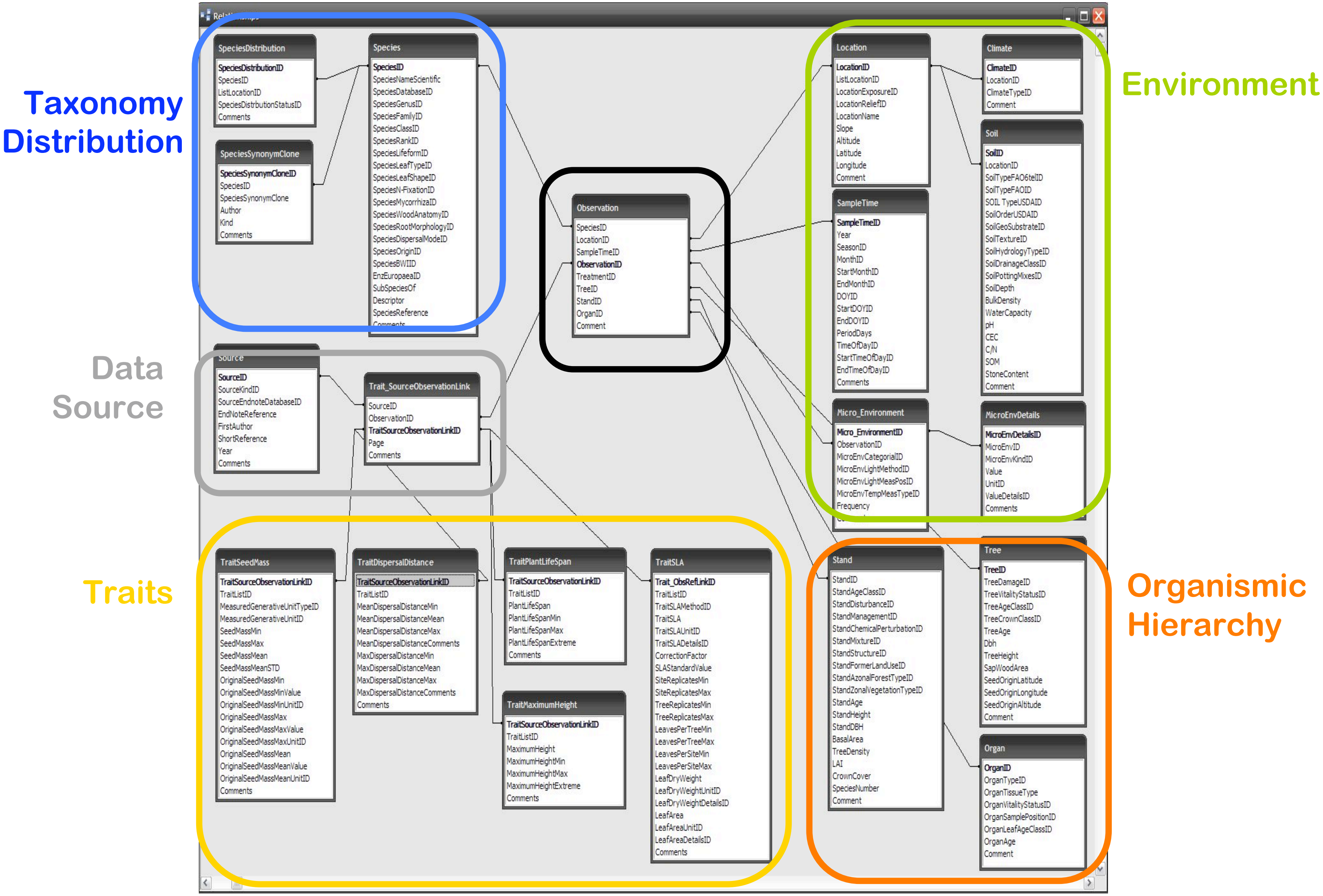
- Hierarchical Structure
- Identity Principle
- Flexible aggregation
- Assimilation of general meta data from external sources
- Compatibility with existing literature
- Relational

