



# ICP Forests

## RELATIONSHIP BETWEEN CROWN DEFOLIATION AND TREE DIVERSITY DEPEND ON THE ENVIRONMENTAL CONTEXT

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RESEARCH

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# Linking forest diversity and tree health: preliminary insights from a large-scale survey in Italy

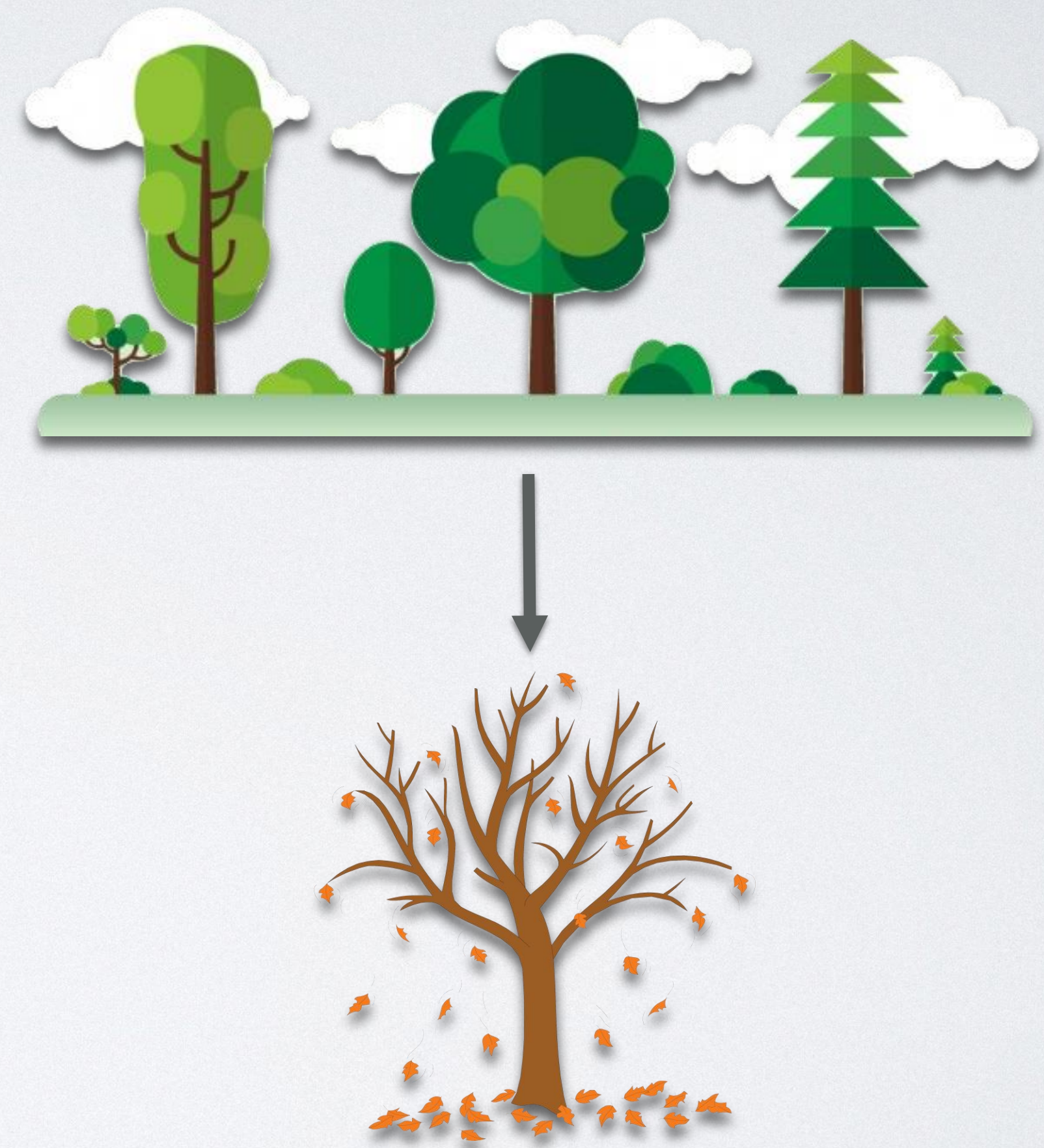
Filippo Bussotti<sup>1\*</sup> , Matteo Feducci<sup>1</sup>, Giovanni Iacopetti<sup>1</sup>, Filomena Maggino<sup>2</sup>, Martina Pollastrini<sup>1</sup> and Federico Selvi<sup>1</sup>

## Abstract

Forest health is currently assessed in Europe (ICP Forests monitoring program). Crown defoliation and dieback, tree mortality, and pathogenic damage are the main aspects considered in tree health assessment. The worsening of environmental conditions (i.e., increase of temperature and drought events) may cause large-spatial scale

