Scenarios of forest type change & resulting shifts in ecosystem service potential
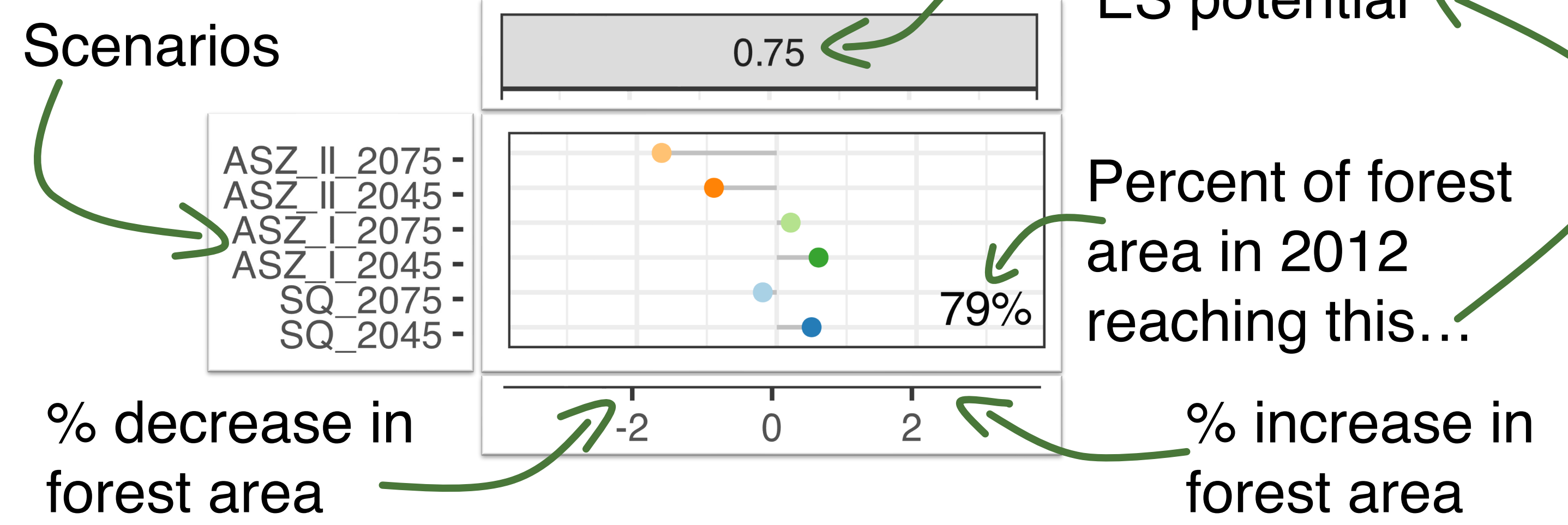
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BioHolz PROJEKT

