

How do traits and interactions influence the responses of wood-inhabiting fungi to forest management?

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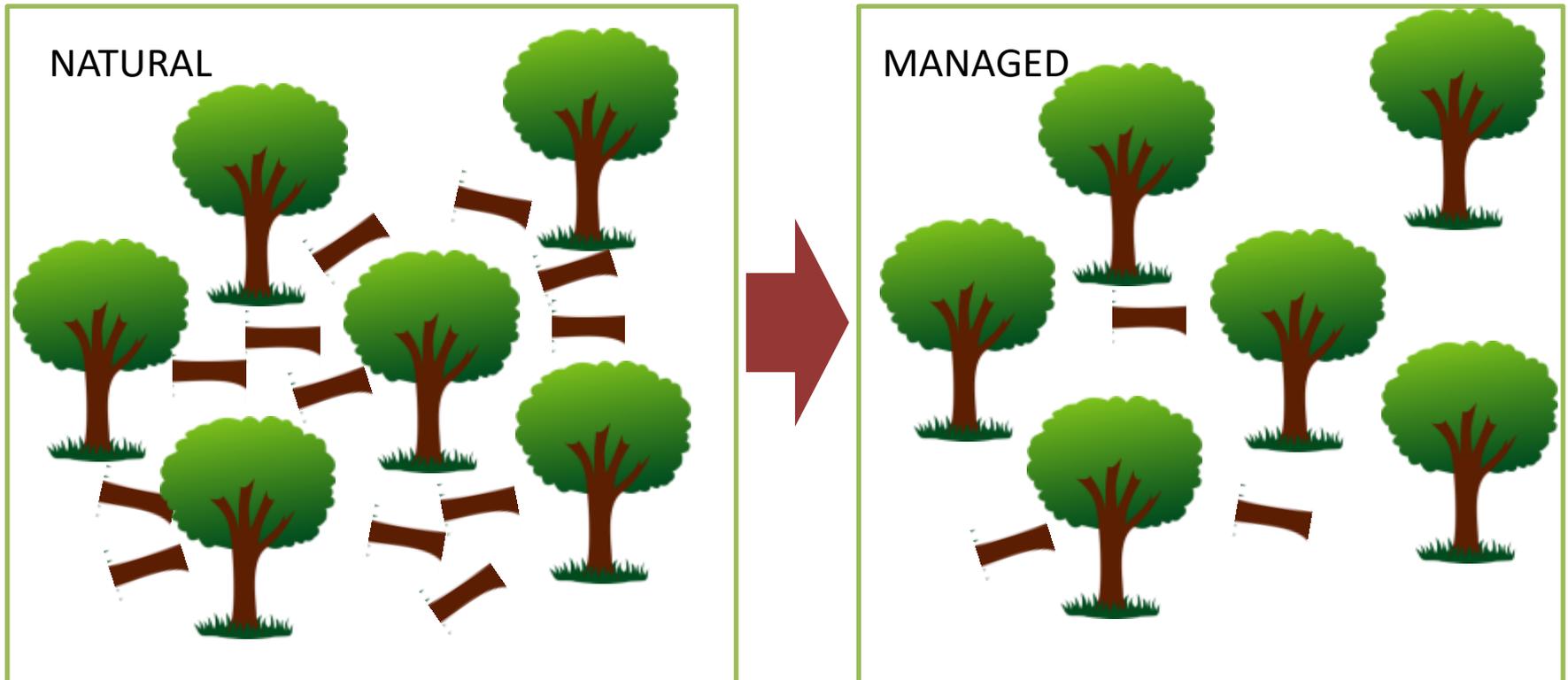
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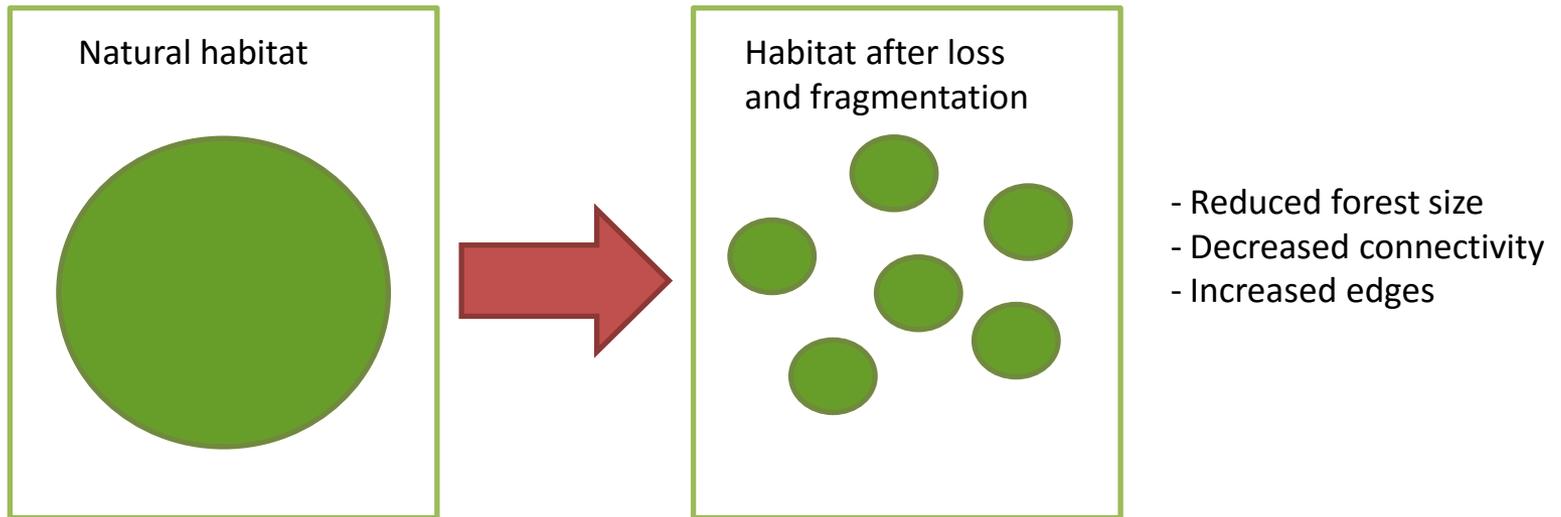
Effects of forest management on wood-dependent organisms