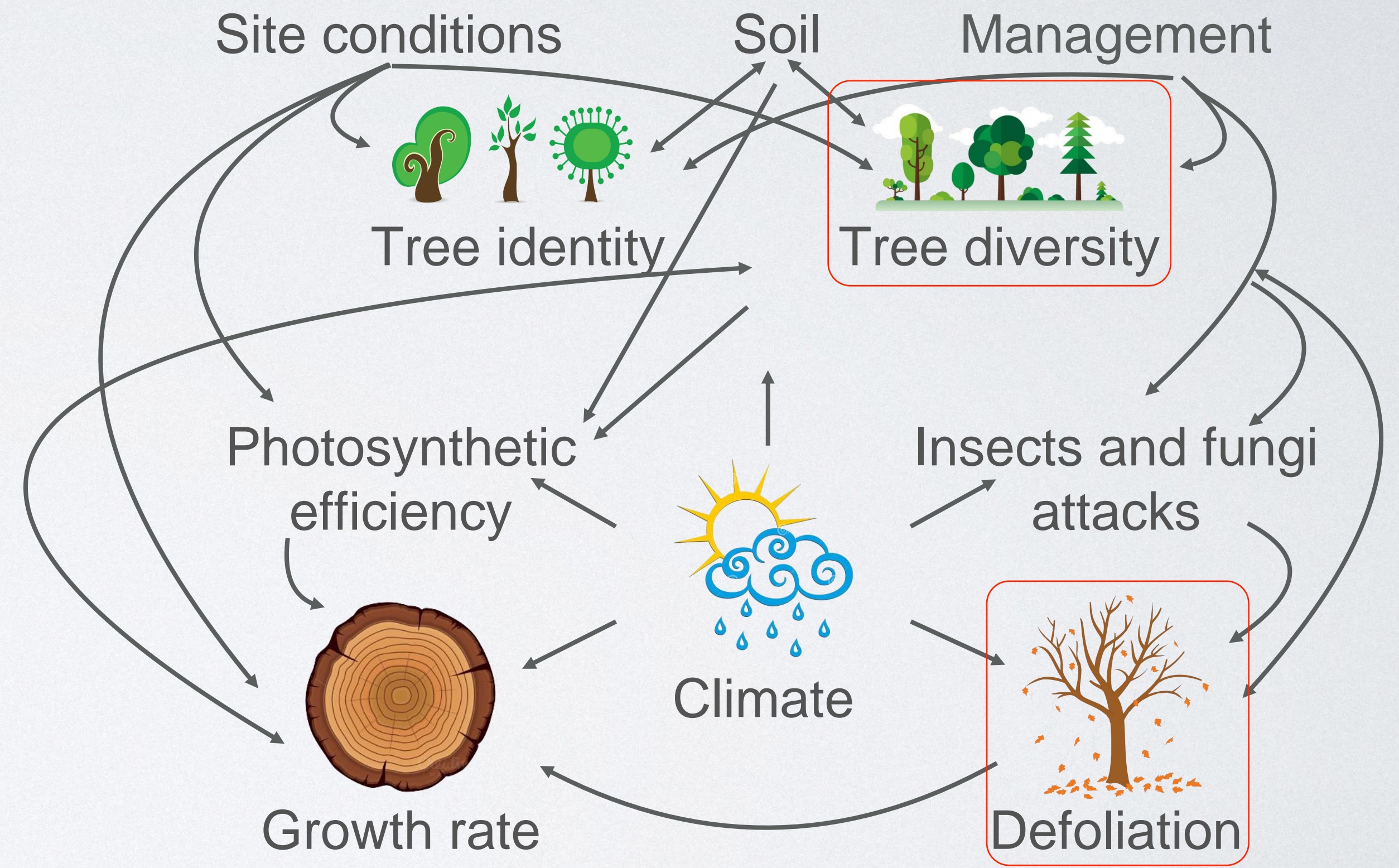
# TREE DIVERSITY AND VITALITY

- Contrasting evidences about the role of diversity in the complex tree-ecosystem relationship
- No general evidence of the relationship in the ICP forest program
- Italy provides a good setting, with diverse conditions and taxa



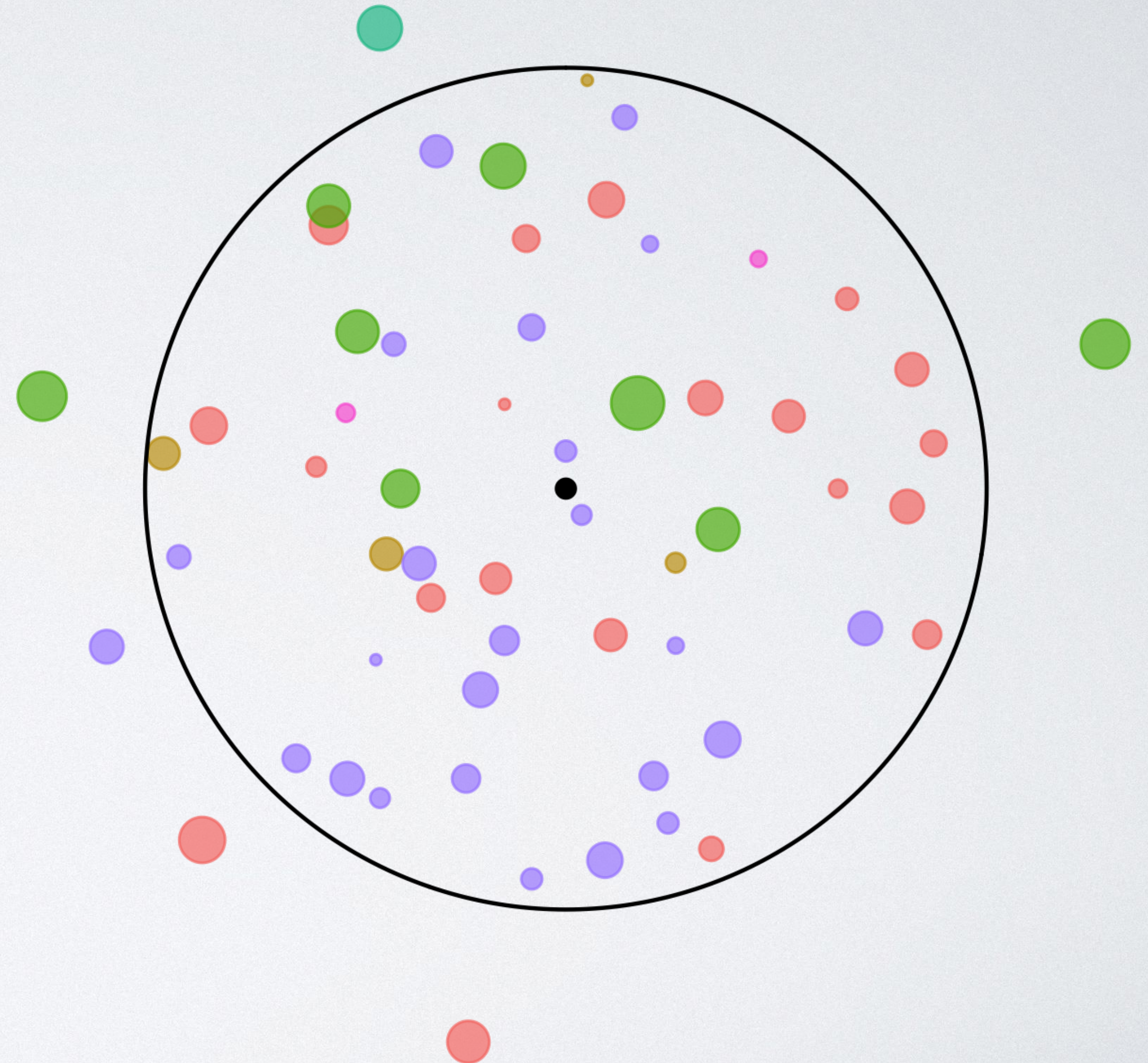
# THE LANDSCAPE HETEROGENEITY PROBLEM

- Defoliation has several and often correlated causes
- Many are the same that influence the stand composition
- Landscape heterogeneity has to be controlled in order to limit the interferences



