

SINGLE-IMPACT FICHE

LANDSCAPE FEATURES

IMPACT: CARBON SEQUESTRATION

Data extracted in October 2021

Note to the reader: This fiche summarises the impact of four landscape features (field margins, hedgerows, isolated trees, and terraces¹) on CARBON SEQUESTRATION in soil as well as biomass. It is based on 4 peer-reviewed synthesis research papers², each of them including from 53 to 103 individual studies.

1. WEIGHT OF THE EVIDENCE

- CONSISTENCY OF THE IMPACT:

Landscape features have an overall positive effect on carbon sequestration (i.e. increase of carbon sequestration) compared to cropland or grassland without landscape features (see **Table 1**):

- Field margins have a positive effect on soil carbon sequestration compared to cropland and grassland without field margins, according to the only 1 synthesis paper reviewed.
- Hedgerows have a positive effect on carbon sequestration compared to cropland and grassland without hedgerows. 3 synthesis papers reported a positive effect on soil carbon sequestration, while 1 synthesis paper reported no effect. Another synthesis paper reported relevant results for carbon sequestration both in soil and in biomass, but without statistical test of the effects and it is labelled as uncertain. Details are provided below in Table 2 and in the summary reports.
- Isolated trees have an uncertain effect on carbon sequestration in biomass compared to cropland and grassland without isolated trees. One synthesis paper reported relevant results, but without statistical test of the effects and it is labelled as uncertain. Details are provided below in Table 2 and in the summary reports.
- Terraces have differing effects on soil carbon sequestration compared to cropland and grassland without terraces depending on the type of terrace (contour bound or stone terraces vegetated or not), according to the 1 synthesis paper reviewed.

Among the 5 reviewed synthesis papers, 4 include data collected in Europe (see **Table 2**).

Table 1. Summary of effects. The numbers between parentheses 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. One synthesis paper reported more than one effect for terraces and two synthesis papers reported effects for more than one landscape feature.

Impact	Intervention	Positive	Negative	No effect	Uncertain*
Increase carbon sequestration	Field margins	1 (1)	0	0	0
	Hedgerows	3 (3)	0	1 (0)	1 (0)

¹ Described in the General Fiche.

² Research synthesis papers include a formal meta-analysis or systematic reviews with some quantitative results. Details can be found in the methodology section of the WIKI.

	Isolated trees	0	0	0	1 (0)
	Terraces	1 (1)	0	1 (1)	0

* Number of synthesis papers that report relevant results but without statistical test comparison of the intervention and the control.

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 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 landscape features on soil organic carbon. The references are ordered chronologically with the most recent publication date first.

Reference	Population	Scale	Num. papers	Intervention	Comparator	Metric	Conclusion	Quality score
Drexler, S; Gensior, A; Don, A 2021	Croplands and grasslands	Global	9	Hedgerows	No hedgerows	Soil organic carbon stock	The establishment of hedgerows, especially on cropland, can be an effective option for C sequestration in agricultural landscapes.	100%
Abera, W; Tamene, L; Tibebe, D; Adimassu, Z; Kassa, H; Hailu, H; Mekonnen, K; Desta, G; Sommer, R; Verchot, L 2020	Degraded landscape across several agroecology zones	Ethiopia	103	1) Contour bunds; 2) Terraces; 3) Vegetated contour bunds (all classified as terraces)	No treatment, before treatment	Soil organic carbon	The mean effect of all land restoration interventions on soil organic carbon is positive, the highest effect being from "bunds + biological" (139%) followed by enclosure (90%).	62%
England, JR; OGrady, AP; Fleming, A; Marais, Z; Mendham, D 2020	Grazed dairy systems	Global	83	1) Shelterbelts (hedgerows); 2) Pasture trees (isolated trees)	Grazed dairy pasture without trees	Carbon sequestration	Variable results with large increases in biomass C, but changes in soil C following reforestation of on-farm woody elements highly variable and uncertain. <i>Reviewers' note: We labelled the results as uncertain due to the lack of statistical testing.</i>	38%
Zheng, YL; Wang, HY; Qin, QQ; Wang, YG 2020	Croplands	Global	53	Hedgerows	No hedgerows	Soil organic matter content	Plant hedgerows can effectively increase soil organic matter content.	81%
Van Vooren, L; Reubens, B; Broekx, S; De Frenne, P; Nelissen, V; Pardon, P; Verheyen, K 2017	Arable crops	Global (temperate climate)	60	1) Grass strips (field margins); 2) Hedgerows	1) No grass strips; 2) No hedgerows	Carbon stock	Grass strips and hedgerows showed positive effect on the increase of soil carbon stock.	75%

3. KNOWLEDGE GAPS

- Drexler et al., 2021** With the current dataset, it was not possible to identify an influence of hedgerow age, soil texture or climate on the effect of hedgerow establishment on SOC storage due to the small dataset.
- England et al., 2020** The number of publications supporting a given relationship was often relatively low.