1) Resource unit level



Effects of forest management on wood-dependent organisms

1) Forest cover level



Wood-inhabiting fungal communities: many species have drastically declined

Resource-specialised species declined

Species richness reduced

Community composition modified



Amylocystis lapponica



Fomitopsis rosea

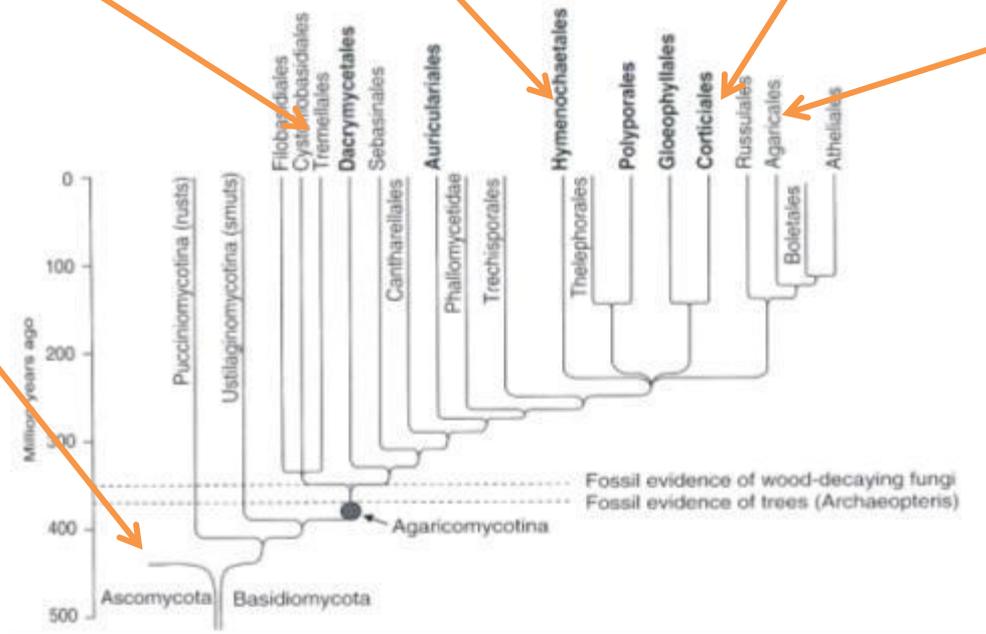
These species occur only in coarse dead wood of well connected and natural forests

Background

Abrego N.