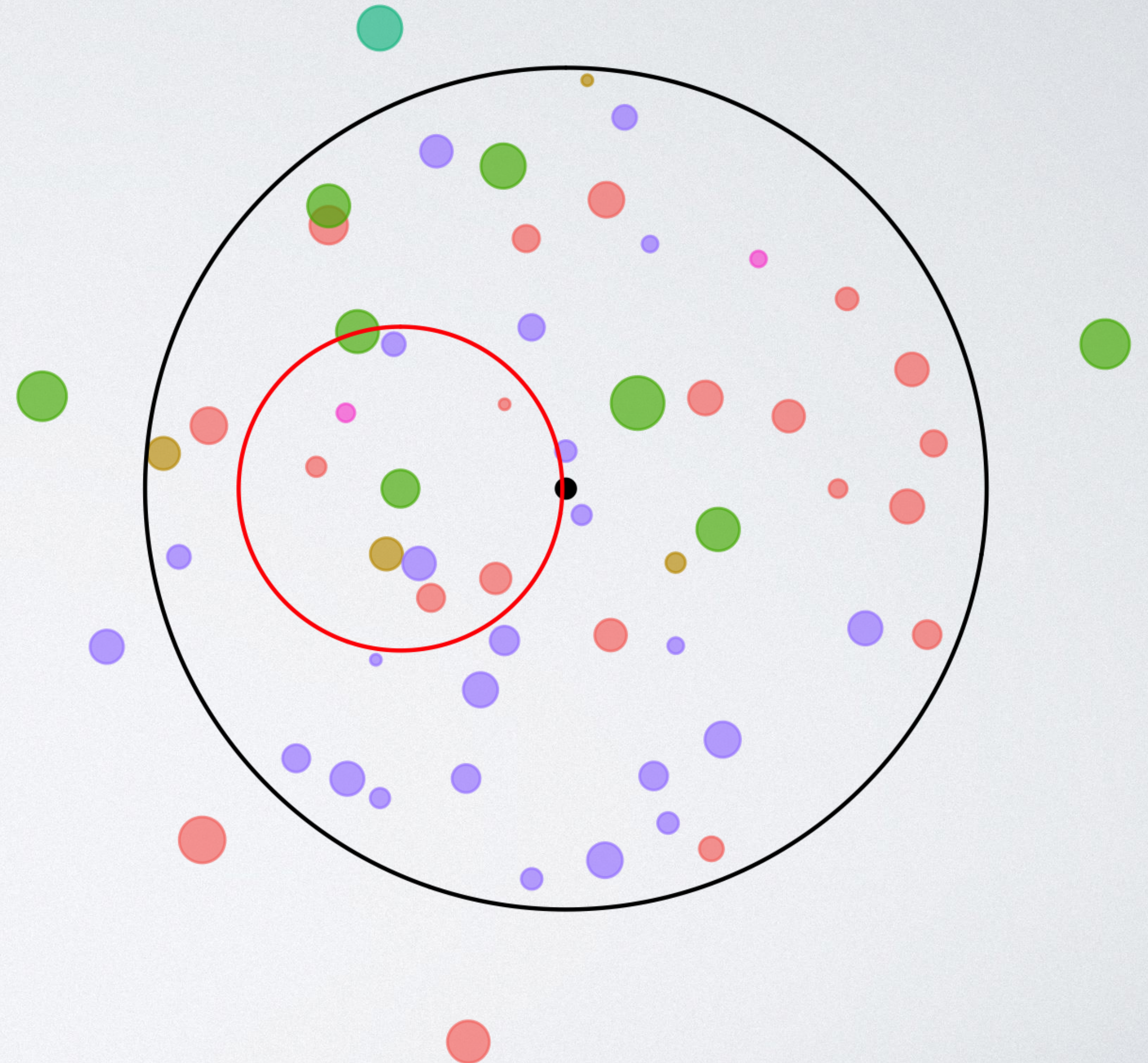
# TAXONOMIC AND STRUCTURAL DIVERSITY

- **Plot level**
- **Shannon and Simpson**
- **Community Weighted Mean**
- **Functional Divergence**
- Specific Leaf Area
- Wood Density
- Height
- Leaf Nitrogen Content
- Seed Weight



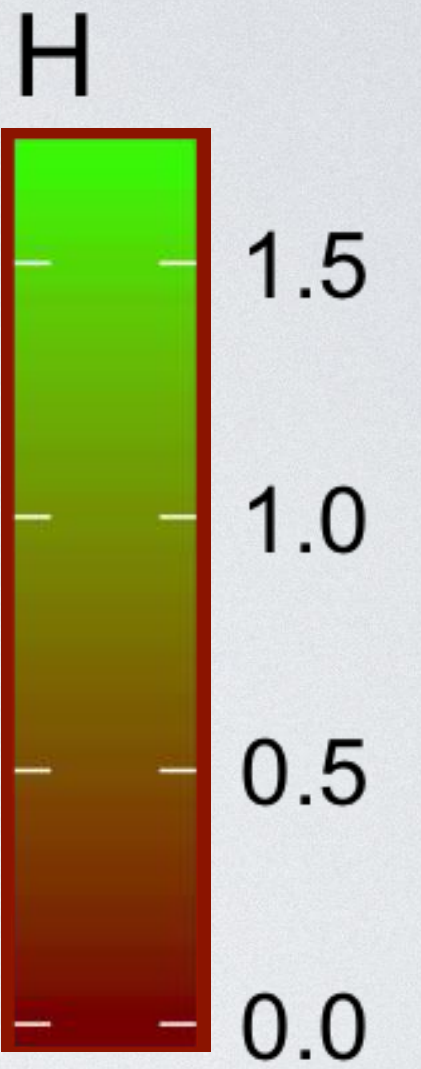
# TAXONOMIC AND STRUCTURAL DIVERSITY

- **Single tree level**
- **Local Shannon**
- **Structure indices**
  - Dominance
  - DBH differentiation
  - Mingling



