

MSc thesis topic announcement (start date from May 2026):

Review of agri-environmental characteristics of endemic climate tree species in succession stage in Central Europe

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Background and concept:

Agroforestry systems enable the dual use of agricultural land, which boosts productivity from a research perspective (Sollen-Norrllin et al. 2020). Agroforestry systems have thus been described as having higher land equivalent ratios (LER) and therefore having a greater economic viability when compared to conventional agriculture (Lehmann et al. 2020, Smith et al. 2022). Positive impacts on erosion reduction, biodiversity enhancement and soil fertility are often cited as evidence for ecosystem services (Smith et al. 2022, Fagerholm et al. 2016). However, farmers must expect crop yield losses, particularly in the immediate proximity of tree rows (1-4 m) (Reuse und Langhof 2025). At the same time, provisioning services, such as potential biomass enhancement or optimisation for crops, are not well understood (Torralba et al. 2016). The successful establishment of an agroforestry system as an integrated ecosystem needs fundamental research, especially as a novel agro-ecological system in Germany. In this context, understanding ecological traits and the implications for ecosystem productivity based on plant-soil interactions and ecological processes is essential for effective resource management and for understanding underlying agroecological concepts (den Herder et al. 2015).

Agroforestry is currently experiencing a boom in Germany, with researchers, farmers, and policymakers still investigating the influence of trees on crops from the beginning of their planting, when the tree rows are in the pioneer stage (ARPS, tree age=1-3 years). Experiments with agroforestry rows in the succession stage (ARSS, tree age >25 years old) are very scarce, particularly when it comes to marginal sites.

Specific objectives:

Our field experiment with ARSS and ARPS in Northeast Germany aims to analyse the ecosystem service potential of agroforestry systems within a two-year crop rotation. Our focus is on comparing provisioning and supporting ecosystem services between ARSS and ARPS.

The master thesis project aims to address the following research question:

I. How do small-leaved lime (*Tilia cordata*), European ash (*Fraxinus excelsior*), large-leaved lime (*Tilia platyphyllos*), silver maple (*Acer saccharinum*), pin oak (*Quercus palustris*), English oak (*Quercus robur*), and sycamore maple (*Acer pseudoplatanus*) interact with the nutrients of crops and weeds?

Methods:

I. A systematic review and analysis of peer- and non-peer reviewed literature on agroforestry case studies that include each of the tree species in the succession stage, as listed above, and their impacts on crop yield and soil.

II. A systematic review on peer- and non-peer reviewed literature on potential allelopathy and allelospoly effects of each of the tree species in the succession stage, as listed above, on crops and weeds including:

- chemical properties of roots in soil
- chemical properties of foliage in soil

Requirements:

- Focus within a master's programme in agriculture, horticulture, forestry, environmental sciences or a related discipline.
- Experience in literature research and evaluation
- Experience in literature management with Citavi
- Proficient command of the English language

Proposed schedule:

Your work will constitute a Master thesis and will contribute to one scientific publication. The thesis can be submitted in either German or English.

Tasks	Month					
	1	2	3	4	5	6
Literature review and data analysis round I						
Literature review and data analysis round II						
Data analysis and interpretation						
Writing the master thesis						

Application:

Please send your application (in PDF format) by email with the subject line: **MasterThesis-Review-of-endemic-trees-2026** to: Sonoko.Bellingrath-Kimura@zalf.de

When you apply, we collect and process your personal data in accordance with Articles 5 and 6 of the EU GDPR solely for the purpose of processing your application and for purposes that may arise from possible future employment at ZALF. Your data will be deleted after six months.

Reference list:

- Fagerholm, N.; Torralba, M.; Burgess, P. J.; Plieninger, T. (2016): A systematic map of ecosystem services assessments around European agroforestry. In: *Ecological Indicators* 62, S. 47–65. DOI: 10.1016/j.ecolind.2015.11.016.
- Helder, M. den; Burgees, P. J.; Mosquera-Losada, M. R.; Herzog, F.; Hartel, T.; Upson, M. et al. (2015): Preliminary stratification and quantification of agroforestry in Europe. AGFORWARD - Milestone 1. Hg. v. European Commission. Online verfügbar unter https://www.agforward.eu/documents/M1_Stratification%20of%20agroforestry.pdf.
- Lehmann, L. M.; Smith, J.; Westaway, S.; Pisanelli, A.; Russo, G.; Borek, R. et al. (2020): Productivity and Economic Evaluation of Agroforestry Systems for Sustainable Production of Food and Non-Food Products. In: *Sustainability* 12 (13), S. 5429. DOI: 10.3390/su12135429.
- Reuse, C.; Langhof, M. (2025): The impact of tree height and distance on crop yields in a temperate short rotation alley cropping agroforestry system: a multi-year study. In: *Agroforest Syst* 99 (6). DOI: 10.1007/s10457-025-01237-1.
- Smith, L. G.; Westaway, S.; Mullender, S.; Ghaley, B. B.; Xu, Y.; Lehmann, L. M. et al. (2022): Assessing the multidimensional elements of sustainability in European agroforestry systems. In: *Agricultural Systems* 197, S. 103357. DOI: 10.1016/j.agry.2021.103357.
- Sollen-Norrin, M.; Ghaley, B. B.; Rintoul, N. L. J. (2020): Agroforestry Benefits and Challenges for Adoption in Europe and Beyond. In: *Sustainability* 12 (17), S. 7001. DOI: 10.3390/su12177001.
- Torralba, M.; Fagerholm, N.; Burgess, P. J.; Moreno, G.; Plieninger, T. (2016): Do European agroforestry systems enhance biodiversity and ecosystem services? A meta-analysis. In: *Agriculture, Ecosystems & Environment* 230, S. 150–161. DOI: 10.1016/j.agee.2016.06.002.