Agroforestry and carbon sequestration

Reference 9

Torralba, M; Fagerholm, N; Burgess, PJ; Moreno, G; Plieninger, T. 2016 Do European agroforestry systems enhance biodiversity and ecosystem services? A meta-analysis. Agriculture, Ecosystems & Environment 230: 150-161. doi: 10.1016/j.agee.2016.06.002

Background and objective

Agroforestry has played an important role in Europe in the past, and traditional agroforestry practices, such as wood pasture and grazed or intercropped orchards, are still practised widely in Europe. During the 20th century, the area of many European agroforestry systems decreased while the remaining agroforestry practices are vulnerable. In 2005, the European Union provided opportunity for national and regional governments to financially support the establishment of new agroforestry systems. The study aimed at answering the following research questions: 1) Does European agroforestry enhance biodiversity and ecosystem services relative to conventional agriculture or forestry (natural and planted forest)?; 2) Which species groups and which categories of ecosystem services are most supported by agroforestry?; 3) What differences arise among different kinds of agroforestry (e.g. silvoarable systems, silvopastoral agroforestry)?; 4) Do biophysical system properties such as temperature and precipitation drive inter-site differences? Here, only results regarding soil organic carbon are reported.

Search strategy and selection criteria

The literature search was performed in August 2014 by generating combinations of keywords in three databases: ISI Web of Science; SCOPUS and CAB abstract. Additionally, the first 50 documents provided by Google Scholar were included and in the end of the process added five papers recommended by three experts in the field. The systematic literature mapping sought to include all scientific publications that provide quantitative data comparing agroforestry with an alternative land use system in a European study area and using indicators that assess biodiversity and ecosystem services.

Data and analysis

Effect sizes were used as dependent variables to construct a random-effect model (effect sizes nested within studies) and calculate the mean effect size assuming random variation among the observations. Hence 95% confidence intervals were calculated around the mean effect size with bootstrapping of 999 iterations. To assess the effect of the different response variables, sub-group analyses were performed using the explanatory moderators as independent variables

Number of papers	Population	Intervention	Comparator	Outcome	Quality score
53 (31 silvopastoral, 13 silvoarable, 7 mixed)	Agricultural land, pasture, forestry land in the EU.	Agroforestry (silvoarable, silvopasture and mixed).	1)Agricultural land, 2)pasture land, 3) forestry land (natural and planted).	Logarithm of ratio of biomass production in agroforestry systems to biomass production in non-agroforestry systems.	81%

Results

- Agroforestry (silvoarable, silvopasture and mixed systems) showed complexively significant reductions in biomass production relative to both forestry and pasture. No data available for comparison to arable land.
- Among different types of AF, only silvopasture systems (compared to natural forests and pasture) had a significantly negative effect on biomass production (compared to natural forests and pastures). For mixed systems and silvoarable systems, the analysis did not show clear positive or negative outcomes.
- NA
- NA
- NA

Factors influencing effect sizes

NA

Conclusion

Agroforestry reduced biomass production in relation to forestry and pasture. However, biomass results should be taken with caution as some of the authors that found such effects acknowledge the difficulty to assess productivity in agroforestry systems, as the biomass usually considers only the woody or the non-woody elements of the system, but not both together, giving a partial assessment of the biomass production in the system.