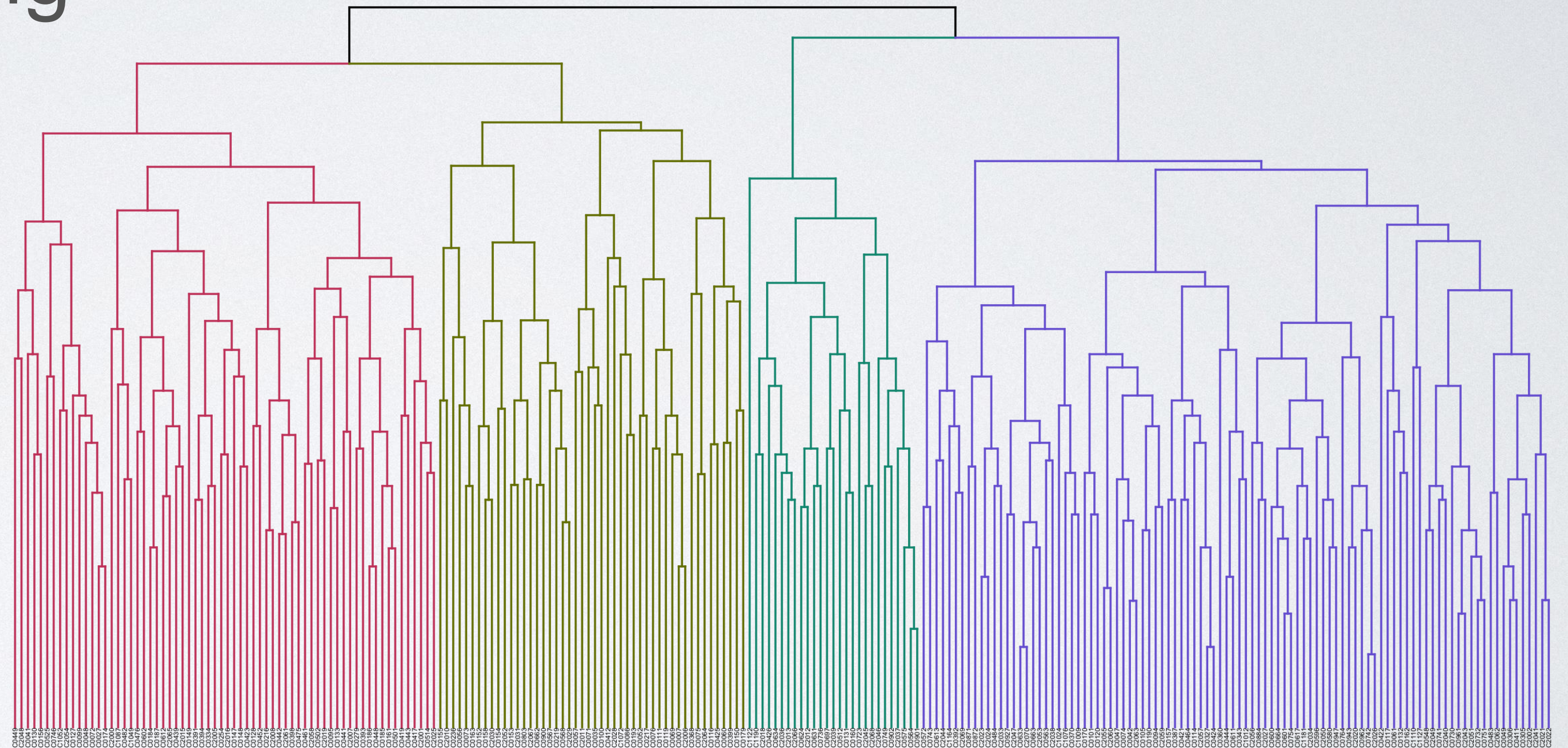
# SHANNON INDEX

Italy, Level I sites



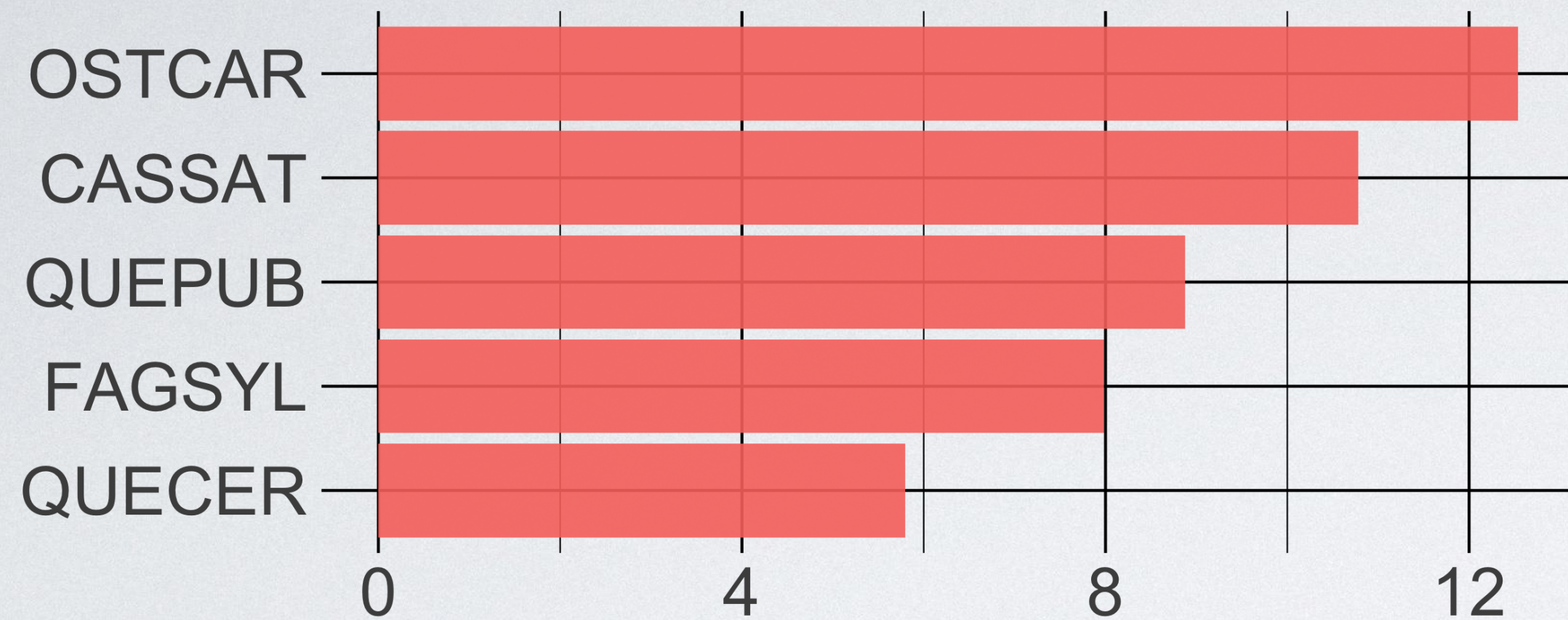
# CLUSTERING

- Hierarchical clustering
- Euclidean Distance
- Complete Aggregation
- Actual clustering
- Euclidean distance
- k-medoids (k = 4)

