

Drought and Forest Biodiversity



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&
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The context: Biodiversity crisis

- **Fastest species loss ever.**
- **20% within the next 30 – 50 yrs.**
- **Man-made!**
- **Most species will go extinct before they are described / known.**

Chordates

Molluscs

'Protozoa'

Algae

Viruses

Bacteria

Others

Levels of Biodiversity

Ecosystems

Habitats

Species

Genes



Biodiversity Compartments

Regional

Associated

Aboveground

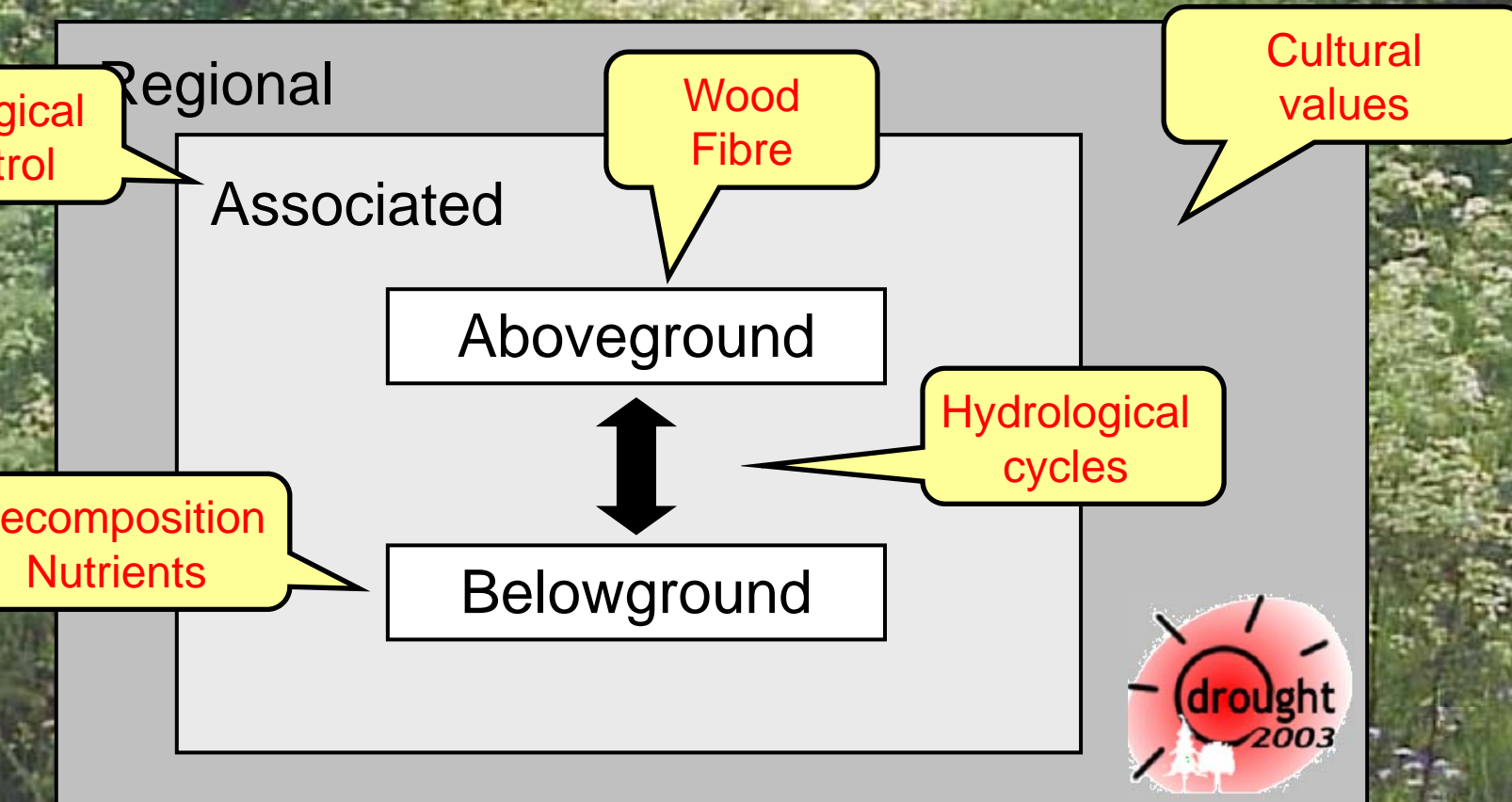


Belowground



Why do we care?

Ecosystem services



Major Questions

How does drought affect the various levels and components of forest diversity?

How does diversity affect the resistance of forests against drought (incl. secondary effects such as pest outbreaks)?



Major Questions

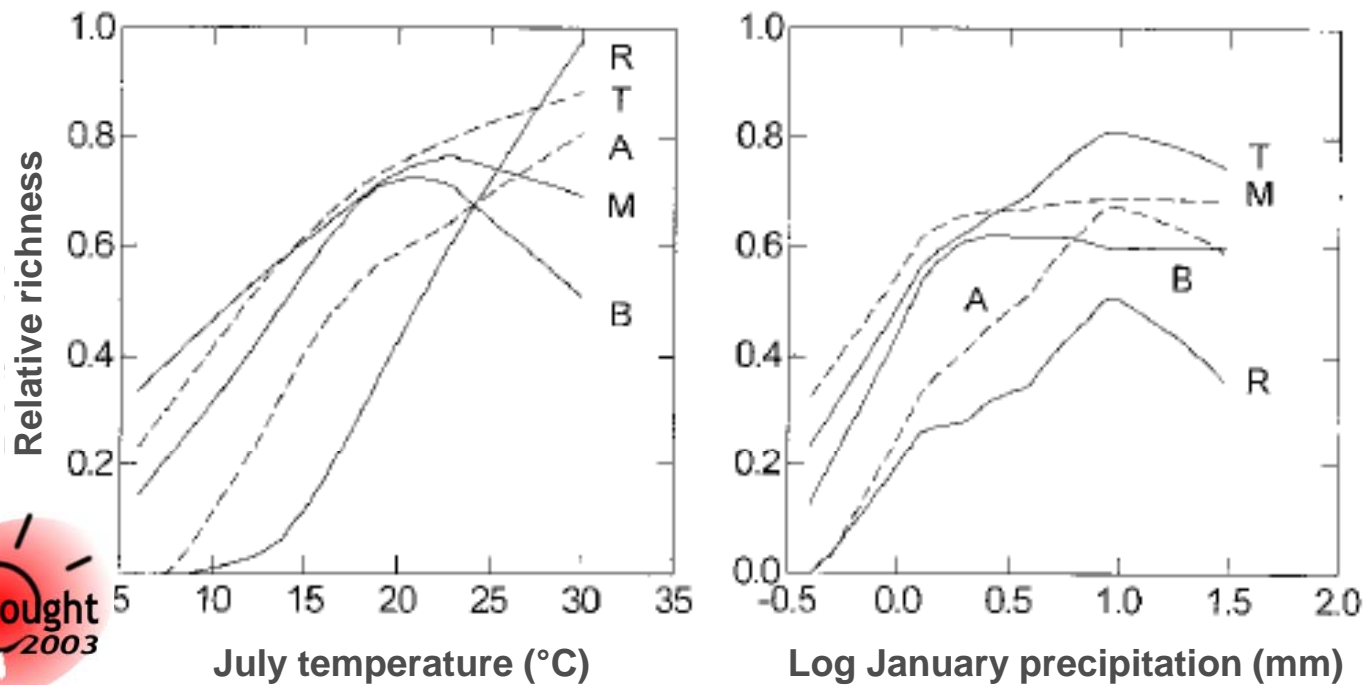
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Richness, Temperature & Precipitation

R: Reptiles T: Trees M: Mammals A: Amphibians B: Birds



Drought & Species response

Mechanisms

Drought induced habitat change

Immigration



Emigration

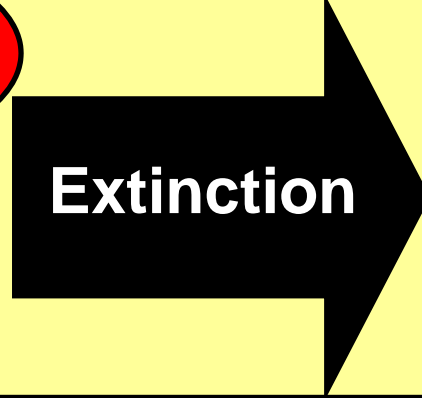
Extinction



Drought & Species response

short-term: Decline

Drought induced habitat change



Drought & Species loss

Hypotheses

Selection:

Less abundant species are lost.