Wood-inhabiting fungal communities: high morphological and taxonomic diversity

In boreal forests: 46% of saproxylic species are wood inhabiting fungi



Background

Abrego N.

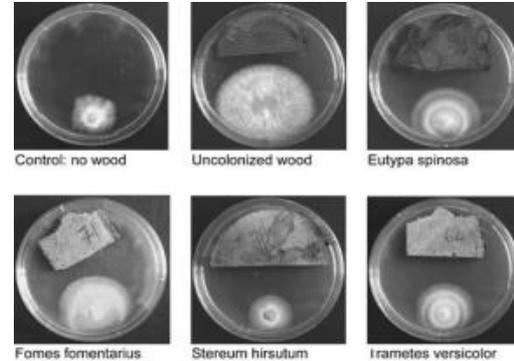
Wood-inhabiting fungal communities: highly interactive metacommunity systems

Competition for nutrients and space, facilitation or growth inhibition through metabolite secretion or modification of the substrate, parasitism...

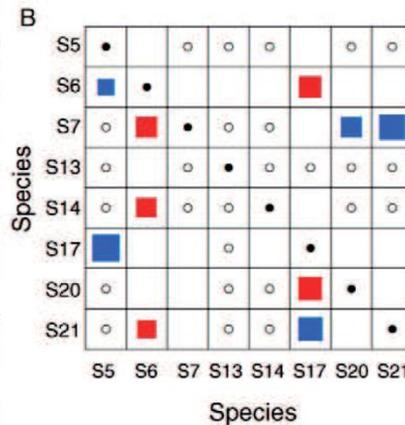


Tremella aurantia parasite of *Stereum hirsutum*

Mycenitis alliaceus paired with...



Heilmann-Clausen & Boddy 2005



Some fungal species co-occur or avoid each other more often than should be expected by shared ecological requirements (Ovaskainen et al. 2010)

Given that the effects of forest management are known to be strong environmental filters on shaping wood-inhabiting fungal communities...

...and...

1) ... biotic interactions are known to structure wood-inhabiting fungal communities...

... we asked whether the **interactions** influenced the responses of the species in the community

2) ... there is such a high morphological diversity in wood-inhabiting fungal communities...

... we asked whether the **traits** of the species influenced the responses of the species in the community

Methods

Abrego N.

Hierarchical modelling of species communities with a joint species distribution model

Species occurrence

=

Environmental filtering

+

Biotic assembly and random variation

326 fungal species

on 22500 resource units

Managed/Natural beech forests

$$L_{ij} = \sum_k x_{ik} \beta_{jk} + \sum_k \eta_{ik} \lambda_{jk}$$

j =species, i =sampling unit

Linear predictor for the occurrence of species j in site i

Measured covariates at different spatial levels

Latent factors at different spatial levels

$$\beta_{i.} \sim N(\mu, V)$$

Species level Community level

Traits

Species-to-species associations

$$\text{Cov}(\varepsilon_{ij}, \varepsilon_{i'j}) = \Omega_{ii'}, \quad \Omega = \lambda \lambda^T + I$$

