Agroforestry and soil nutrient

Reference 5

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 nutrients 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 soil fertility/nutrient cycling in agroforestry systems to soil fertility/nutrient cycling in non-agroforestry systems.	81%

Results

- When compared to forestry, agroforestry had a significant positive effect on soil fertility/nutrient cycling.
- Both silvopasture and silvoarable systems had significant positive effects on soil fertility, compared to all controls. For mixed systems, the analysis did not show clear positive or negative outcomes.
- Benefits were observed for the Mediterranean and Pannonian biogeographical regions; the effects of agroforestry in the Continental, Alpine and Boreal regions were not significant.
- When compared with agricultural land and pastureland, agroforestry had non-significant effects on soil fertility/nutrient cycling.
- NA

Factors influencing effect sizes

Climate: benefit of agroforestry (versus forestry land) tended to decrease with precipitation and increase with temperature, but the effects were not clear enough to infer an influence.

Conclusion

When compared with forestry, agroforestry had a significant positive effect on soil fertility/nutrient cycling. In comparison with pastureland and agricultural land, no significant differences were reported.