The benefits of integrating agroforestry practices in regenerative/agroecology systems: knowledge gaps in meta-analysis literature

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Although agroforestry has attracted interest in the European Union (EU) in recent decades and has received some support from the Common Agricultural Policy (CAP), it has only been marginally implemented by farmers in EU member states to date. In the current CAP 2022-2027 and in view of the challenges to meet the goals of the EU Green Deal and Farm to Fork strategy, the EU Commission is collecting the available scientific evidence to support decisions about funding schemes for agricultural practices, including agroforestry. Recently, different evidence maps based on published meta-analyses (MAs) have been synthesizing the available evidence regarding the environmental benefits of agroforestry 1–5.

Different types of agroforestry practices are described in such meta-literature, with different degrees of integration within regenerative/agroecology farming systems. With this term, we intend farming systems which aim at agroecosystems regeneration by simultaneously integrating different management options (such as crop diversification, soil management, reduced input, crop-livestock integration, management of landscape elements etc.) with more holistic view (agroecology approach). According to agroecology principles, the combination of diversified agroforestry practices (especially multi-species/ multistrata/ successional vegetation designs and crop-livestock integration) with other practices promises to be key to enhancing agri-food system sustainability, resilience and environmental health.

Objectives

This study, through a comprehensive systematic review of published MAs, has two main objectives:

1. to map different agroforestry practices, according to their degrees of integration into the agroecology framework;
2. to synthesize existing scientific evidence on the environmental, climate, and production impacts of agroforestry practices;
3. to identify critical knowledge gaps in the literature to indicate the possible paths for further research.

Results

We screened over 100 records retrieved from Web of Science and Scopus databases from which 31 MAs were selected. Each MA synthetizes through statistical analysis the results of several individual studies conducted around the world (ranging from 3 to 140), reporting the comparison of agroforestry practices versus conventional agriculture, on a large set of environmental and agricultural production outcomes.

We mapped existing results, grouping agroforestry practices into 10 different types, plus a general category for results obtained from unspecified types of agroforestry practices (Fig.1). From the definitions provided by the MAs, we also classified how these practices fall simultaneously into different management categories existing in the CAP framework. Based on this, we ranked the different agroforestry types using an ‘’agroecology score’’ (i.e. the number of management categories simultaneously involved by each type of agroforestry). The type “Diversified agroforestry systems” (including multi-species/ multistrata/ successional vegetation designs which often integrate livestock in mixed farming) covers the highest number of management categories (8), followed by ‘’agroforestry with leguminous trees’’ and “silvopasture systems” (Fig. 1).

The different MAs show strong consensus across different types of agroforestry practices, compared to conventional agriculture, reporting significant positive effects on a wide range of environmental, climatic and production objectives of the CAP, with few or no trade-offs among them (4% of all results reporting significant negative effect). Evidence is however available mostly for agroforestry systems as general category (54 results over a total of 213). The most studied types are “agroforestry systems (all types unspecified)”, “silvoarable systems” and “hedgerows, windbreaks, shelterbelts” (Fig.2).

The highest agroecology-scoring types (i.e. diversified agroforestry systems) received little attention (9 results). Results however look promising, with the highest share of significantly positive effects (78%), on carbon sequestration and biodiversity metrics, and no trade-off. However, only 1 of these MAs include experiments carried out under European pedo-climates.

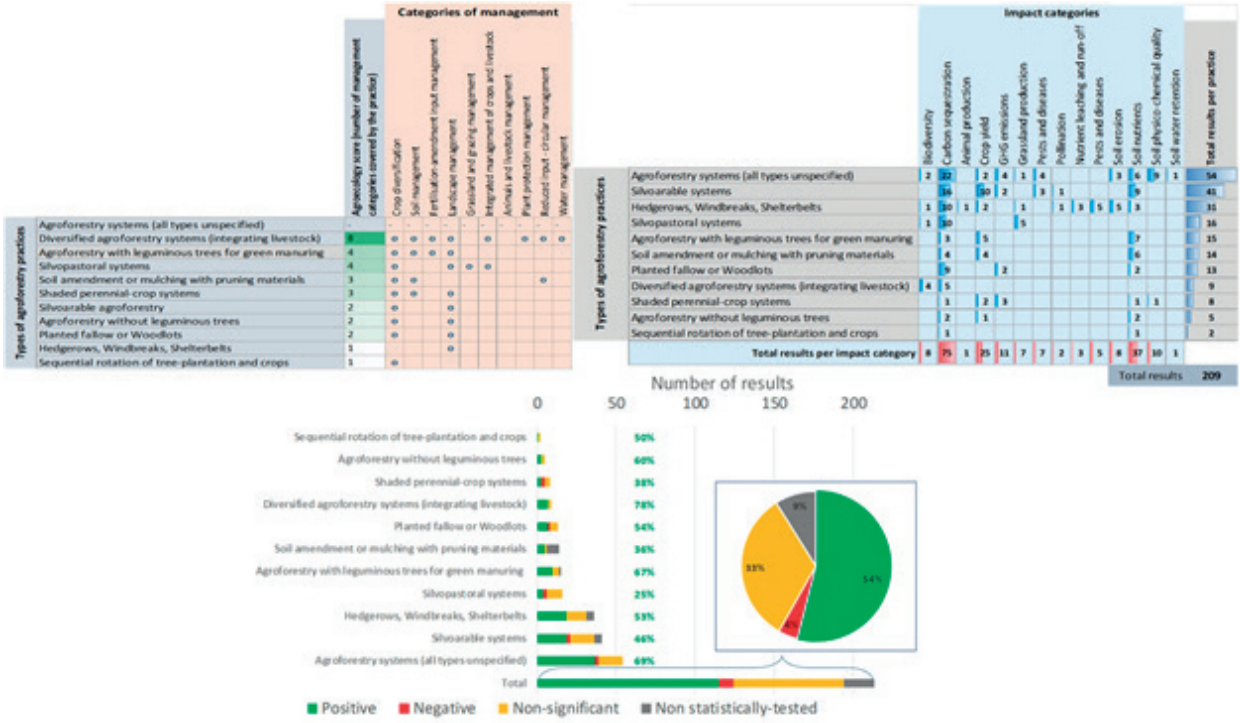
Conclusions

We conclude that there is evidence for regenerative-agroecology agroforestry to show positive effects on climate mitigation, soil fertility and biodiversity enhancement. However, we also highlight a strong need for further scientific evidence, especially in the European context.

Keywords

agroecology, assisted natural regeneration, systematic review, agricultural policy, meta-analysis, agri-environmental system

Aditional Attachment II.



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