Motivation

- use a consensus of expert knowledge on future forest development to define realistic scenarios
- model the potential of different forest types to provide ecosystem services for each scenario
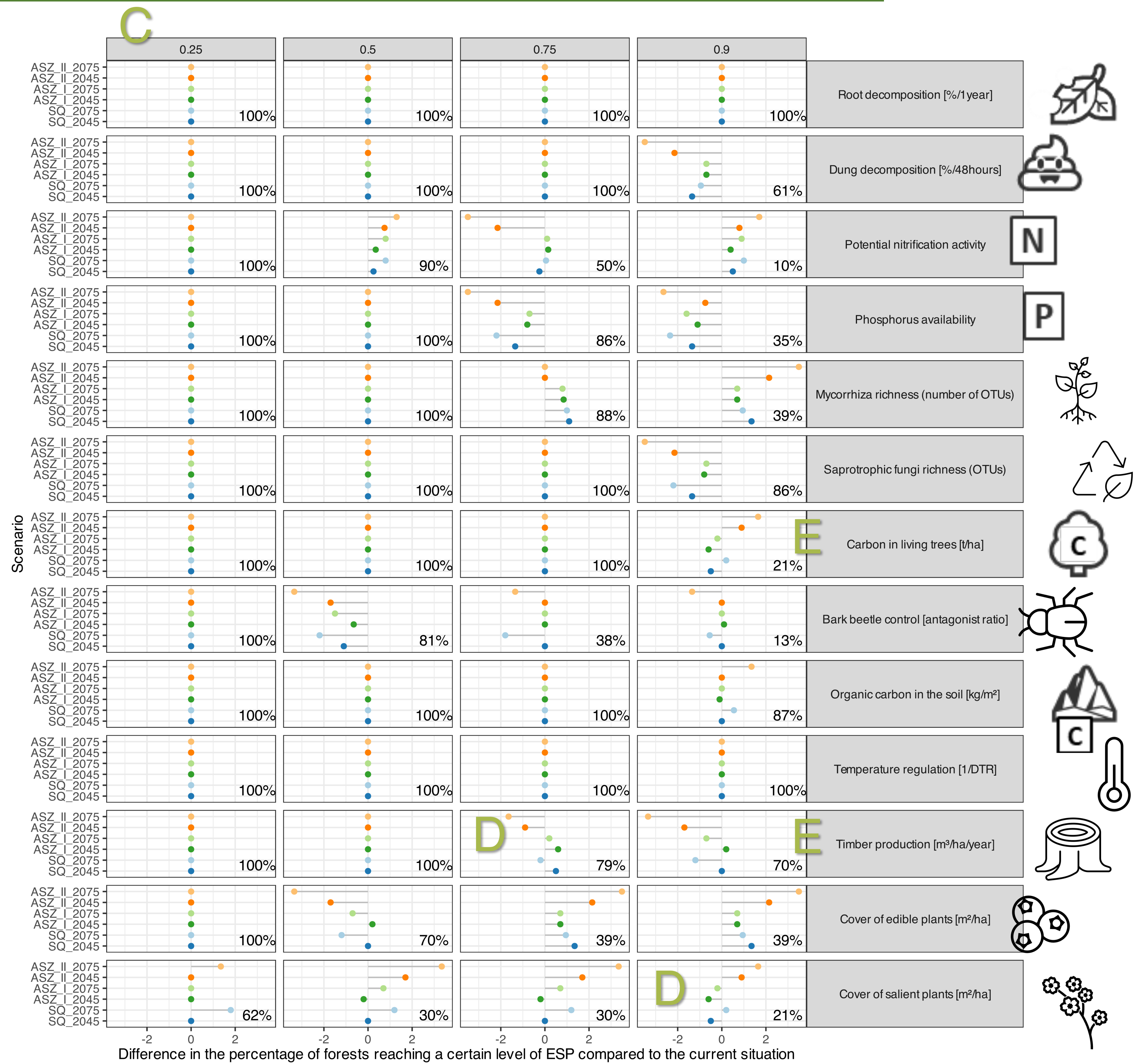- identify synergies and trade-offs between ecosystem services and scenarios
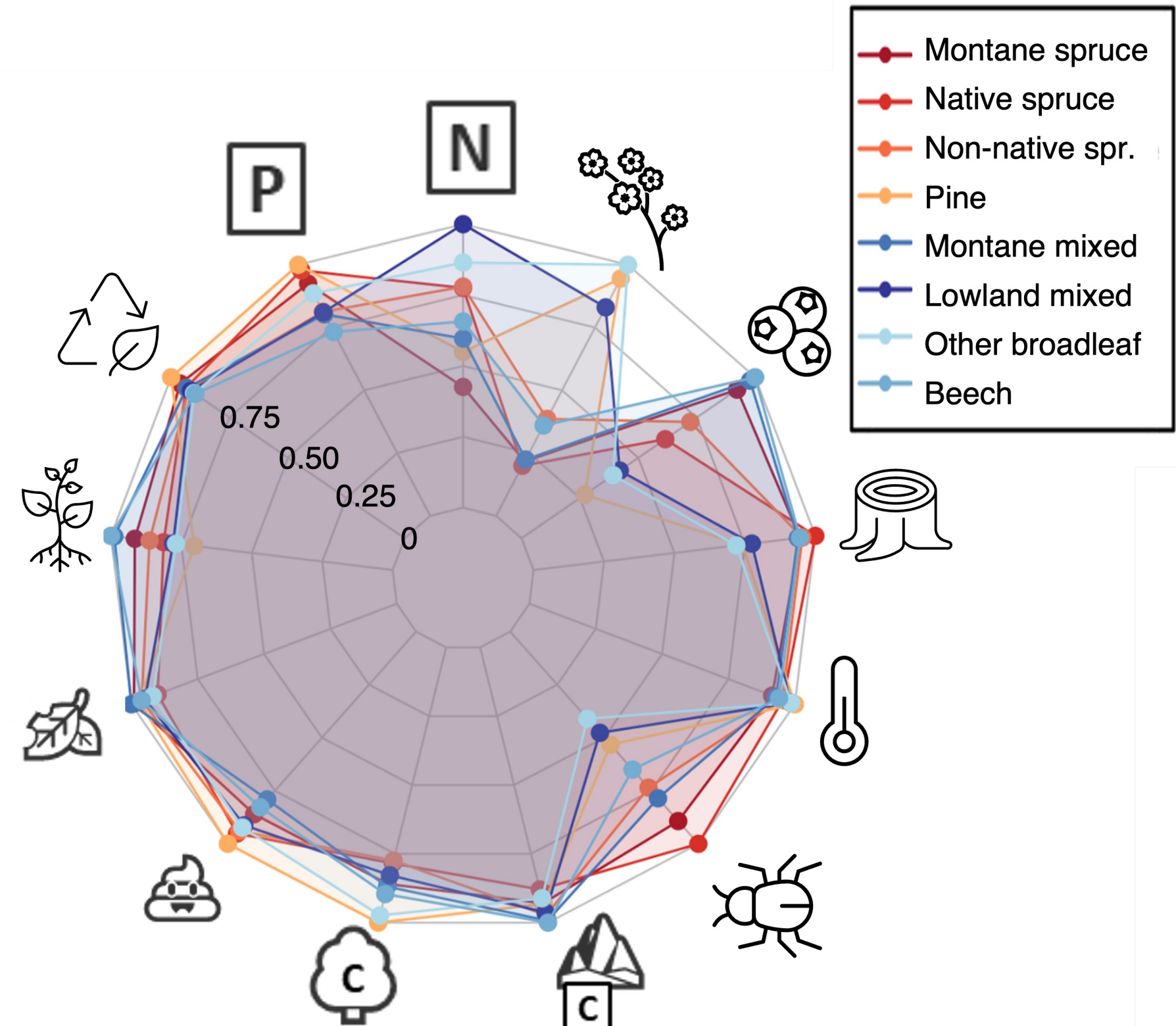
How to read the figure