Shift:

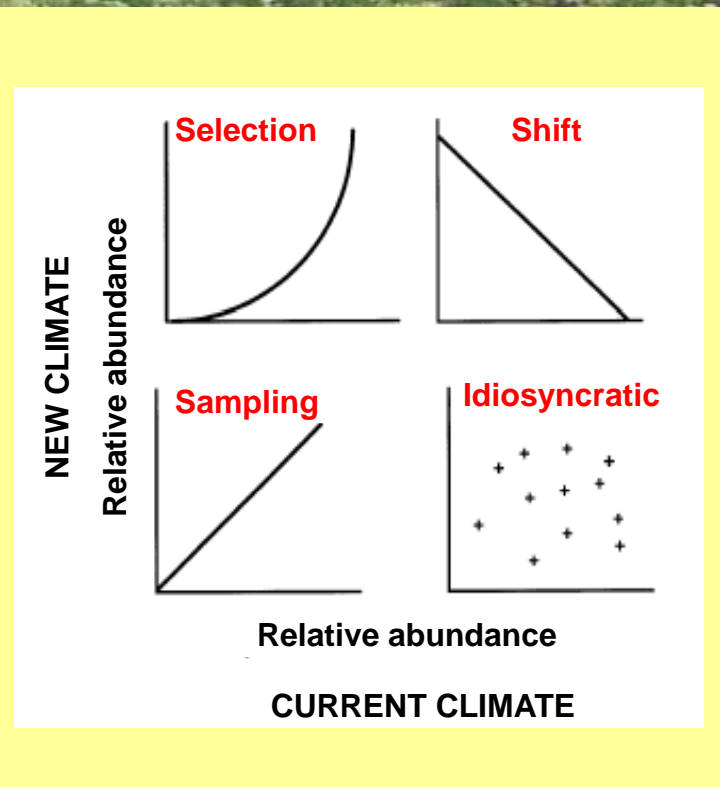
Most abundant species are lost.

Sampling:

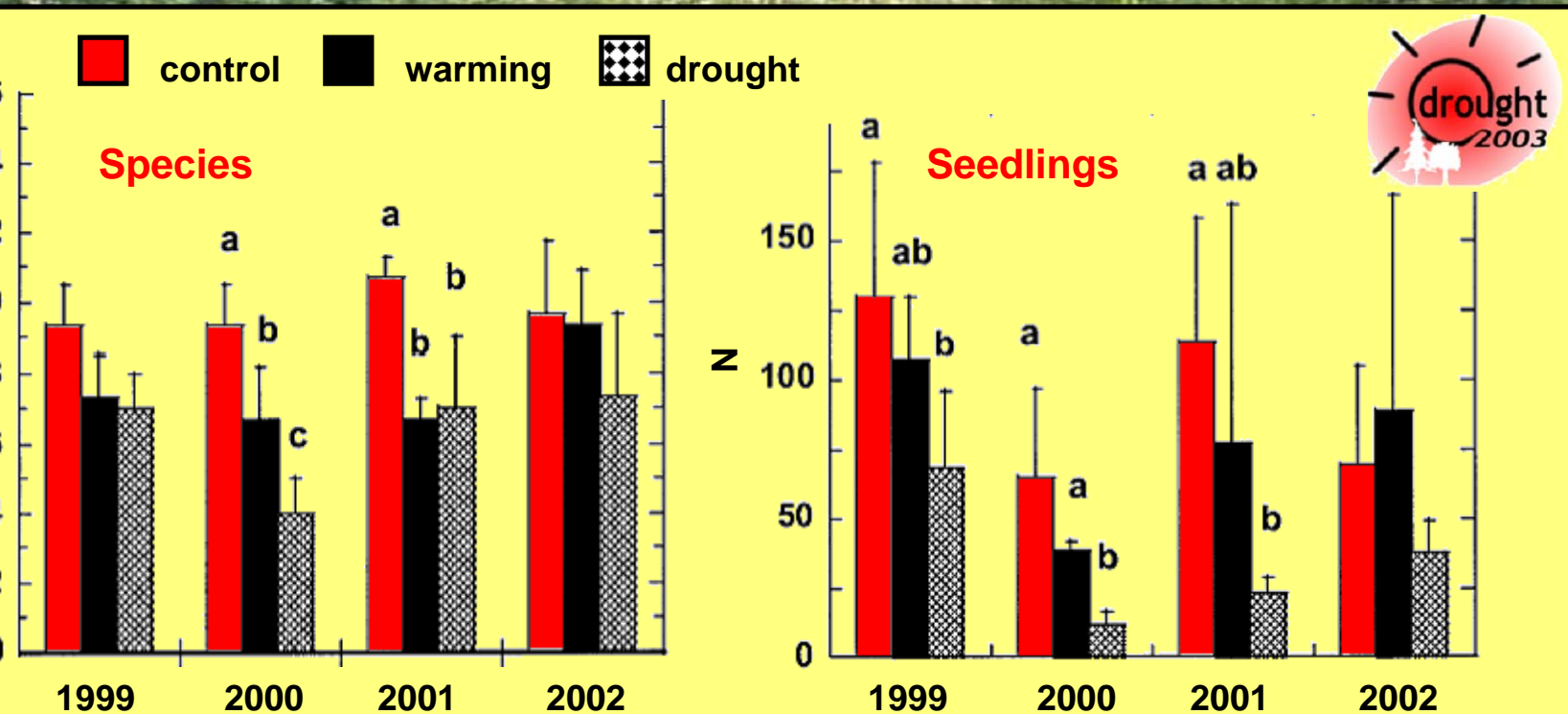
Loss proportional to abundance.

Idiosyncratic:

Not related to abundance.