Database Structure



Status: February 2007

A snapshot of the database

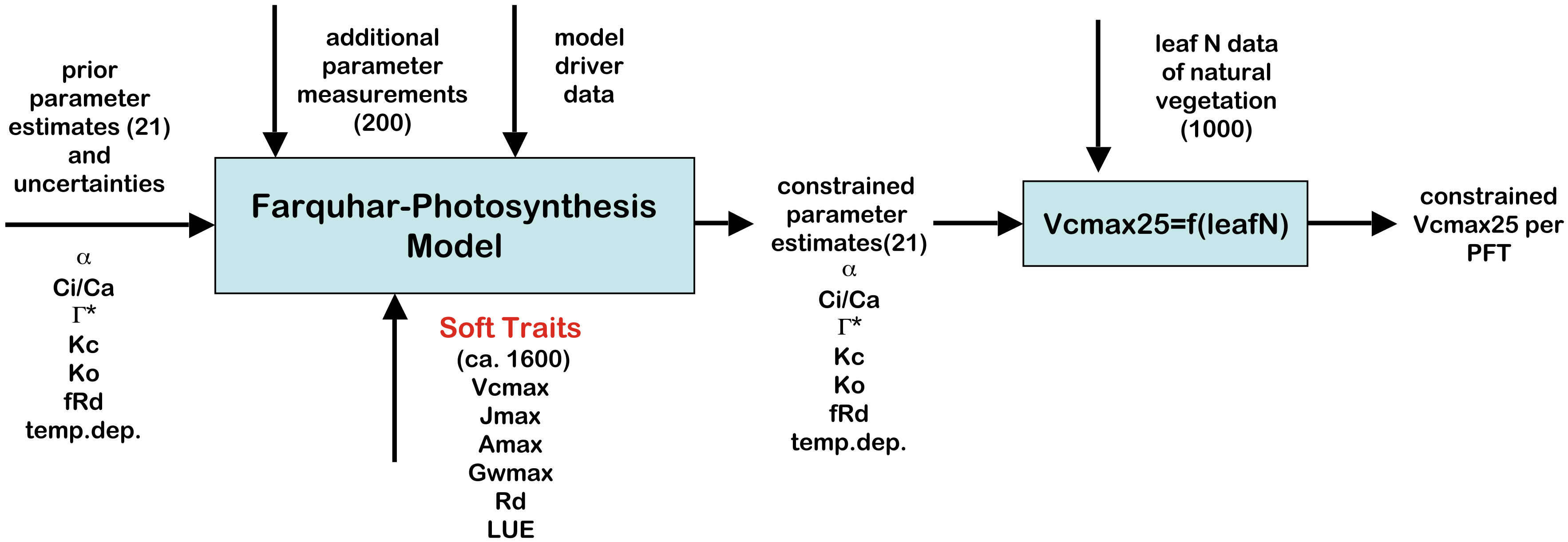


Examples

- A data-assimilation framework to invert model parameter estimates (hard traits) from various kinds of measurements (soft traits)

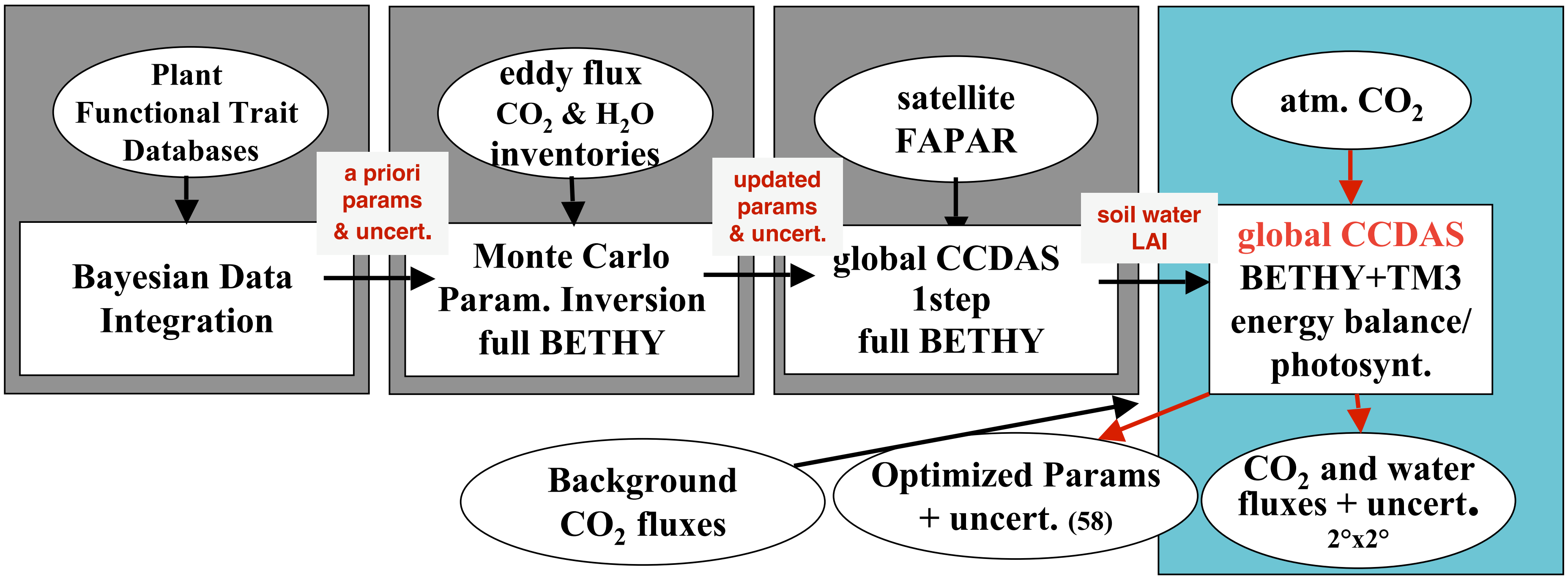
- A case study: Old-growth biomass trajectories

