

SINGLE-IMPACT FICHE

LANDSCAPE FEATURES

IMPACT: CROP YIELD

Data extracted in October 2021

Note to the reader: This fiche summarises the impact of six landscape features (field margins, flower strips, hedgerows, isolated trees, terraces, and trees in group¹) on CROP YIELD. It is based on 10 peer-reviewed synthesis research papers², including from 25 to 300 individual studies.

1. WEIGHT OF THE EVIDENCE

- CONSISTENCY OF THE IMPACT:

The effect on crop yield per productive unit (i.e. not accounting for the crop area loss that the establishment of some landscape features may involve) differs among landscape features (see **Table 1**):

- Field margins have a positive effect on crop yield (i.e. increase of crop yield) compared to cropland or grassland without field margins, according to the only synthesis paper reviewed.
- Flower strips have no effect on crop yield compared to cropland or grassland without flower strips, according to the 2 synthesis papers reviewed.
- Hedgerows have an uncertain effect on crop yield compared to cropland or grassland without hedgerows, according to the 2 synthesis papers reviewed. One synthesis paper reported contrasting effects depending on the ratio between hedgerow distance to the productive area and hedgerow height and thus we consider this effect uncertain. The other 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.
- Isolated trees have no effect on crop yield compared to cropland or grassland without isolated trees, according to the 2 synthesis papers reviewed.
- Terraces have differing effects on crop yield compared to cropland or grassland without terraces. 1 single synthesis paper reported 1 positive effect, 1 negative effect and 1 no effect depending on the typology of the terrace (vegetated contour bunds, contour bunds without vegetation, and stone terraces, respectively). In addition, 1 synthesis paper reported uncertain results. In addition, 1 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.
- Trees in group have a positive effect on crop yield compared cropland or grassland without trees in group, according to 1 synthesis paper reviewed. Another 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.

Among the 10 reviewed synthesis papers, 7 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 some synthesis papers reported effects for more than one landscape feature.

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.

Impact	Intervention	Positive	Negative	No effect	Uncertain*
Increase crop yield	Field margins	1 (1)	0	0	0
	Flower strips	0	0	3 (3)	0
	Hedgerows	0	0	1(1)	2 (1)
	Isolated trees	0	0	2 (2)	0
	Terraces	1 (1)	1 (1)	1 (1)	1 (0)
	Trees in group	1 (1)	0	0	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 summarised 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 crop yield. The references are ordered chronologically with the most recent publication date first.

Reference	Population	Scale	Num. papers	Intervention	Comparator	Metric	Conclusion	Quality score
Lowe, EB; Groves, R; Gratton, C 2021	Flower crops	Global	29	Field-edge flower plantings (flower strips)	Unplanted, unmanaged field edges; unplanted, managed field edges (e.g., herbicide or mowing); grass strips; bare ground; and crop fields with no edge	Crop yield	Results show that the influence of field-edge plantings on crop pollination and yield is inconsistent.	88%
Abera, W; Tamene, L; Tibebe, D; Adimassu, Z; Kassa, H; Hailu, H; Mekonnen, K; Desta, G; Sommer, R; Verchot, L 2020	Degradated landscape across several agroecology zones	Ethiopia	103	1)Contour bunds; 2) Terraces; 3) Vegetated contour bunds (all classified as terraces)	No treatment, before treatment	Crop production	For productivity, the highest effect was observed from bunds + biological intervention followed by conservation agriculture practices, with 170% and 18% increase, respectively. The other interventions (bunds, fanya juu, and biological) reveal negligible effect on productivity. This indicates the need for developing integrated land management practices that enhance multiple ecosystem functions and/or identifying appropriate practices and	62%