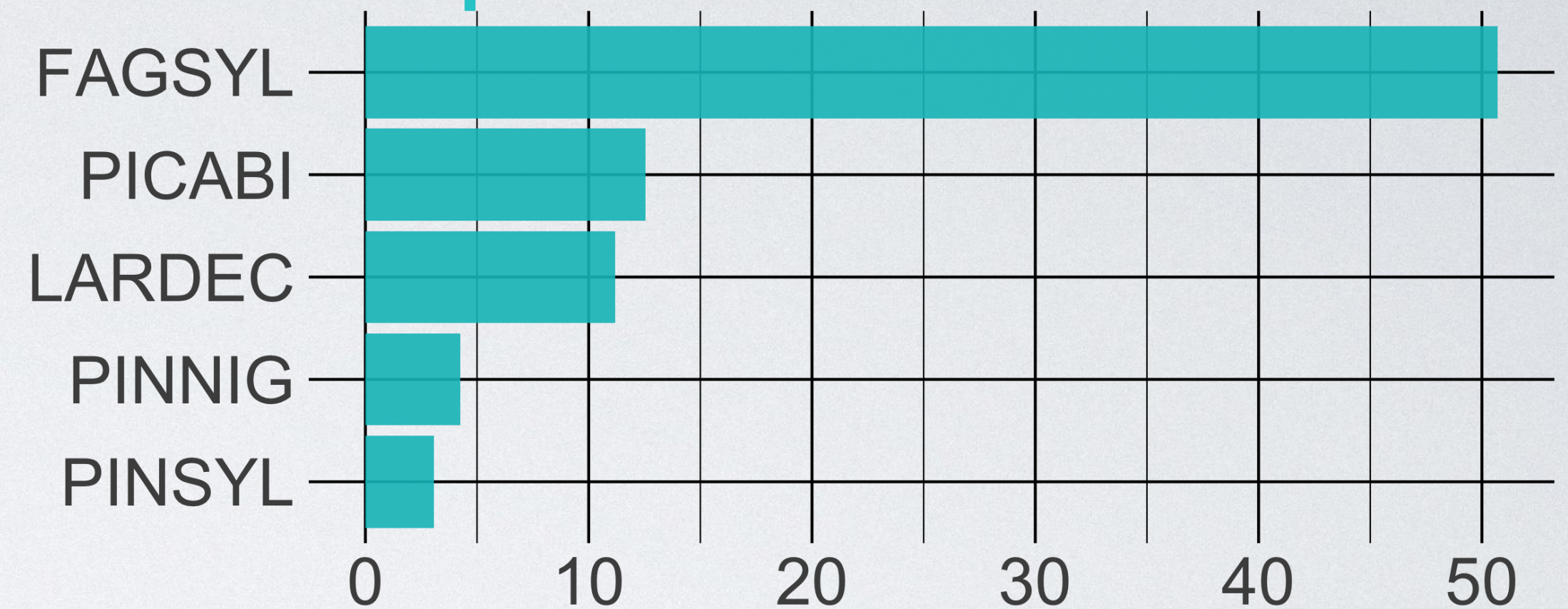




## Mixed mountain forest



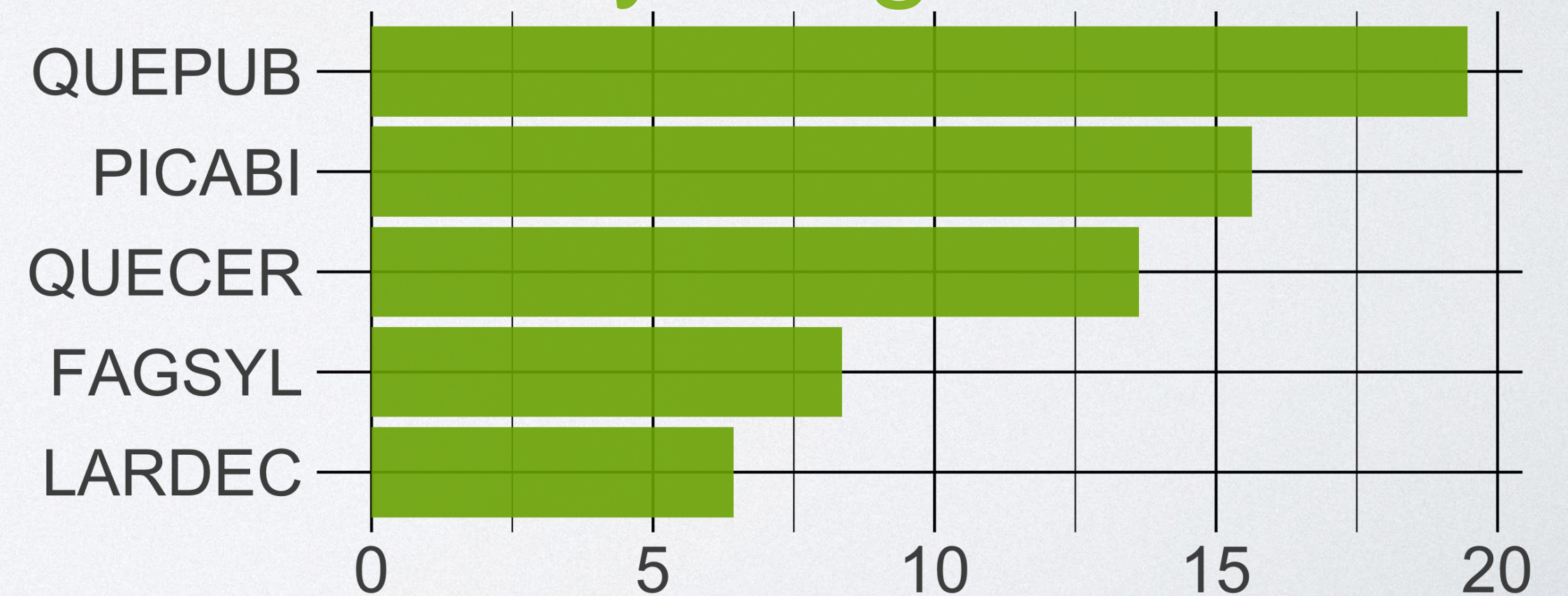