A data-assimilation framework to invert parameter estimates (hard traits) from various kinds of measurements (soft traits)



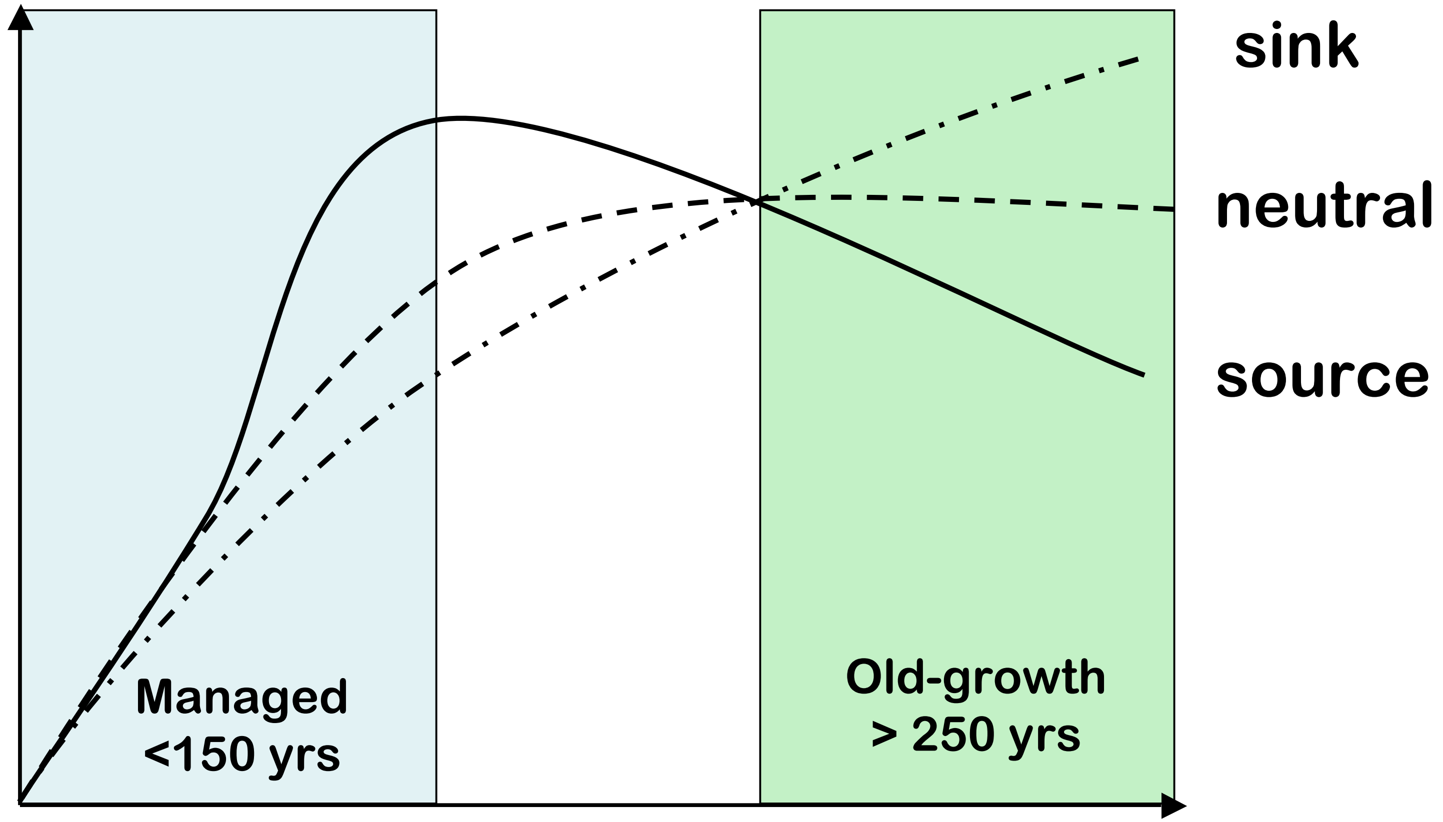
- **Bayesian approach and MCMC inversion technique**