$$\beta \sim N(T\gamma, V \otimes [\rho C + (1 - \rho)I])$$

Traits

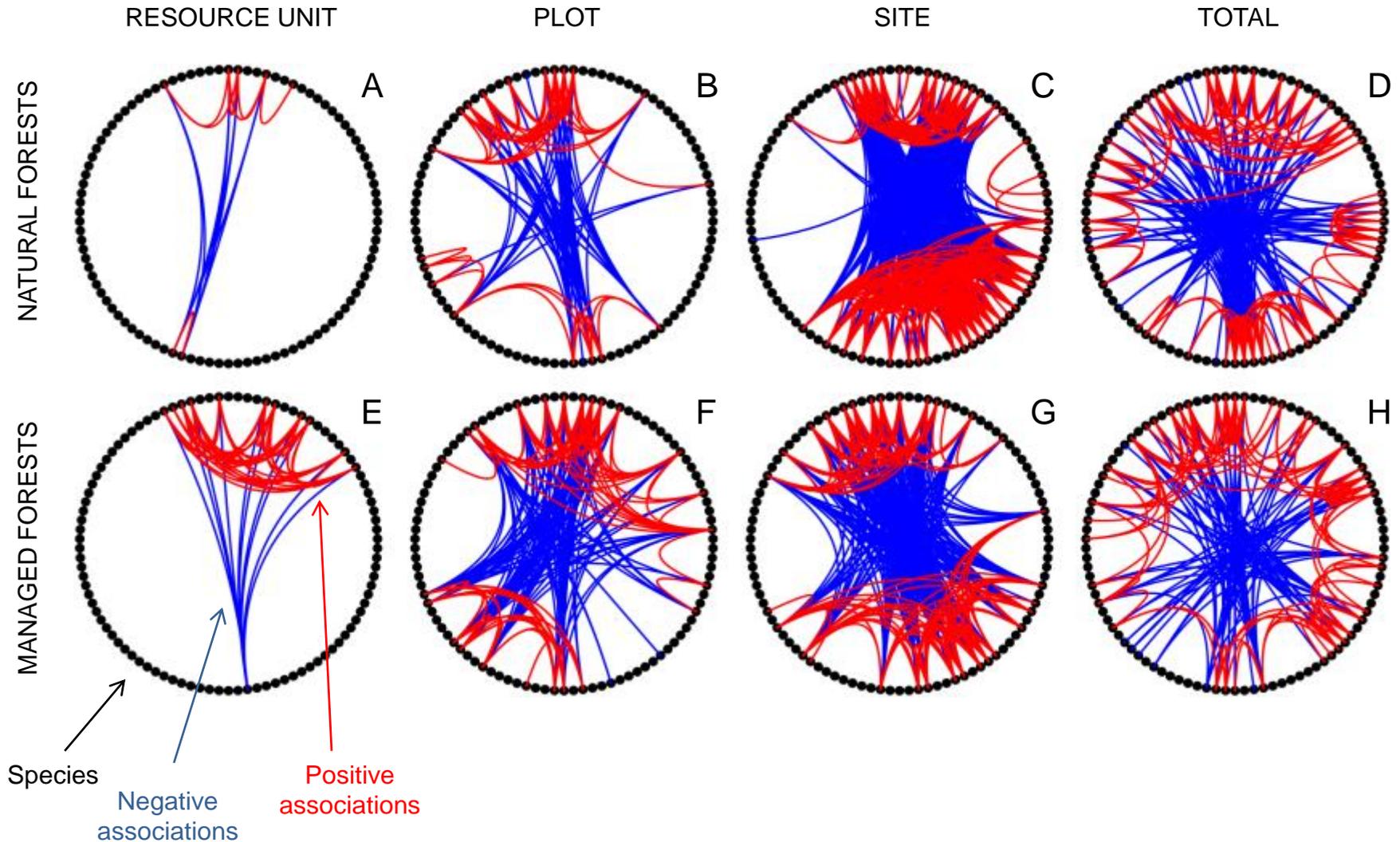
Regression parameters: how traits influence the species responses to environmental covariates

Phylogenetic correlations

Do interactions influence species' response to forest management?

Abrego N.

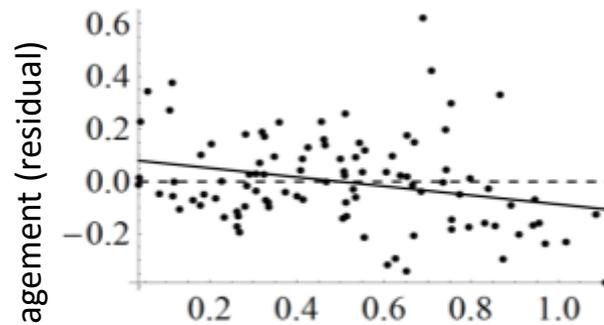
Species-to-species associations



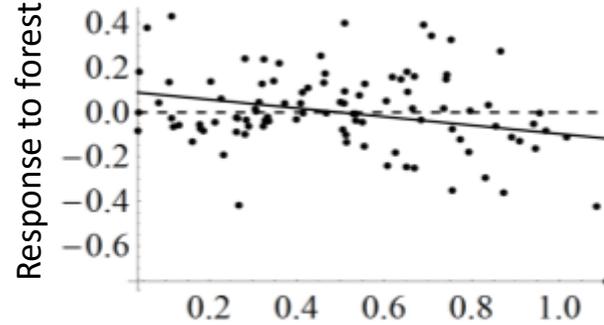
Do interactions influence species' response to forest management?

Abrego N.