Scenarios → | 0.75 ← Level of ES potential

ASZ_II_2075 · ASZ_II_2045 · ASZ_I_2075 · ASZ_I_2045 · SQ_2075 · SQ_2045

Percent of forest area in 2012 reaching this… → 79%

% decrease in forest area ← -2 0 2 → % increase in forest area

Scenarios A

SQ: Status quo (rated most likely)
spruce dominated forests ⬇ 26 %
(mixed) beech dominated ⬆ 21 %

ASZ I: „Intensification of use"
spruce dominated forests ⬇ 17 %
(mixed) beech dominated ⬆ 13 %

ASZ II: „resilient/close-to nature"
spruce dominated forests ⬇ 32 %
(mixed) beech dominated ⬆ 33 %

ES potentials B

Forest types in Bavaria
- Montane spruce
- Native spruce
- Non-native spr.
- Pine
- Montane mixed
- Lowland mixed
- Other broadleaf
- Beech

0   0.25   0.50   0.75

Change in Ecosystem Service provision

C

Scenario (vertical axis): ASZ_II_2075, ASZ_II_2045, ASZ_I_2075, ASZ_I_2045, SQ_2075, SQ_2045

Columns: 0.25 | 0.5 | 0.75 | 0.9

Ecosystem service	0.25	0.5	0.75	0.9
Root decomposition [%/1year]	100%	100%	100%	100%
Dung decomposition [%/48hours]	100%	100%	100%	61%
Potential nitrification activity (N)	100%	90%	50%	10%
Phosphorus availability (P)	100%	100%	86%	35%
Mycorrhiza richness (number of OTUs)	100%	100%	88%	39%
Saprotrophic fungi richness (OTUs)	100%	100%	100%	86%
Carbon in living trees [t/ha]	100%	100%	100%	21% E
Bark beetle control [antagonist ratio]	100%	81%	38%	13%
Organic carbon in the soil [kg/m²]	100%	100%	100%	87%
Temperature regulation [1/DTR]	100%	100%	100%	100%
Timber production [m³/ha/year]	100%	100% (D)	79%	70% E
Cover of edible plants [m²/ha]	100%	70%	39%	39%
Cover of salient plants [m²/ha]	62%	30%	30% (D)	21%

Difference in the percentage of forests reaching a certain level of ESP compared to the current situation

Results & Conclusions

- **A.** Expert scenarios differ mainly in magnitude of change
- **B.** Forest types show strong differences only for few ES
- **C.** All forests provide all ES at a minimum level of 0.25 (i.e. 25% of the maximum observed potential)
- **D.** Scenarios differ in direction of change only for few ES
- **E.** Some ES show clear trade-offs at maximum level of ES potential, irrespective of the scenario
- **F.** Effects of climate change might be underestimated

Approach

F

April 2016 (before drought years in Germany) ... Dec. 2016

ESP functions → ESP of forest types → ESP in scenarios

Panel of forest experts → Delphi I → Forest descriptors → Cluster analysis

German NFI 2012 → Forest characteristics

Influencing factors → Text analysis → Scenario description

Forest types → Delphi II

German NFI → Forest type locations → Scenario Generator → Scenario forests

Transition likelihoods / Scenario description

Legend: Resource | Output/Input Variable | Process | Final outcome

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