CCDAS: a global carbon cycle data assimilation system



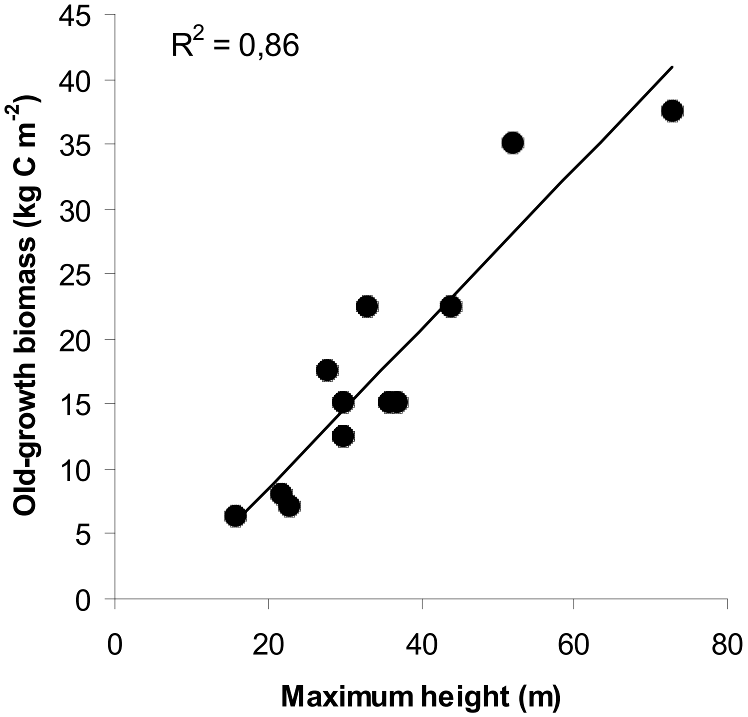
Wolfgang Knorr, Thomas Kaminski, Marko Scholze, Peter Rayner, Ralf Giering, Jens Kattge,
Heinrich Widmann, Christian Roedenbeck, Martin Heimann & Colin Prentice