Prediction 0
No environmental covariates



Prediction 1
Environmental covariates included



Species with $\uparrow\uparrow A$ showed a negative response to forest management

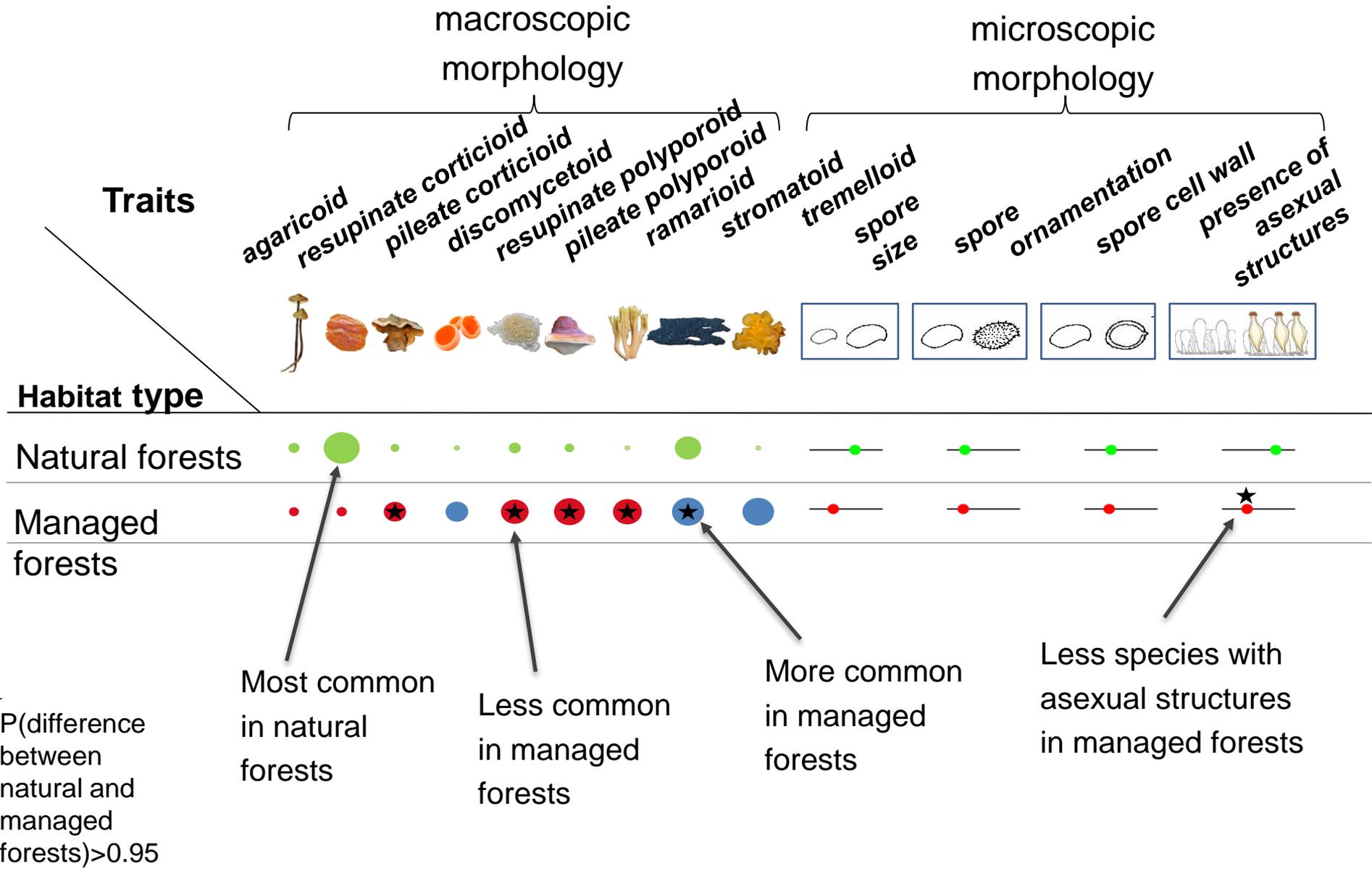
$$A_j = 1 - R_j^2(P1) / R_j^2(P2)$$

Environmental cov
in the model

Environmental cov +
cooccurrences in the
model

Association index A
How much of the spp
occurrences is attributed to
associations