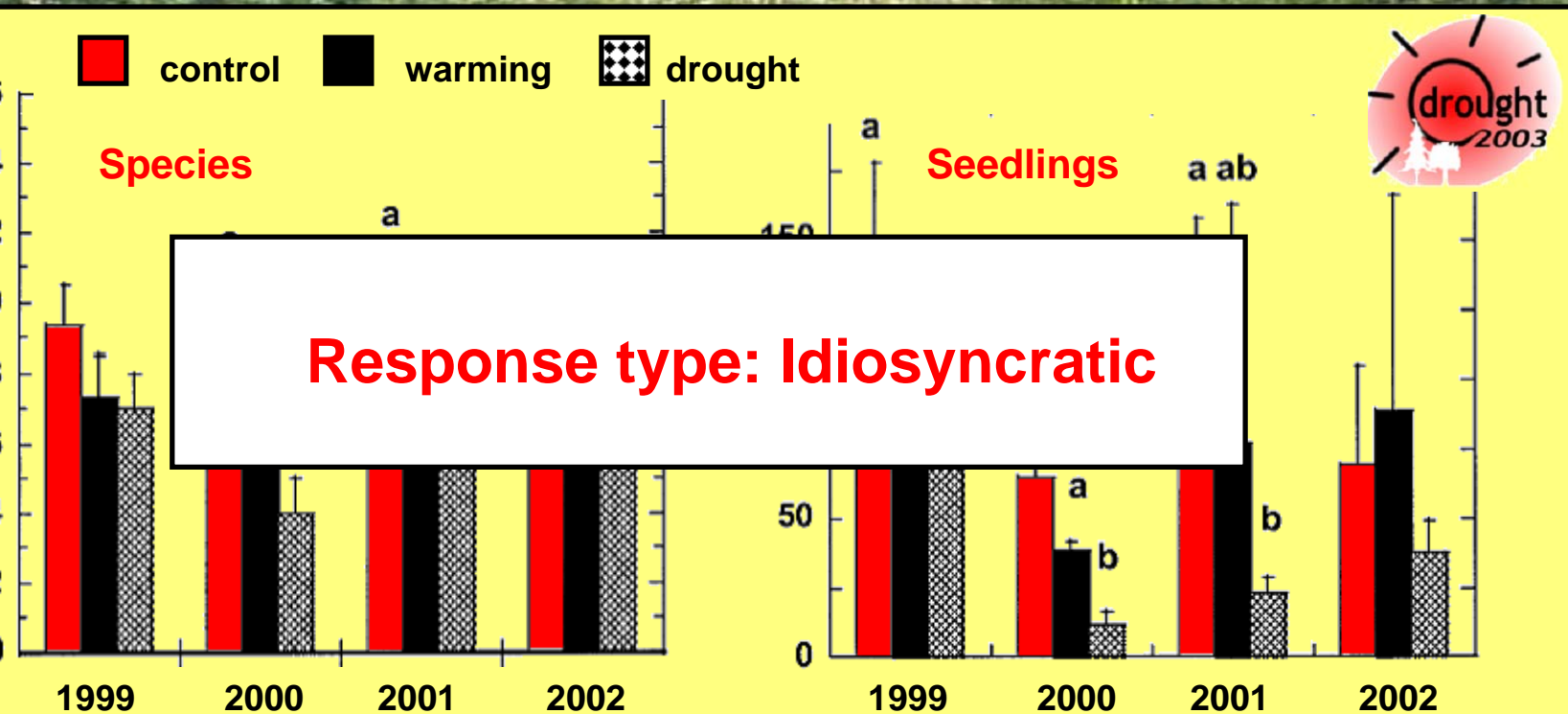


Drought & Sensitivity Experiments



Strong effects of drought on seedling recruitment

Drought & Sensitivity Experiments



Strong effects of drought on seedling recruitment

Drought & Species loss

Literature search

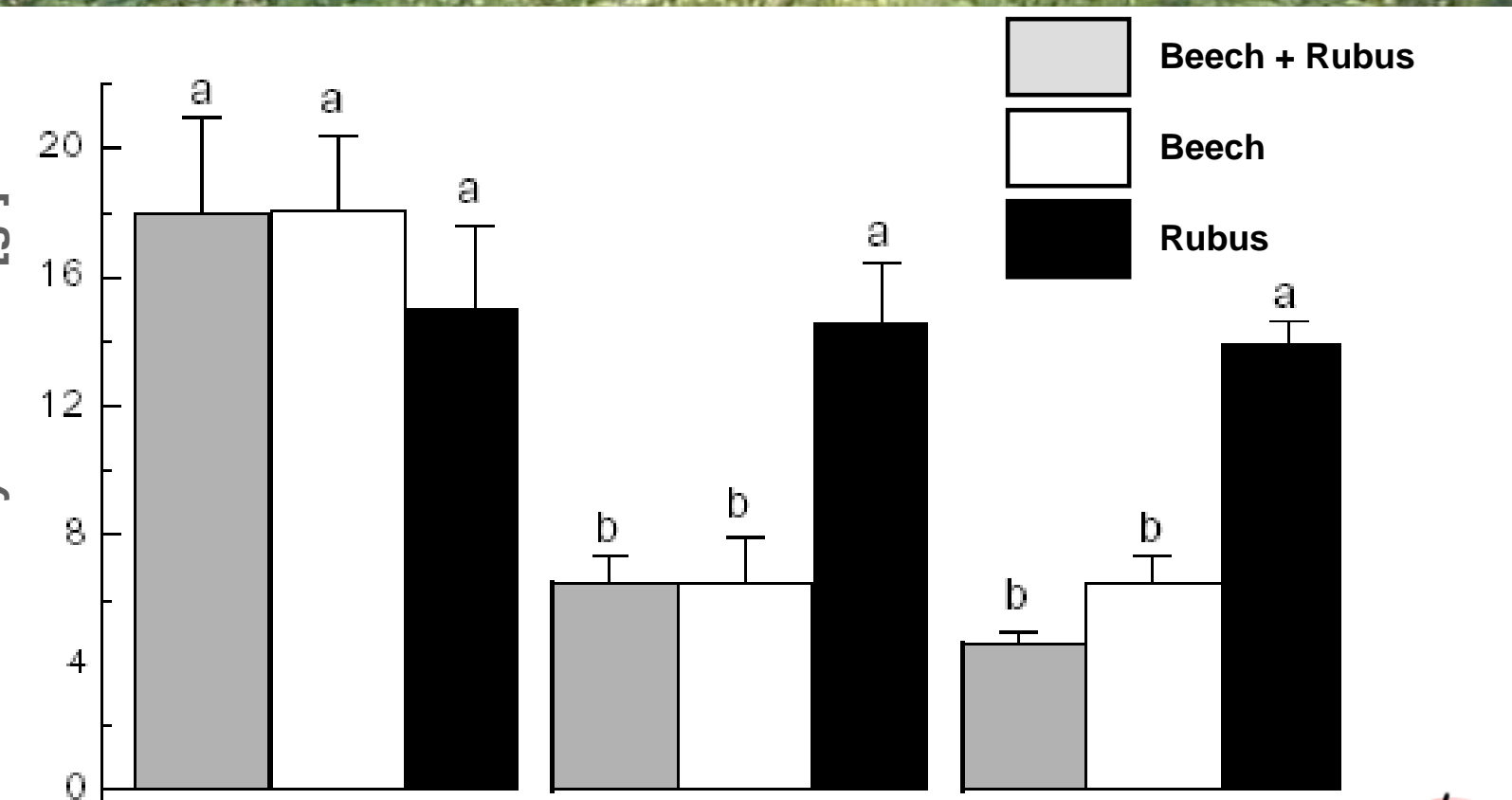
Most sensitive species:



- **Competitive**
- **Adapted to cold and wet conditions**
- **Low reproduction rate**
- **Low mobility**