## Monospecific beech forest

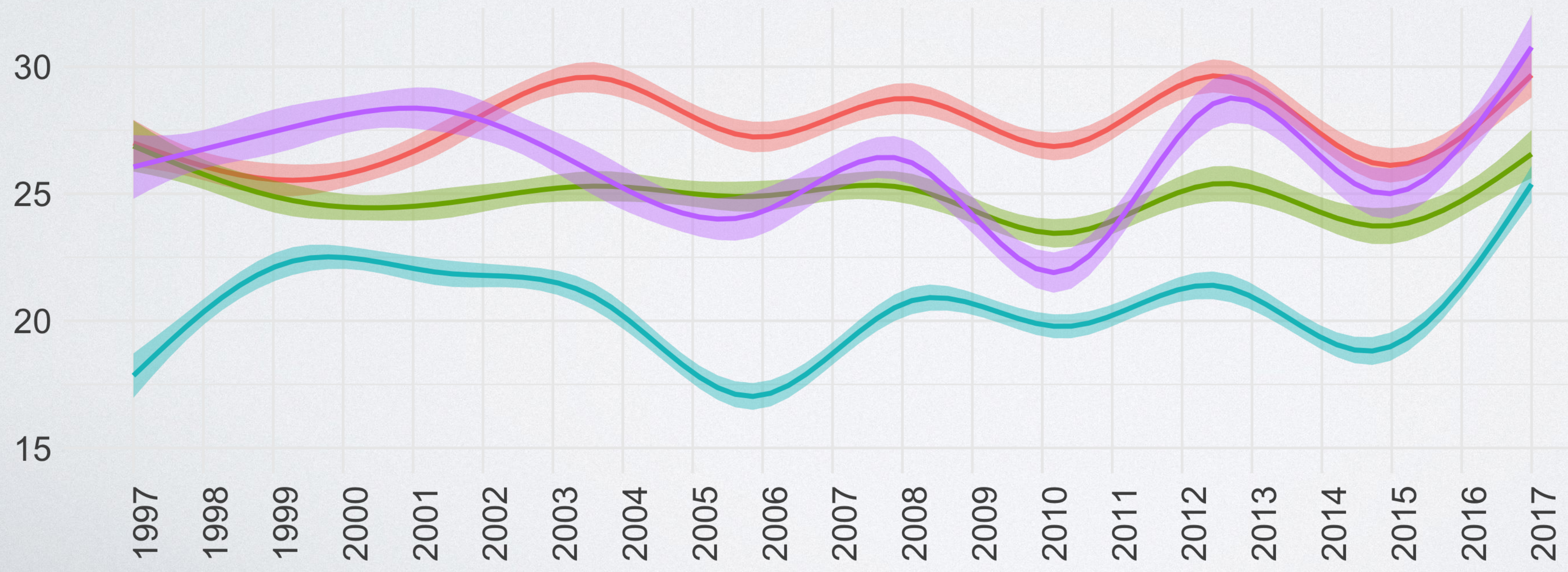
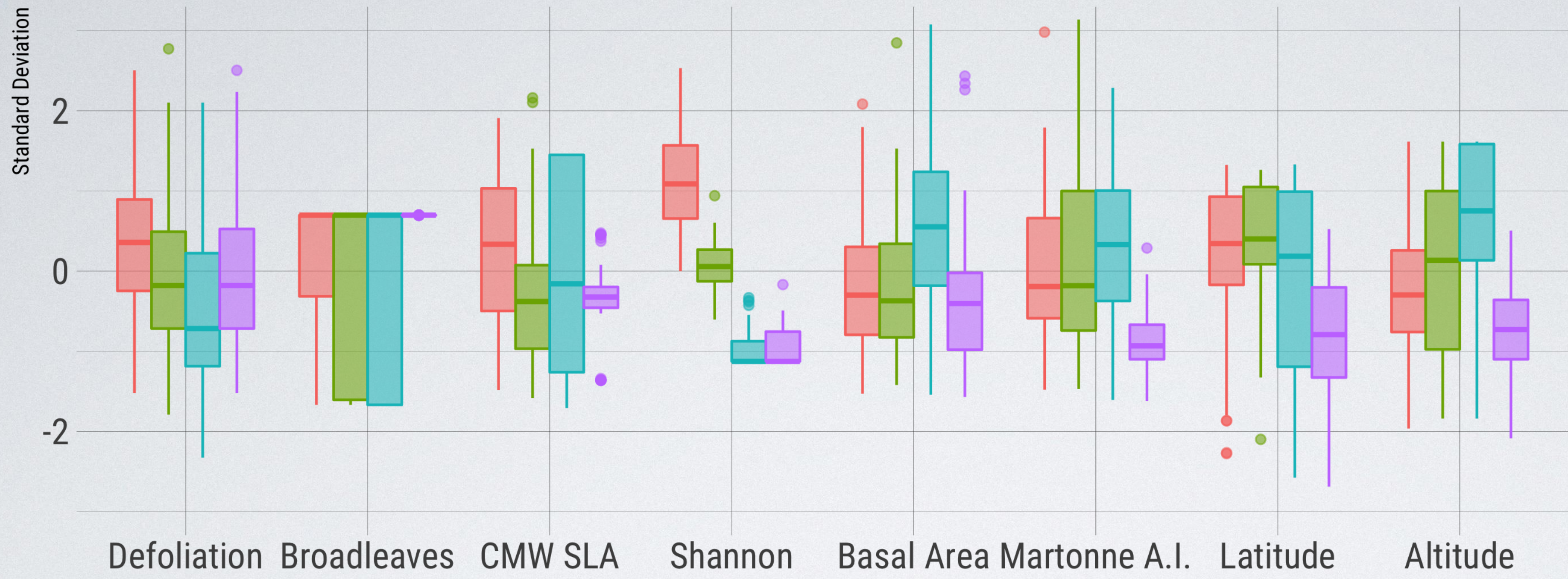