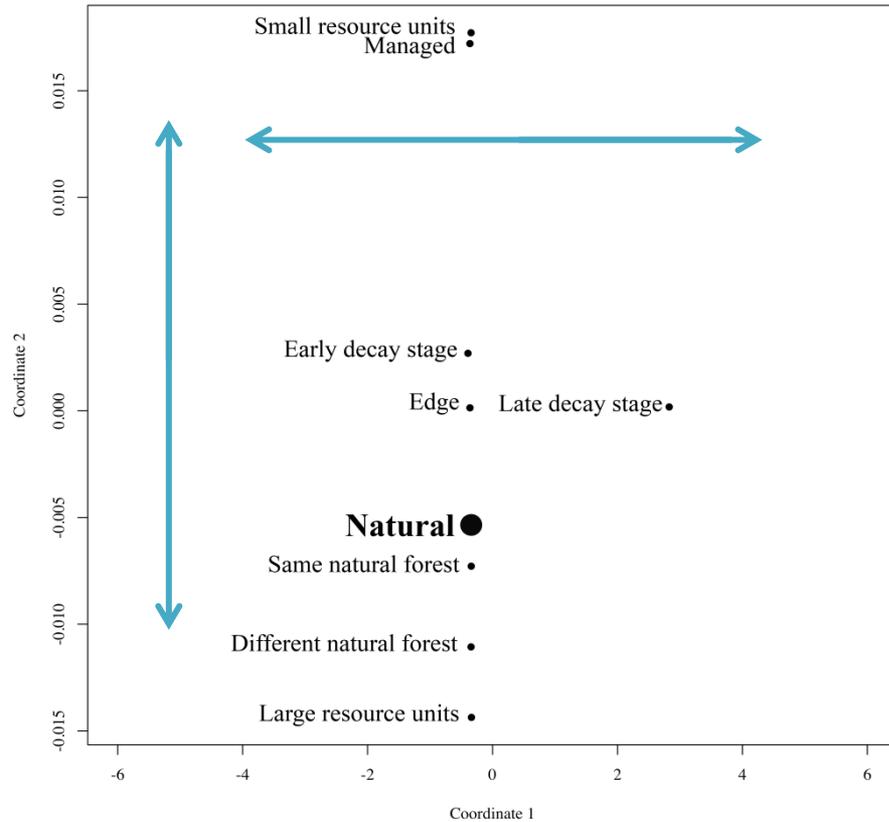
Do traits influence species' response to forest management?



Do traits influence species' response to forest management?

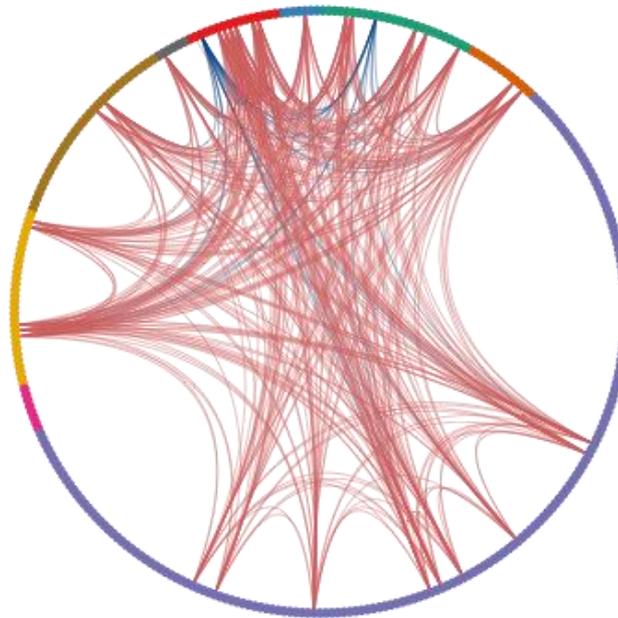
similarities in the functional diversity

Nonmetric MDS for RaoQ



Do traits influence the interspecific interactions?

Traits influenced the number of sp–sp associations, and the number of these links were non-randomly distributed across species with different traits



- Agaricoid
- Pileate corticioid
- Resupinate corticioid
- Discomycetoid
- Pileate polyporoid
- Resupinate polyporoid
- Ramarioid
- Stromatoid
- Tremelloid

Which are the conclusions after all this stuff?

- In addition to the direct loss of resource-specialized species, forest management has strong indirect effects mediated through interactive associations in wood-inhabiting fungal communities
- Species with strong associative links to other species are especially sensitive to forest management
- Traits are linked to the responses of the species by in/decreasing species occurrence probabilities
- Traits influenced the number of species-to-species associations, and the number of these interaction links were not randomly distributed across species with different traits

Which are the conclusions after all this stuff?

Forest management alters ecosystem functions by promoting/reducing species with different functional traits, and altering their interactions networks



KIITOS!!

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PH



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