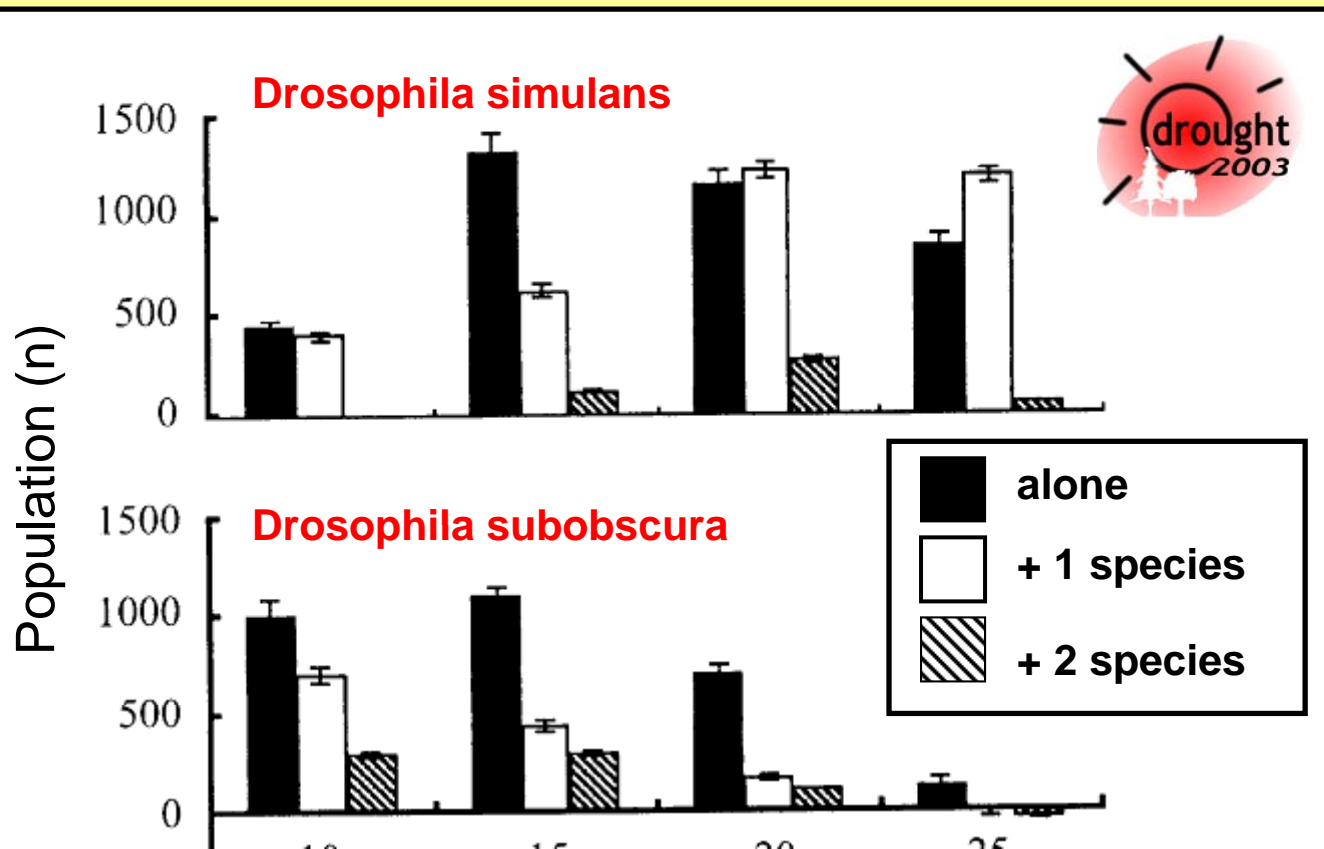
Drought & Community structure

Example: Beech seedlings vs. *Rubus fruticosus*



Temperature & Community structure

Example: Animals



Associated Diversity

Regional

Associated

Aboveground



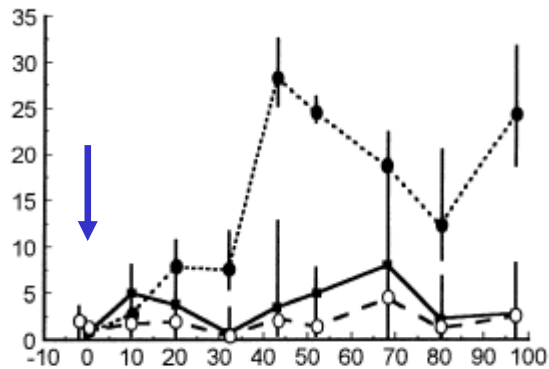
Belowground



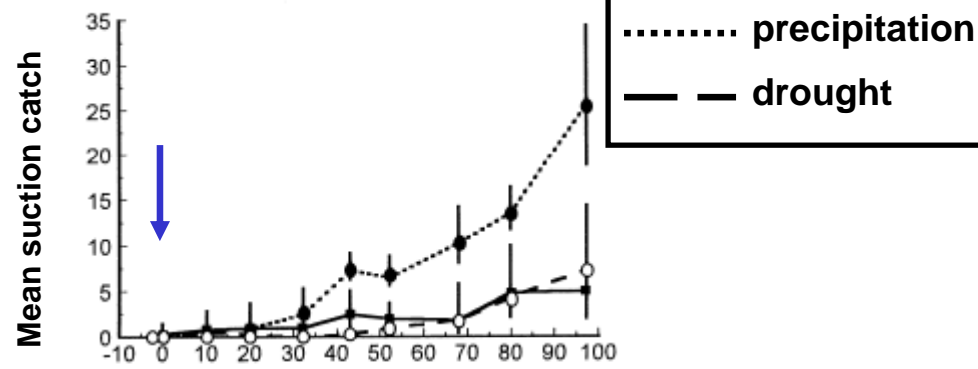
Associated Diversity

Field experiment

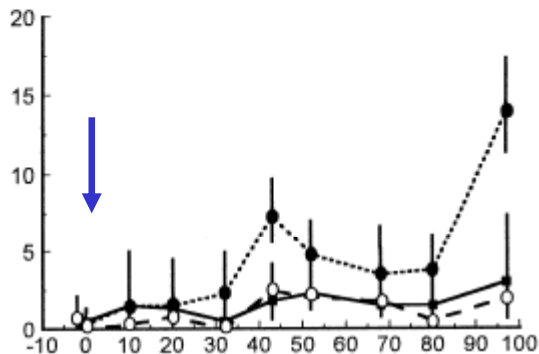
Adult Coleoptera



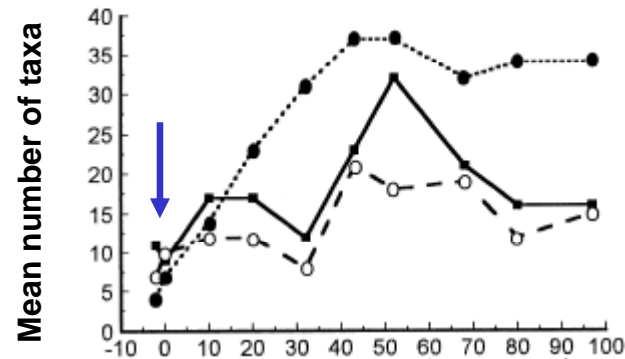
Araneae



Adult parasitic Hymenoptera

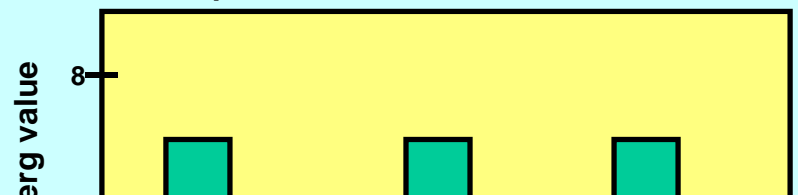
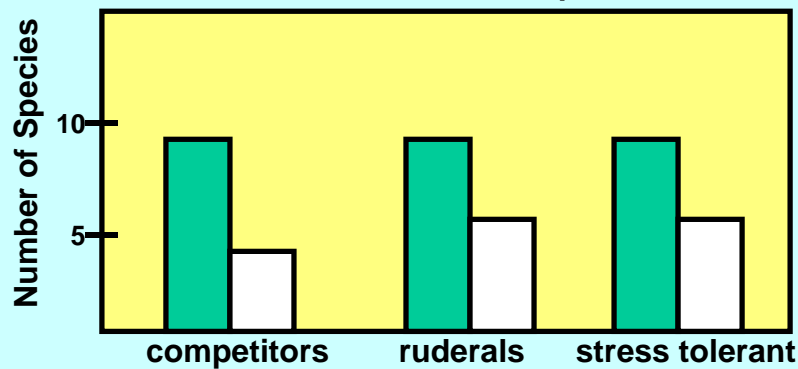
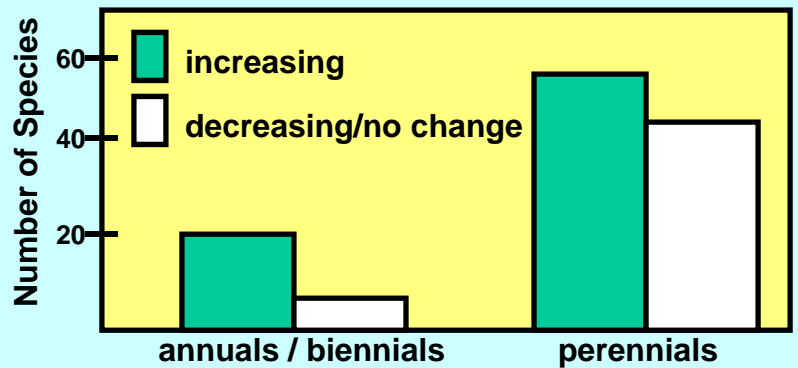