## Mediterranean forest



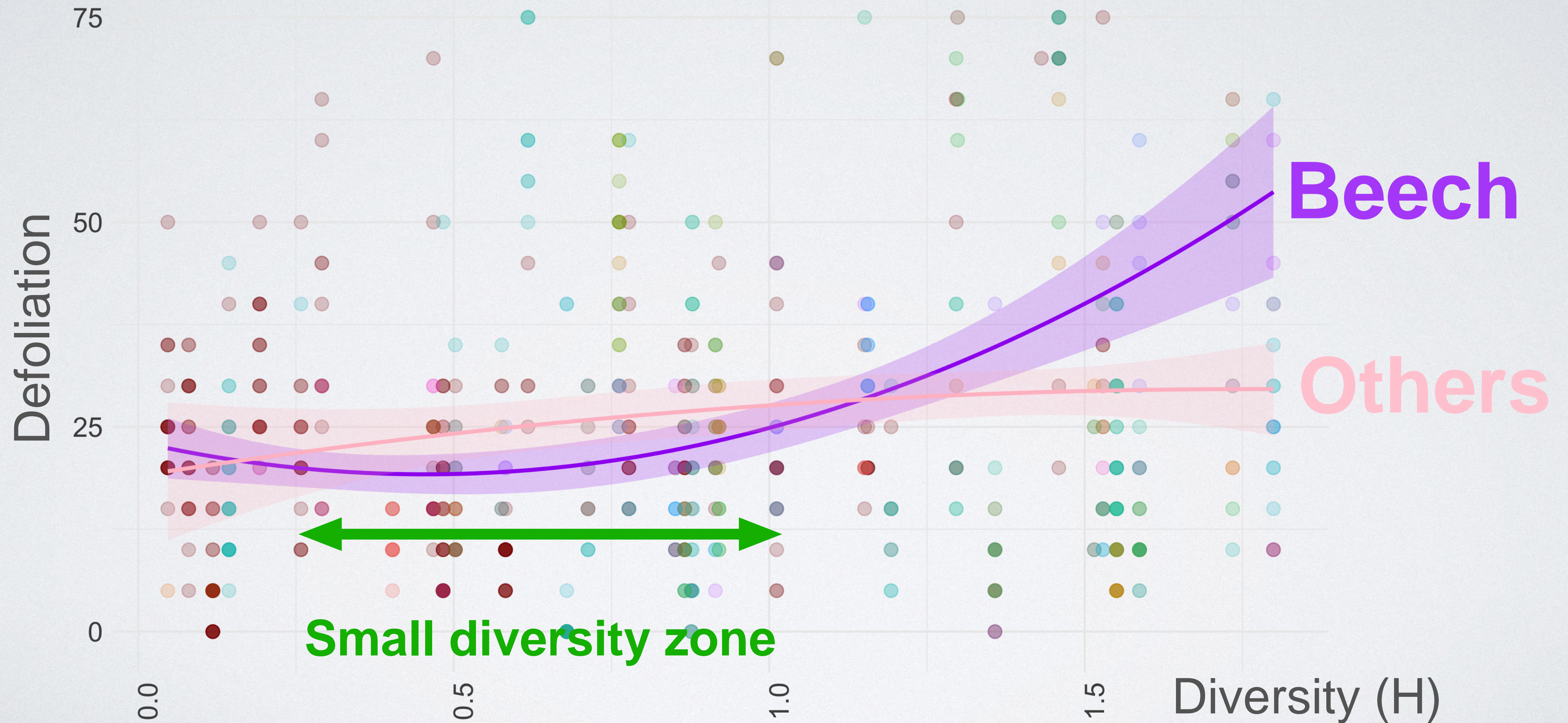
## Everything else





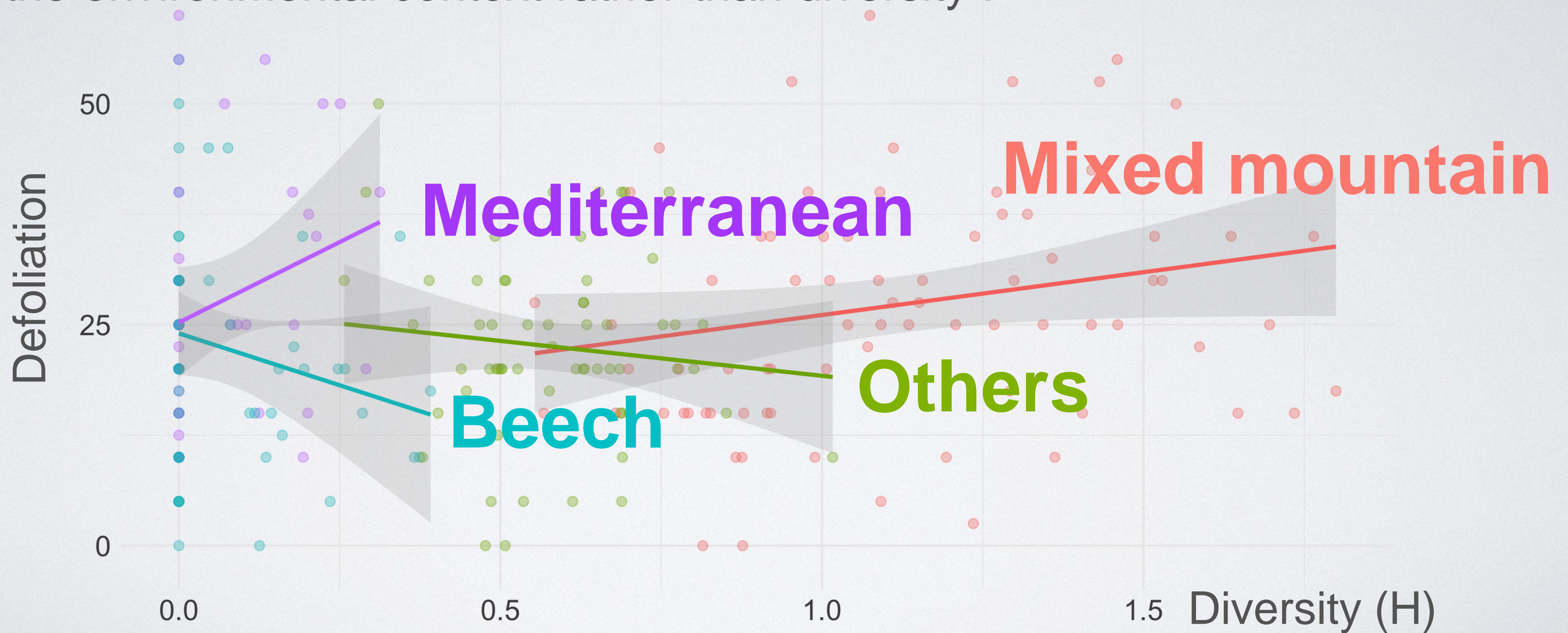
# DEFOLIATION-DIVERSITY CORRELATION

Low levels of stand diversity enhance crown condition better than monospecific stands