Case study:
Old-growth biomass trajectories

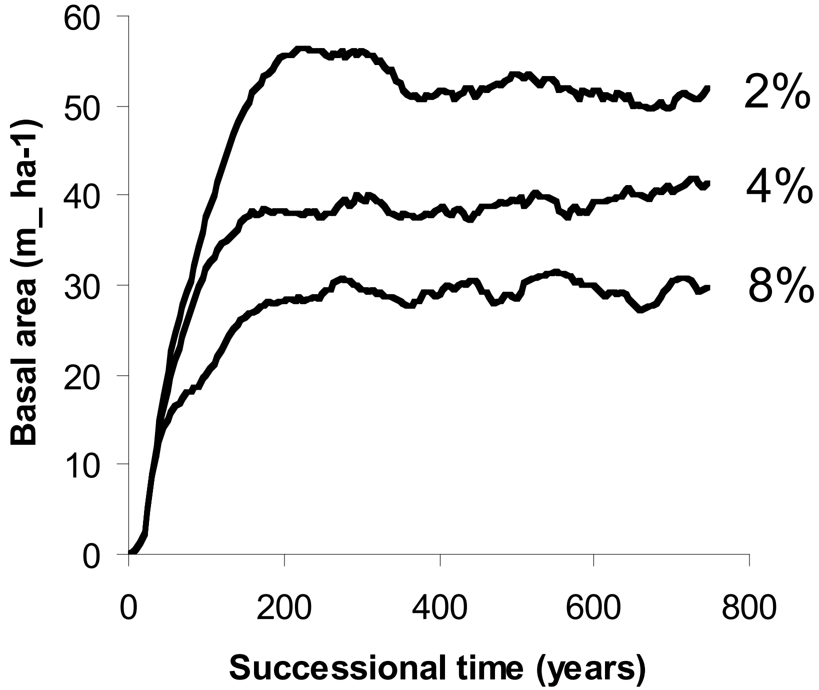


Two traits that may help

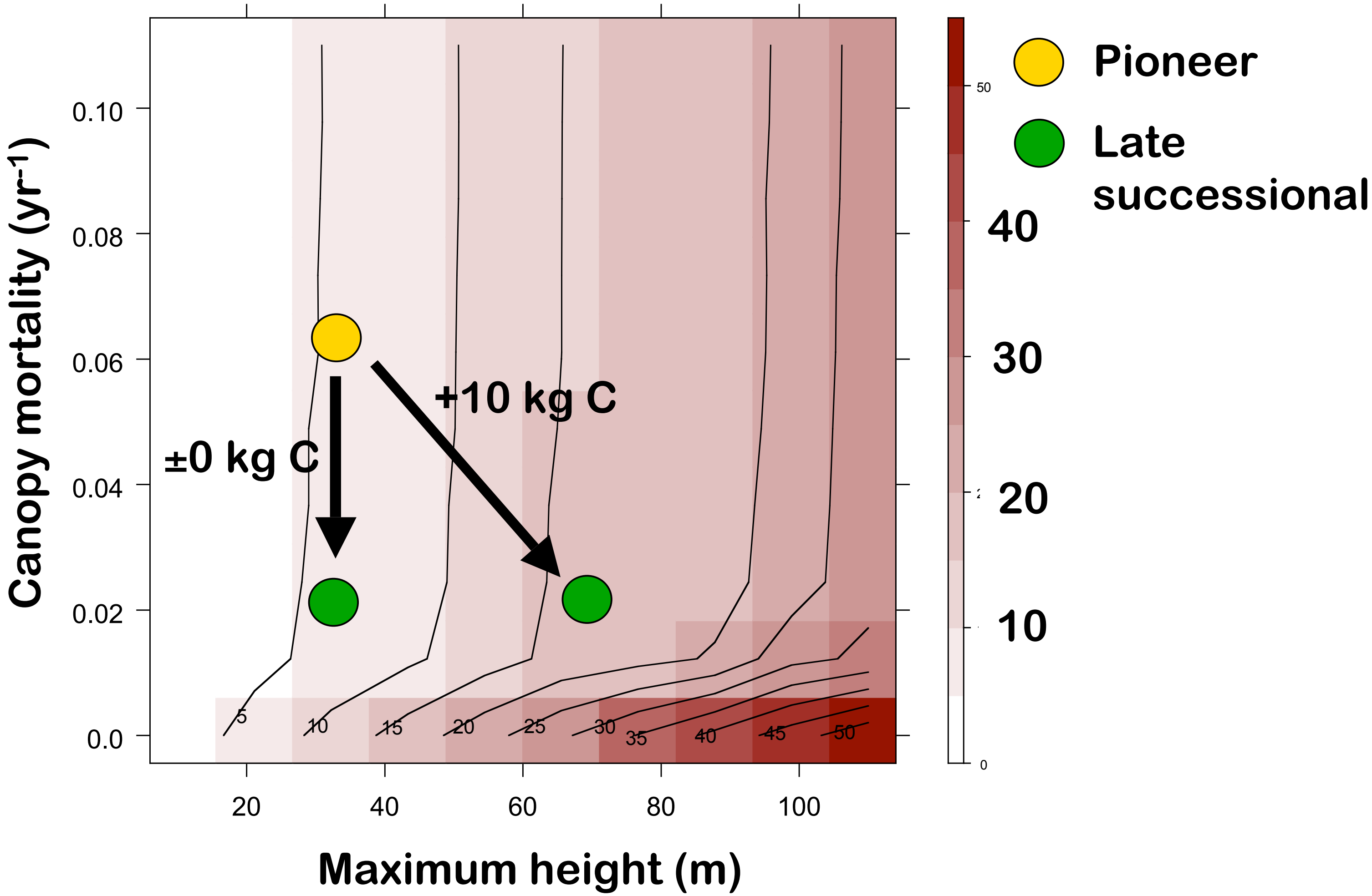
Maximum height