Taxonomic richness



Response of the Herb layer

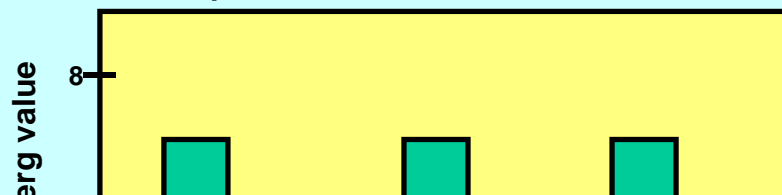
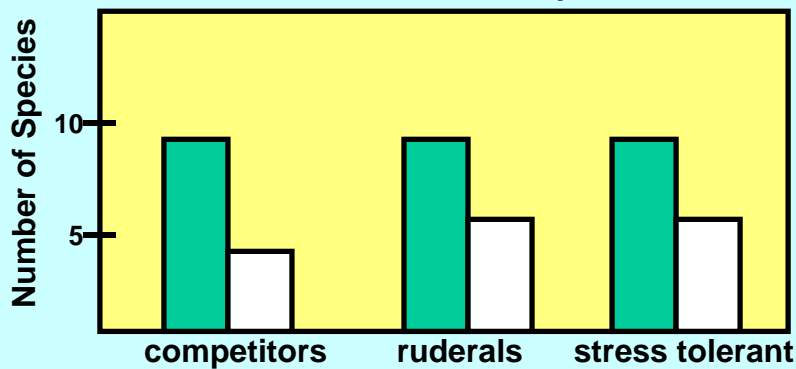
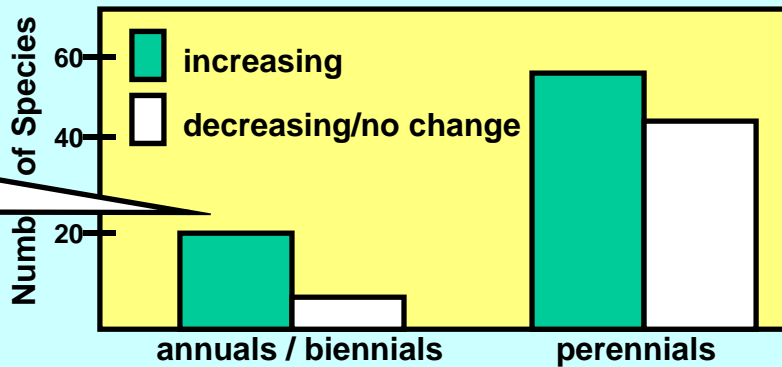
Summer drought 1995