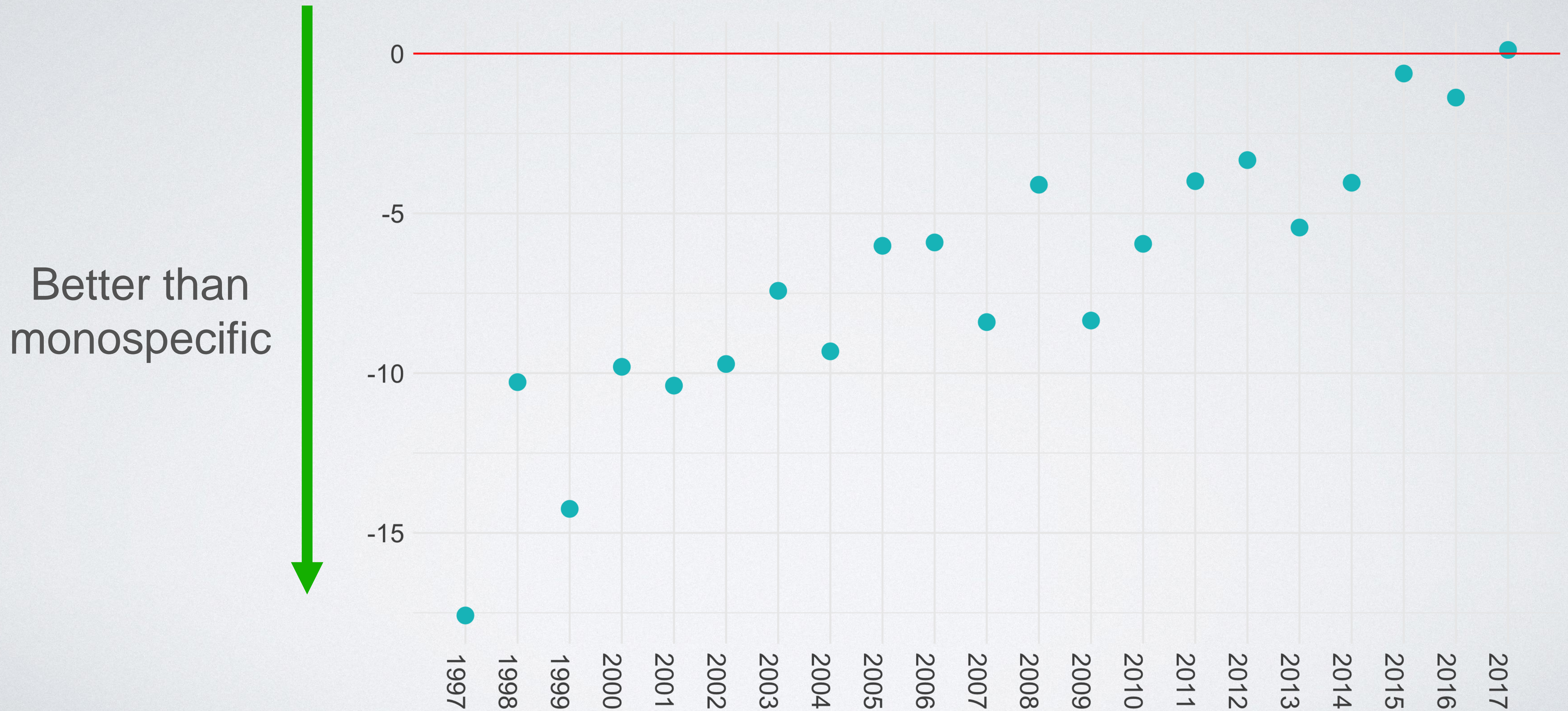


# DEFOLIATION-DIVERSITY CORRELATION

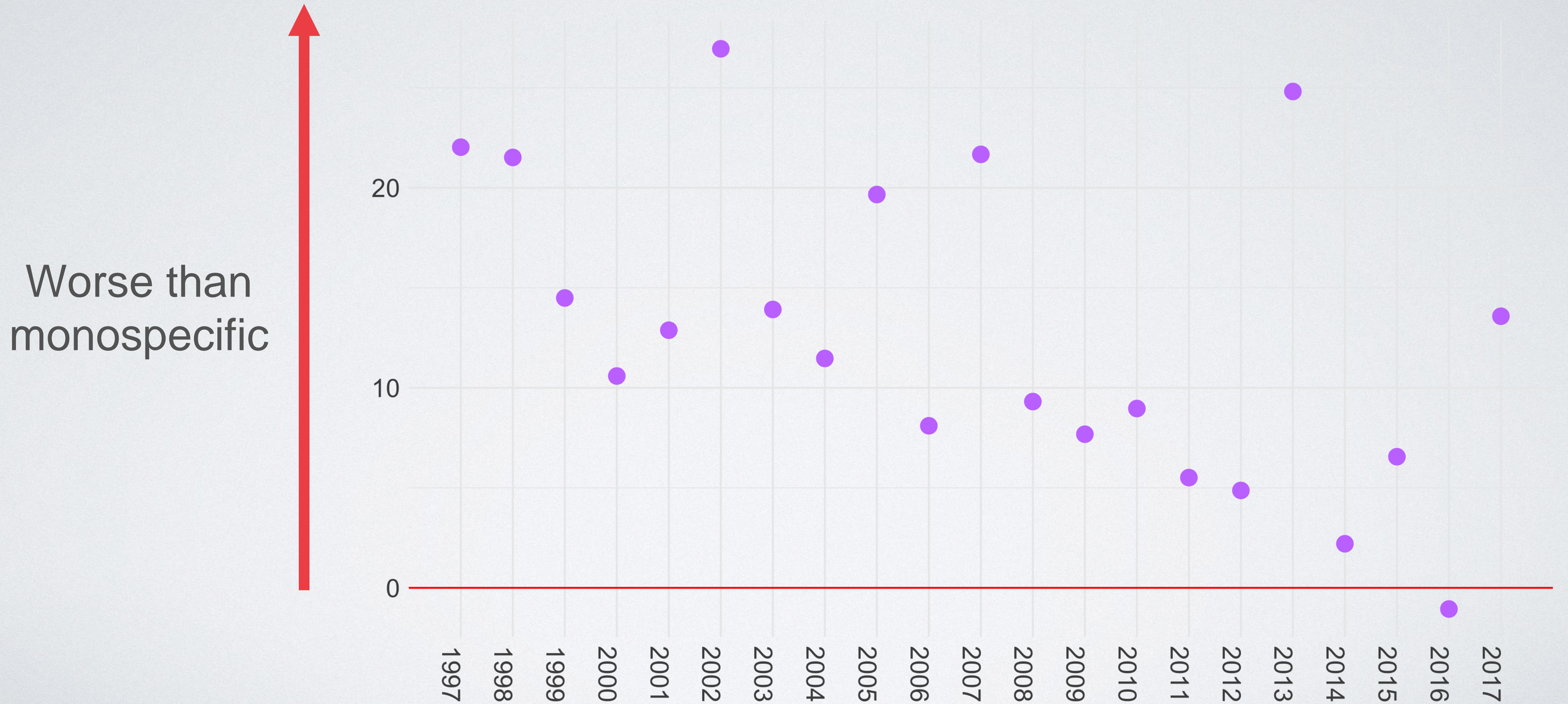
Stand diversity reflect ecological conditions. The crown defoliation is driven by the environmental context rather than diversity .



# SMALL DIVERSITY BEECH FOREST



# SMALL DIVERSITY MEDITERRANEAN FORESTS



# CONCLUSIONS

- Stand diversity reflect ecological conditions. The crown defoliation is driven by the environmental context rather than diversity .
- Low levels of stand diversity enhance crown condition compared to monospecific stands.
- For management: silviculture should promote the diversity in monospecific forests.

# FUTURE DIRECTIONS

- To introduce air pollution factors as explicative variables.
- Including tree growth and damage symptoms as response variables
- Develop a tree health multiparametric index
- Apply this analysis at continental level



THANK YOU