Reference	Population	Scale	Num. papers	Intervention	Comparator	Metric	Conclusion	Quality score
							targeting where they can generate maximum benefit.	
Albrecht, M; Kleijn, D; Williams, NM; Tschumi, M; Blaauw, BR; Bommarco, R; Campbell, AJ; Dainese, M; Drummond, FA; Entling, MH; Ganser, D 2020	Cropland	North America, Europe, New Zealand	35	Flower strips; 2) Hedgerows	No flower strips; 2) No Hedgerows	Crop yield	This synthesis reveals inconsistent and highly variable effects of flower strips and hedgerows on crop yield.	62%
England, JR; OGrady, AP; Fleming, A; Marais, Z; Mendham, D 2020	Grazed dairy systems	Global	83	Shelterbelts (hedgerows)	Grazed dairy pasture without trees	Pasture production and quality	Variable results for the pasture production services provided by on-farm woody systems, with all causal relationships having low confidence. <i>Reviewers' note: We labelled the results as uncertain due to the lack of statistical testing.</i>	38%
Zamorano, J; Bartomeus, I; Grez, AA; Garibaldi, LA 2020	Croplands and grasslands	Northern hemisphere	40	Sites with field margin floral enhancement (only restored edges and herbaceous plants) (flower strips)	Sites without field margin floral enhancement	Crop yield	Overall, there was no effect of field margin floral enhancements on crop yield.	81%
Mandal, D; Srivastava, P; Giri, N; Kaushal, R; Cerda, A; Alam, NM 2017	Croplands in sloppy areas	India	25	Contour grass barrier (field margins)	Without grass barrier	Crop yield	The relative yield gained of various crops through contour grass barriers at different slopes varied between 44 and 53 %.	50%
Van Vooren, L; Reubens, B; Broekx, S; De Frenne, P; Nelissen, V; Pardon, P; Verheyen, K 2017	Arable crops	Global (temperate climate)	60	Hedgerows	No hedgerows	Crop yield	All studies reported a similar trend, consisting of lower crop yield close to the HR and a gradually restoring crop yield when D/H increases.	75%
Wei, W; Chen, D; Wang, LX; Daryanto, S; Chen, LD; Yu, Y; Lu, YL; Sun, G; Feng, TJ 2016	Human-made terraces world wide (including crops of rice, grain, coffee, potato, viticulture or ancient cultivation)	Global	300	Terraces	No terraces	Production potential (biomass accumulation, crop yield, etc.)	This global synthesis suggested that diverse terracing practices played a positive role in ecosystem services provisions, particularly biomass accumulation. <i>Reviewers' note: We labelled the results as uncertain due to the lack of statistical testing.</i>	44%
Rivest, D; Paquette, A; Moreno, G; Messier, C 2013	Pasture land	Global	27	Scattered trees (isolated trees)	No scattered trees	Crop yield	The sign and magnitude of scattered tree effects on pasture yield did vary among tree functional groups and according to precipitation levels. This study suggests that, as drought pressure increases	75%

Reference	Population	Scale	Num. papers	Intervention	Comparator	Metric	Conclusion	Quality score
							abiotic stress, tree facilitation by N ₂ -fixing trees, and competition by Eucalyptus, will become the more common interactions between scattered trees and pasture.	
Bayala, J; Sileshi, GW; Coe, R; Kalinganire, A; Tchoundjeu, Z; Sinclair, F; Garrity, D 2012	Cereals in West Africa	West Africa	63	Parkland trees, coppicing trees (trees in group)	No trees	Crop yield	Parkland trees showed no effect on crop yields while coppicing trees increased crop yield of millet and maize while had no effect on sorghum.	62%

3. KNOWLEDGE GAPS

- Lowe et al., 2021** Critical gaps in our knowledge of when and how plantings can improve ecosystem service provision and delivery. Determining if field-edge plantings affect pollinator population growth may clarify how plantings improve crop pollination, while further research on landscape context and crop type may define when this happens.
- England et al., 2020** The number of publications supporting a given relationship between on-farm woody systems and ecosystem services was often relatively low.
- Wei et al., 2016** There is insufficient knowledge regarding design, construction and maintenance alternatives of terraces.