Response of the Herb layer

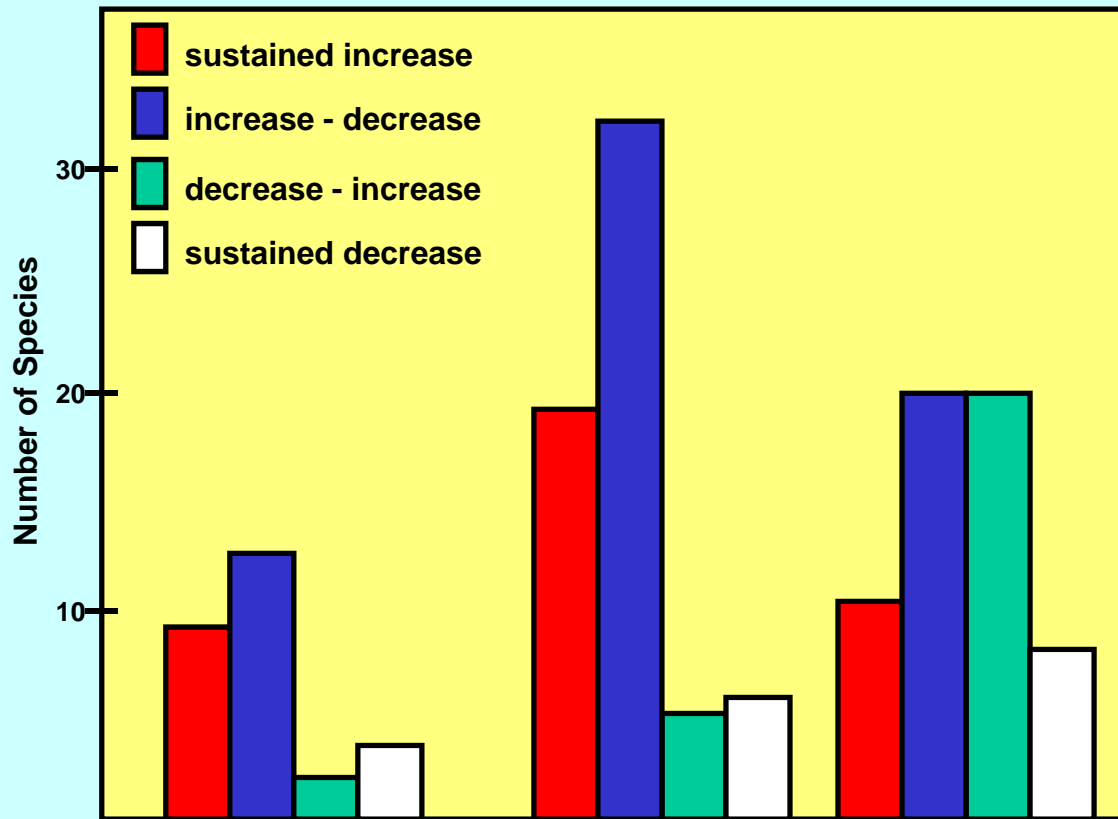
Summer drought 1995

Proportionally more
annuals / biennials
perennials

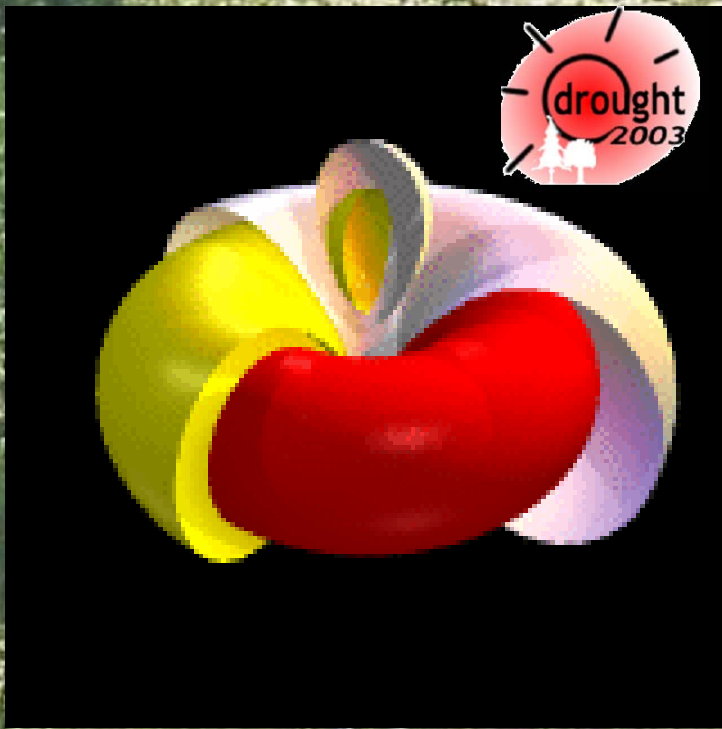


Associated Diversity

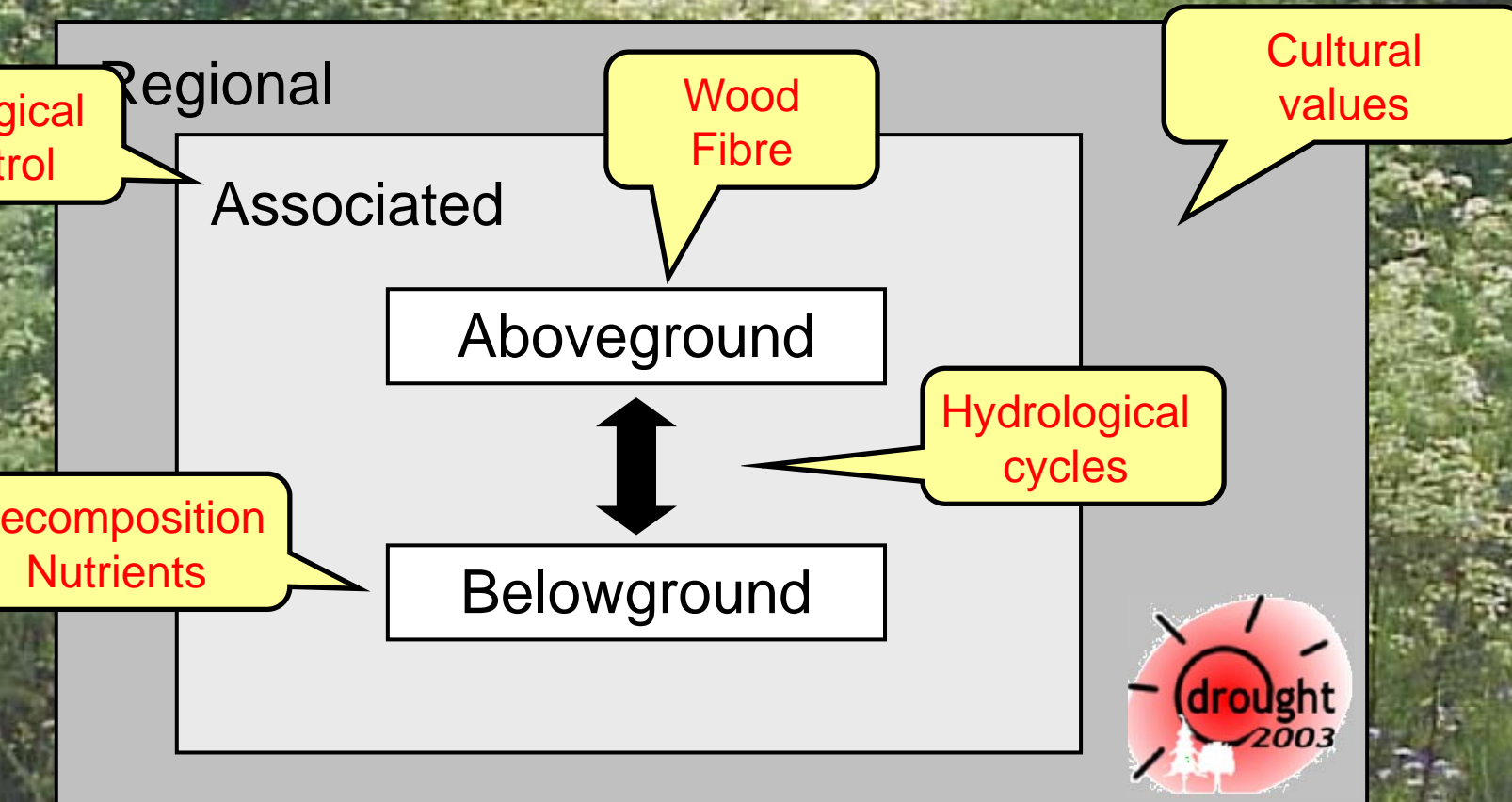
Summer drought 1995



drought, Richness & Function

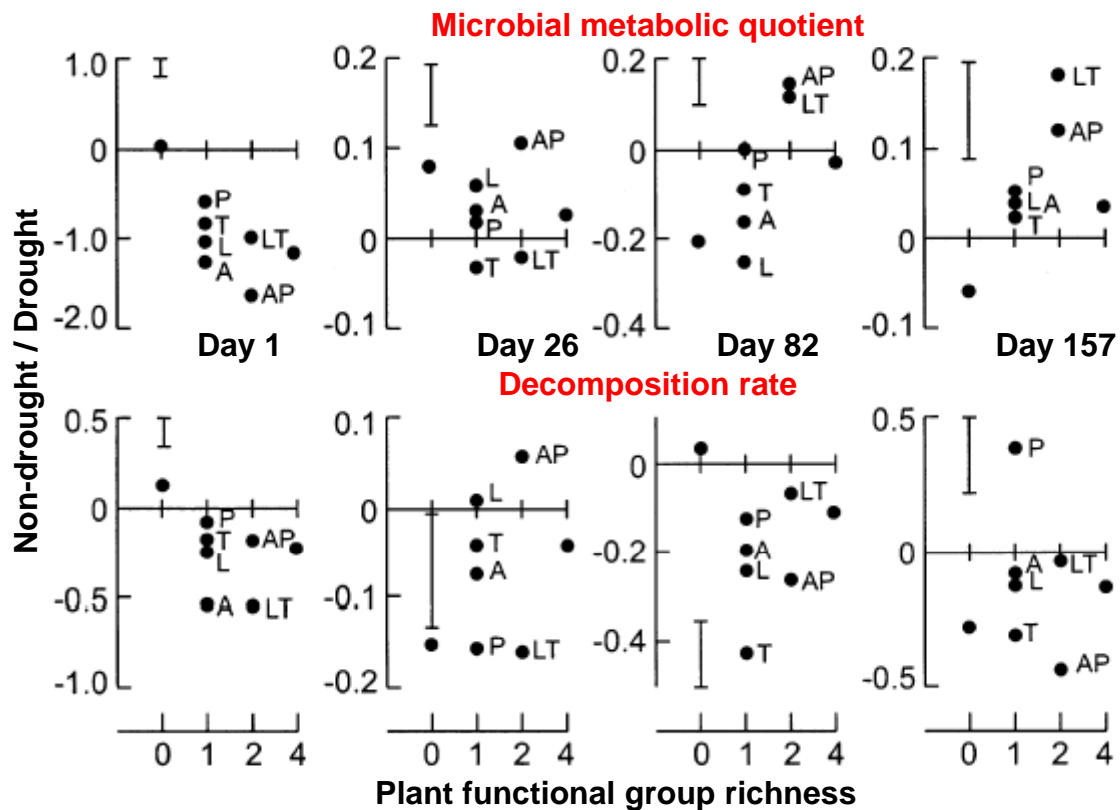


Function = Ecosystem services



drought, Richness & Function

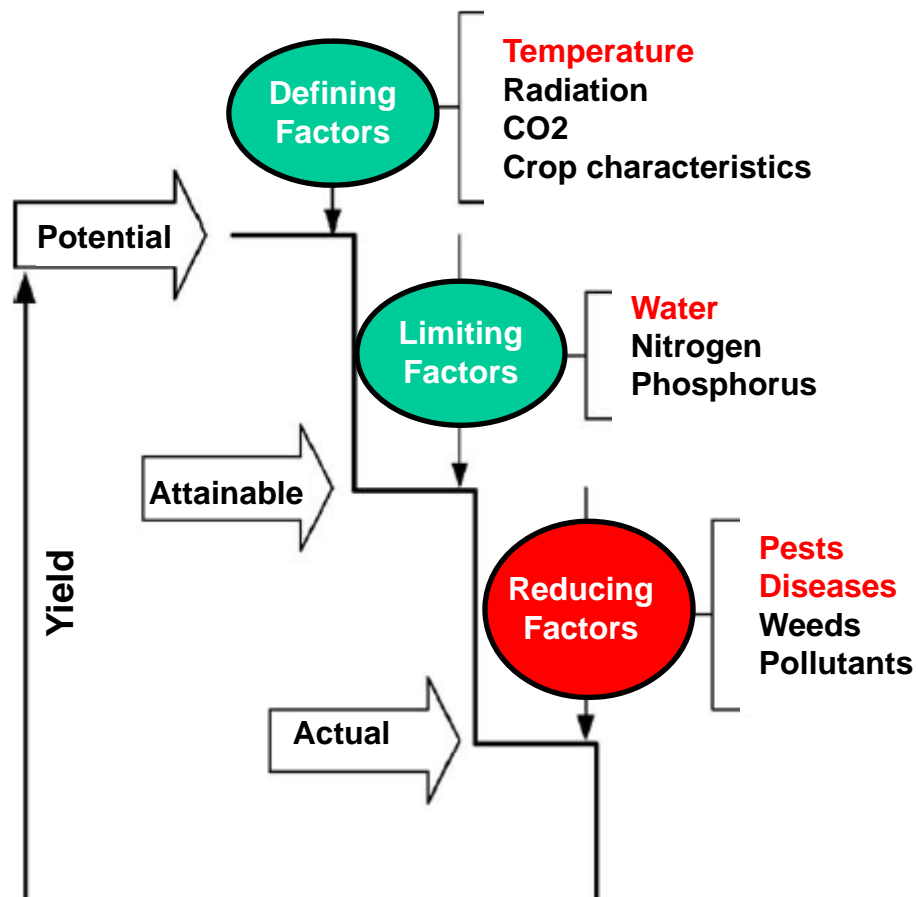
Microcosm experiment: Soil



Wardle et al. (2000)