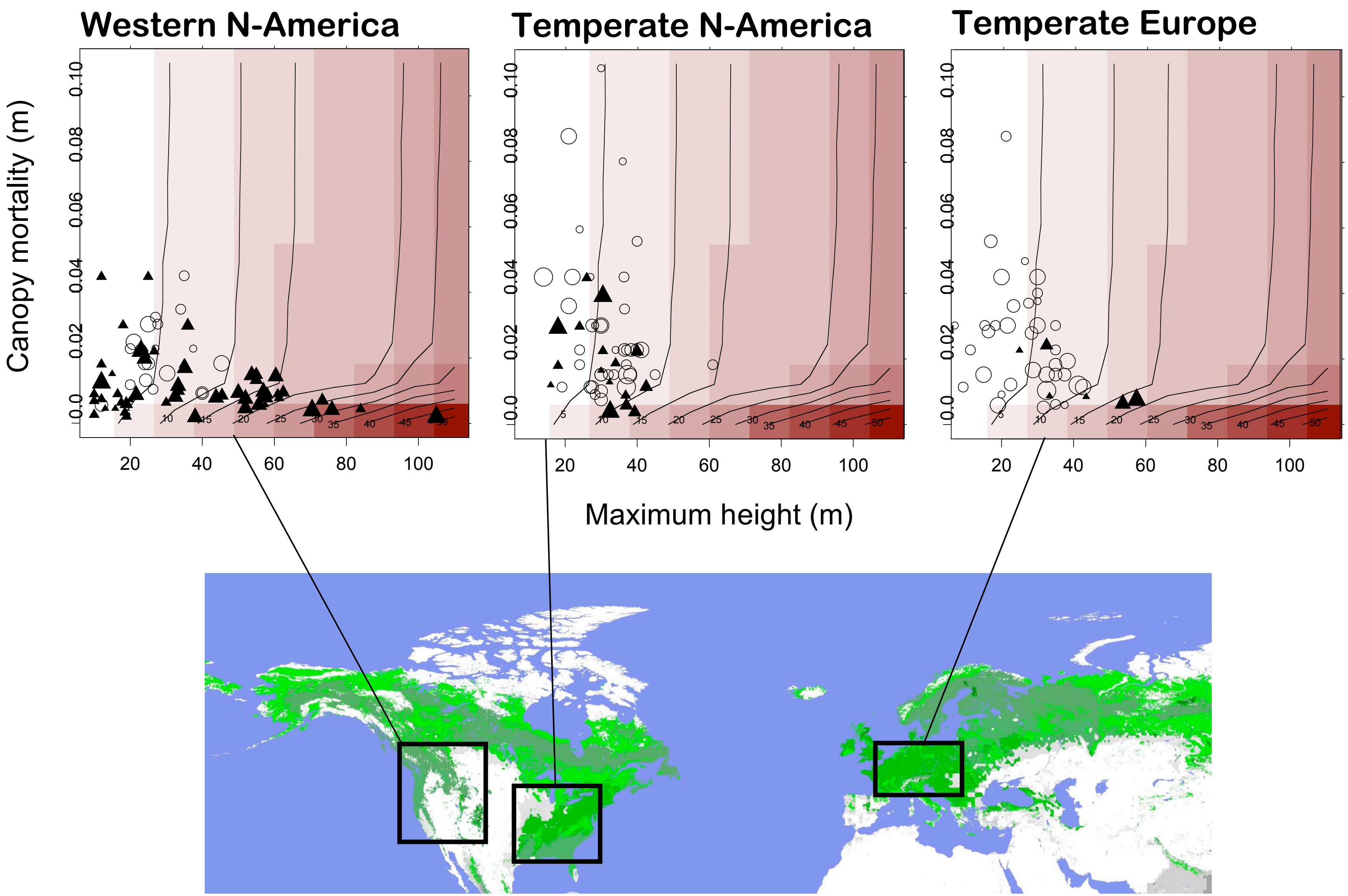
Mortality rates



Old-growth equilibrium biomass = f(H_{max}, mort)



Comparing vegetation zones



Thank’s for your attention!