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Why tree diversity?

Ecosystem functions of agroforestry systems (AFS) may be increased by enhanced tree species diversity as suggested by research in forests with increasing complexity [1-3]. However, for AFS in the temperate climatic zone, no research has assessed the impacts of different levels of tree diversity on ecosystem indicators.

With this research, we aim to put the topic of tree diversity in AFS on the agroforestry (AF) research agenda. Our focus is on tree diversity in terms of tree species and tree-use types (biomass/timber/fruit/others) in modern German AF practice and research.

Data sources

To assess AFS in **modern German agroforestry practice**, we drew on information from the online map provided by the German agroforestry federation (DeFAF) [5]. This map is the largest database of AFS in Germany. Out of a total of 135 entries, 105 alley cropping systems with a size of at least one hectare were selected.

AFS used in **German agroforestry research** were analysed through a systematic search of peer-reviewed literature [6]. 154 studies were screened, and 26 different alley cropping systems identified.



Figure 1: Simple tree row with poplars for biomass production (above) and complex tree row with seven tree and shrub species for fruit, timber and biomass production (below). Both tree rows are situated in the same agroforestry system at Gladbacherhof, Germany [4]. Pictures: Michael Prade.

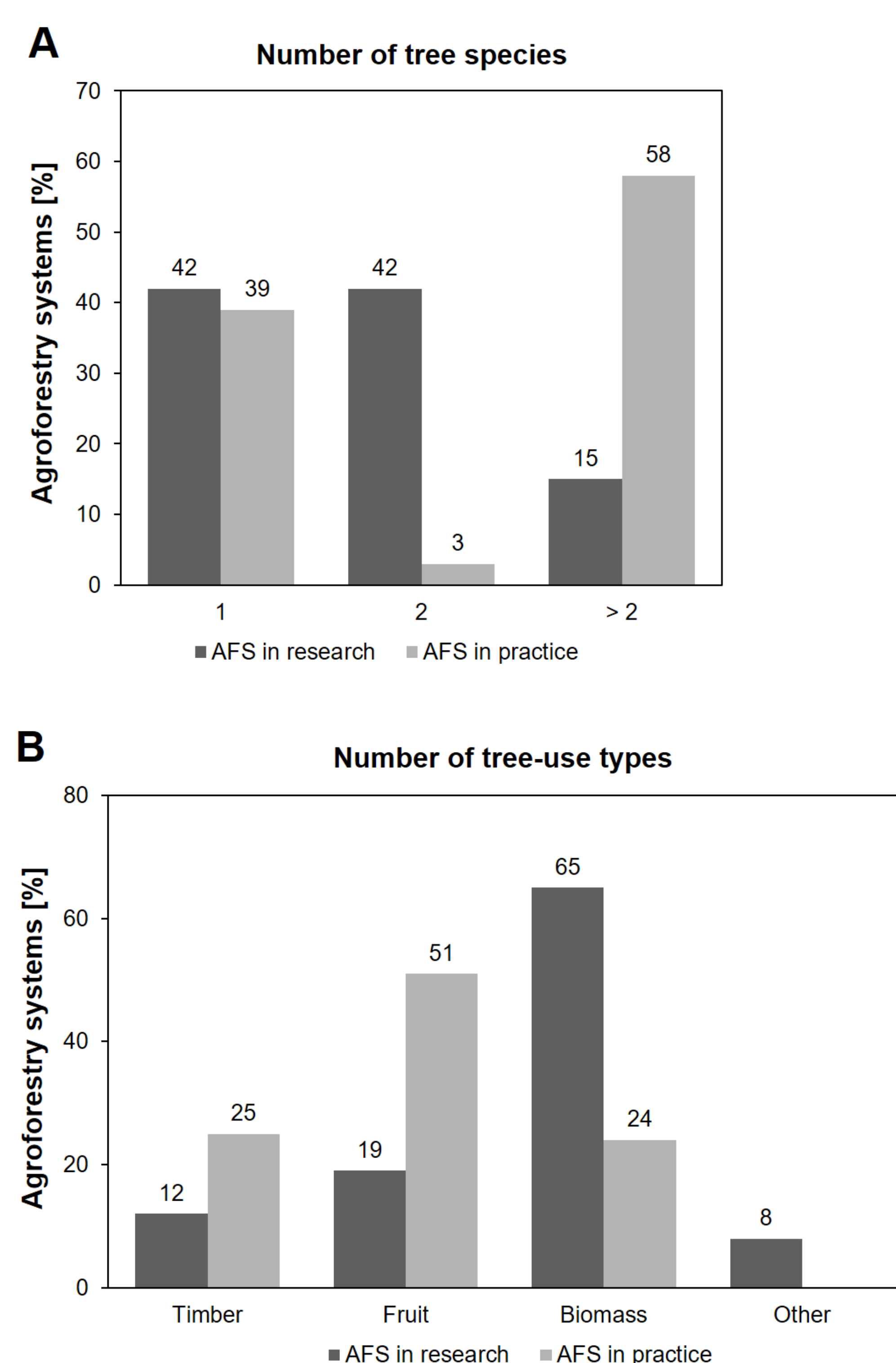


Figure 2: Number of different tree species (A) and tree-use types (B) in German agroforestry practice and research. AFS = agroforestry system.

Results

- Modern German agroforestry practice is characterized by a large share (58%) of systems with three or more different tree species.
- In contrast, AF research in Germany has had a strong focus on alley cropping systems with only one or two tree species (84% of systems).
- With regard to the intended tree-use, biomass systems dominated research (65%) but appeared only in 24% of the cases in AF practice.
- Fruit systems were only analysed in 19% of the studies but account for 51% of the systems in AF practice.

Discussion & suggestions for future research

Modern German AF practice is still in its early stages and seems mainly driven by pioneers with an interest in diverse systems. AF research in Germany has predominantly focussed on simple AFS probably due to the fact that these systems are easier to analyse.

Three major research gaps for AF research in Germany are suggested:

1. AFS with a high tree species or tree-use type diversity remain understudied.
2. Further research on fruit tree AFS should be conducted as this is the main tree-use type in German AF practice.
3. Empirical studies testing the assumption that tree species diversity in AFS can improve ecosystem indicators are needed.