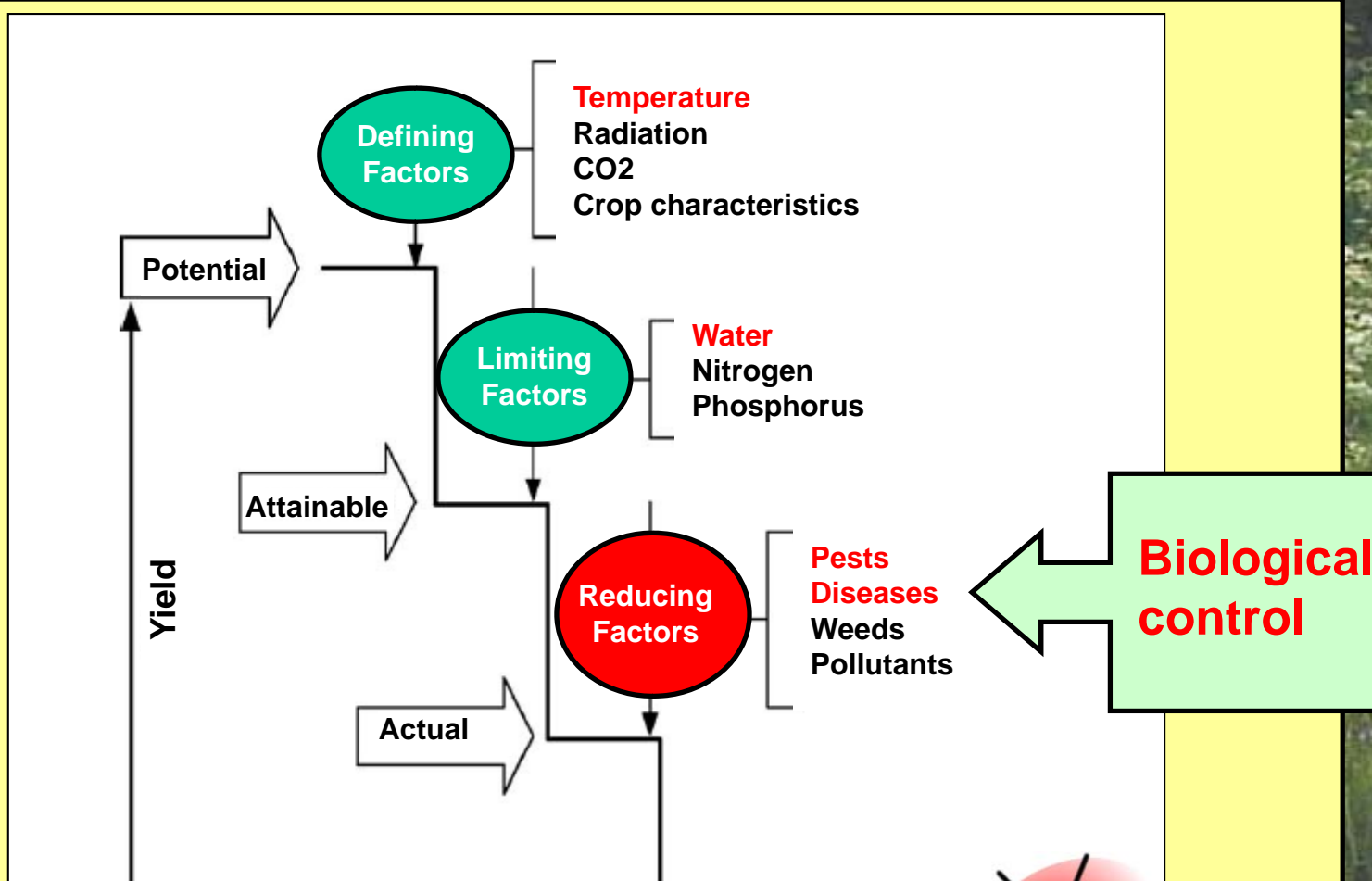
Associated Diversity

Lessons from Agriculture



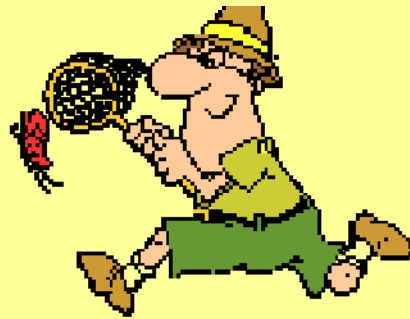
Associated Diversity

Functional implications

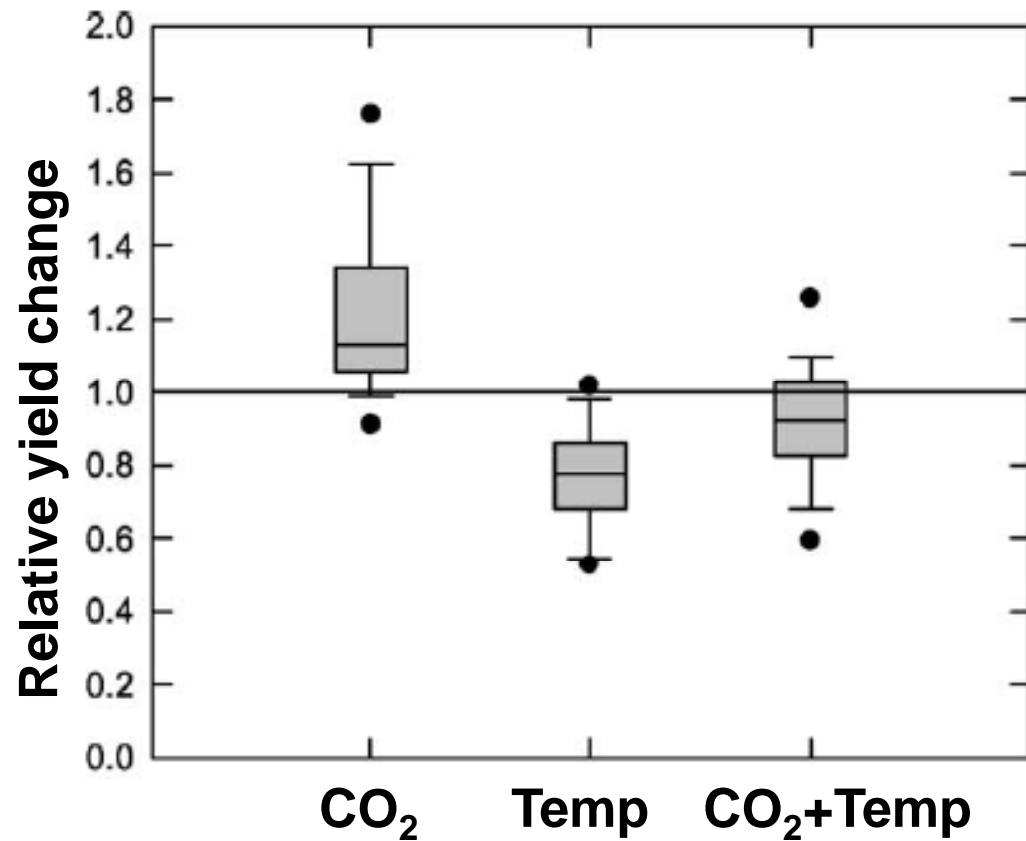


Future Activities

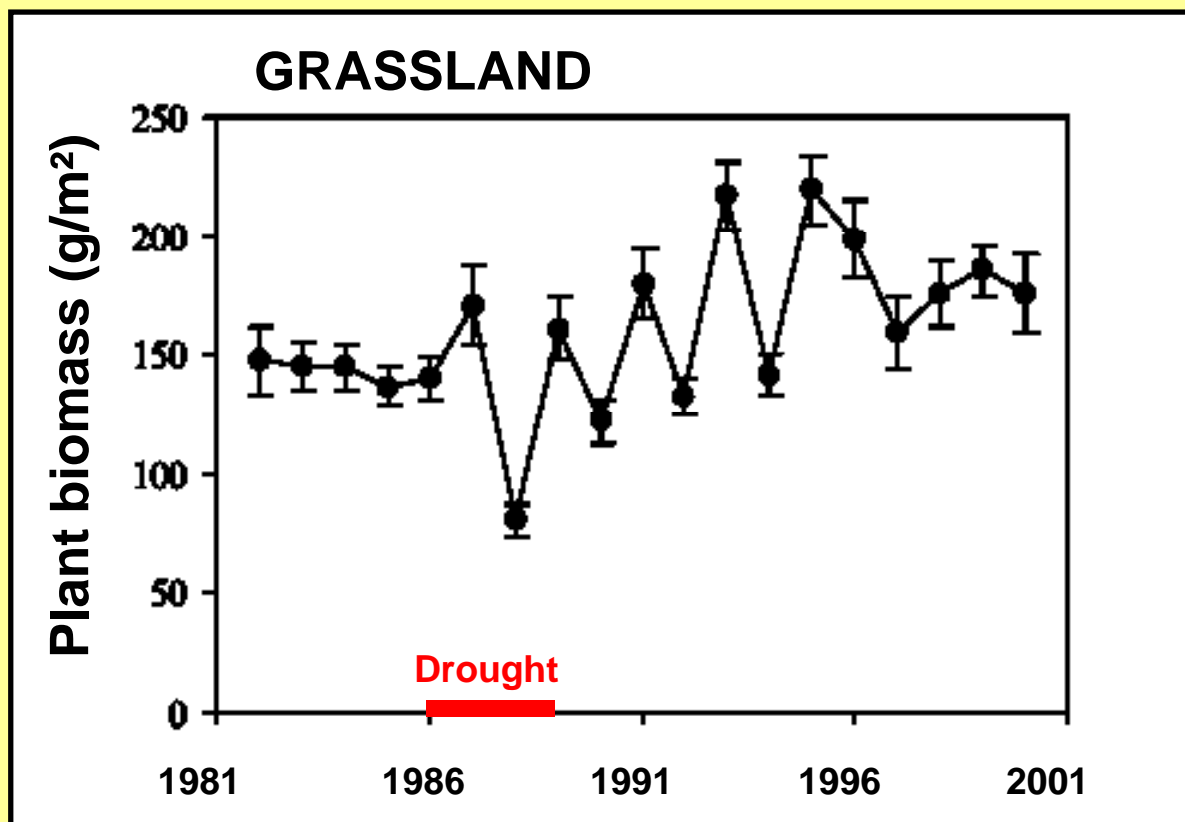
We need to get a better understanding of mechanisms and processes in interdisciplinary approaches!

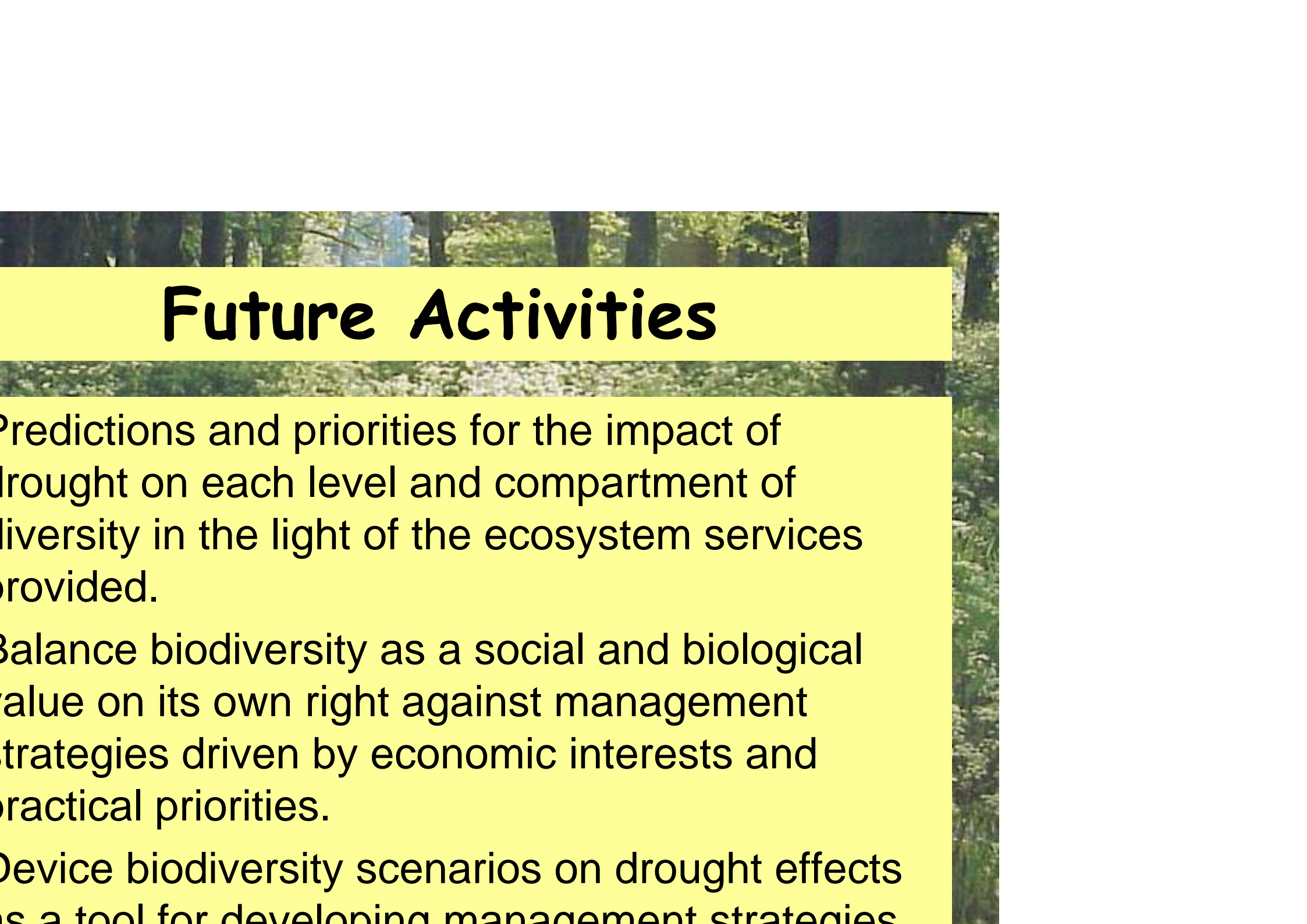


problem: GC drivers interact



Problem: Long-lasting effects



A background image of a forest with tall trees and green foliage. A yellow horizontal bar is overlaid on the top part of the image, containing the title. Below the bar, the text is arranged in three paragraphs on a white background.

Future Activities

Predictions and priorities for the impact of drought on each level and compartment of diversity in the light of the ecosystem services provided.

Balance biodiversity as a social and biological value on its own right against management strategies driven by economic interests and practical priorities.

Device biodiversity scenarios on drought effects as a tool for developing management strategies



**Thank you
for your attention!**

