

SINGLE-IMPACT FICHE – AGROFORESTRY

IMPACT: SOIL EROSION

Data extracted in June 2020

Note to the reader: This fiche summarises the impact of Agroforestry on SOIL EROSION. It is based on a review of 4 peer-reviewed synthesis research papers, each involving 48 to 138 primary research studies.

1. WEIGHT OF THE EVIDENCE

- CONSISTENCY OF THE IMPACT:**
 Out of the 4 synthesis papers dealing with this type of impact, 3 show positive effect of agroforestry on soil erosion control (see **Table 1**): 2 compared to land use without trees (cropland) in Sub-Saharan Africa and Tropical zones, and one compared to forests in Europe. One synthesis paper reports an uncertain effect in Western Africa. See **Table 2** for details.

Table 1. Summary of effects. The numbers between parenthesis indicate the number of synthesis papers with a quality score of at least 50%. Details on quality criteria can be found in the next section.

Impact	Comparator	Effects (all studies)				Effects (only studies including EU)			
		Positive	Negative	No effect	Uncertain	Positive	Negative	No effect	Uncertain
Soil erosion control	Land use without trees	2	0	0	0	0	0	0	0
	Forests	1	0	0	0	1	0	0	0

- QUALITY OF THE SYNTHESIS PAPERS:** *The quality score summarises 16 criteria assessing the quality of three main aspects of the synthesis papers: 1) the literature search strategy and studies selection; 2) the statistical analysis; 3) the potential bias. Details on quality criteria can be found in the methodology section of this WIKI.*

2. IMPACTS

The main characteristics and results of the 4 synthesis papers are summarized in **Table 2**. Summaries of the meta-analyses provide fuller information about the results reported in each synthesis paper, in particular about the modulation of effects by factors related to soil, climate and management practices.

Table 2. Main characteristics of the synthesis papers reporting impacts of agroforestry systems on soil erosion.

	Reference	Population	Geographical scale	Intervention	Control	Conclusion	Quality score	Global effect
1	Muchane, MN; Sileshi GW; Gripenberg, S; Jonsson, M; Pumariño, L; Barrios, E. 2020	Crop production systems in tropics.	Humid and sub-humid tropics in all continents.	1) simultaneous agroforestry where trees and crops occur on the same piece of land during the same cropping season (e.g. alley cropping, intercropping, multi-storey agroforests); and 2) sequential agroforestry where trees and crops occur on the same piece of land but in a temporal sequence as part of a rotation (e.g. improved fallows).	Crop monoculture.	Agroforestry practices significantly reduce soil erosion rates, compared to crop monocultures. The provision of organic inputs by agroforestry trees through litterfall and prunings contributes to soil cover. Trees can also provide physical barriers to soil erosion. This combined with the predominance of reduced/no-tillage practices in agroforestry is likely an important reason for the lower soil erosion rates.	75%	Positive, compared to crop monocultures.
2	Kuyah, S; Whitney, CW; Jonsson, M; Sileshi, GW; Oborn, I; Muthuri, CW; Luedeling, E. 2019	Agricultural systems in sub-saharian Africa.	Sub-Saharan Africa.	Agroforestry practices: alley cropping, dispersed intercropping, hedgerow, planted fallow, and crops planted under tree canopies in parkland agroforestry systems.	Non-agroforestry practices (includes sole cropping, continuous cropping without trees, and plots outside tree crowns in the case of parklands).	Agroforestry practices significantly reduce soil erosion rates, compared to non-agroforestry cropping. This happened for all types of agroforestry, type of soil, ecological zone, elevation, type of perennials used.	81%	Positive, compared to non-agroforestry practices on cropland.
3	Torralba, M; Fagerholm, N; Burgess, PJ; Moreno, G; Plieninger, T. 2016	Agricultural land, pasture, forestry land in the EU.	Europe	Agroforestry (silvoarable, silvopasture and mixed).	1) Agricultural land, 2) pasture land, 3) forestry land (natural and planted).	When compared with forestry, agroforestry (either silvopasture or silvoarable) had a significant positive effect on erosion control.	81%	Positive, compared to forestry (natural and planted).
4	Sinare, H; Gordon, LJ. 2015	Cropland and pastureland in Sudano-Sahelian zone of West Africa.	Sudano-Sahelian zone of West Africa.	Presence of woody vegetation.	Not specified	No clear conclusion available.	50%	Uncertain

3. KNOWLEDGE GAPS

- Few primary data available for comparisons of agroforestry to cropland, pastureland and forest in Europe (three synthesis papers out of 4 did not report data for Europe). This fragmented structure of the primary data should be taken into account, especially when focusing on trade-offs between ecosystem services. The synthesis paper for Europe compares only individual provisioning services (e.g., woody biomass production or grass production), and not the full amount of food, timber, or biomass produced.