

# 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 group<sup>1</sup>) on CROP YIELD. It is based on 10 peer-reviewed synthesis research papers<sup>2</sup>, 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 to 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 effect with the higher score is marked in bold and the cell coloured. The numbers between parentheses indicate the number of synthesis papers with a quality score of at least 50%. Details on quality criteria can be

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<sup>1</sup> Described in the General Fiche.

<sup>2</sup> Research synthesis papers include a formal meta-analysis or systematic reviews with some quantitative results  
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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.

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 this document [→](#).*

As shown in the "Quality score" in **Table 2**, the quality the 10 synthesis papers retrieved ranged between 38% to 88%. The least frequently satisfied quality criteria were: "Search string", "Number of studies at each step", "Individual effect sizes", "Dataset available", "Heterogeneity of results analysed" and "Publication bias analysed".

## 2. IMPACTS

The main characteristics and results of the synthesis papers are summarised in **Table 2**. Detailed results of each synthesis study are reported in the summary reports [→](#).

**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	62%

Reference	Population	Scale	Num. papers	Intervention	Comparator	Metric	Conclusion	Quality score
							developing integrated land management practices that enhance multiple ecosystem functions and/or identifying appropriate practices and 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;	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	75%

Reference	Population	Scale	Num. papers	Intervention	Comparator	Metric	Conclusion	Quality score
Messier, C 2013							among tree functional groups and according to precipitation levels. This study suggests that, as drought pressure increases abiotic stress, tree facilitation by N <sub>2</sub> -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.

### 4. SYSTEMATIC REVIEW SEARCH STRATEGY

<b>Keywords</b>	<p>Different searches were conducted with the following search strings:</p> <p>1) TS= ("terrac*" OR "contour bund*" OR "level bench*" OR "level ditch*" OR "fish-scale pit*" OR "dry-stone wall*" OR "dry stone wall*" OR "stone wall*" OR "earth wall*" OR "dry wall*" OR "dry-wall*" OR "rubble wall*") AND TS= ("meta-analy*" OR "systematic* review*" OR "evidence map" OR "global synthesis" OR "evidence synthesis" OR "research synthesis") AND TS= (agric* OR cultiv* OR crop* OR farm*)</p> <p>or</p> <p>TITLE-ABS-KEY: ("terrac*" OR "contour bund*" OR "level bench*" OR "level ditch*" OR "fish-scale pit*" OR "dry-stone wall*" OR "dry stone wall*" OR "stone wall*" OR "earth wall*" OR "dry wall*" OR "dry-wall*" OR "rubble wall*") AND TITLE-ABS-KEY: ("meta-analy*" OR "systematic* review*")</p>
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OR "evidence map" OR "global synthesis" OR "evidence synthesis" OR "research synthesis") AND TITLE-ABS-KEY: (agric\* OR cultiv\* OR crop\* OR farm\*)

2) TS= ("ditch\*" OR "earth bund\*" OR "open-channel" OR "intermittent W/4 stream" OR "small W/4 stream") AND TS= ("meta-analy\*" OR "systematic\* review\*" OR "evidence map" OR "global synthesis" OR "evidence synthesis" OR "research synthesis") AND TS= ("agric\*" OR "cultiv\*" OR "crop\*" OR "farm\*")

or

TITLE-ABS-KEY: ("ditch\*" OR "earth bund\*" OR "open-channel" OR "intermittent near/4 stream" OR "small near/4 stream") AND TITLE-ABS-KEY: ("meta-analy\*" OR "systematic\* review\*" OR "evidence map" OR "global synthesis" OR "evidence synthesis" OR "research synthesis") AND TITLE-ABS-KEY: ("agric\*" OR "cultiv\*" OR "crop\*" OR "farm\*")

3) TS= ("pond\*" OR "soda pan\*" OR "reedbed\*" OR "small W/4 lake\*" OR "small W/4 wetland\*") AND TS= ("meta-analy\*" OR "systematic\* review\*" OR "evidence map" OR "global synthesis" OR "evidence synthesis" OR "research synthesis") AND TS= ("agric\*" OR "cultiv\*" OR "crop\*" OR "farm\*")

or

TITLE-ABS-KEY: ("pond\*" OR "soda pan\*" OR "reedbed\*" OR "small near/4 lake\*" OR "small near/4 wetland\*") AND TITLE-ABS-KEY: ("meta-analy\*" OR "systematic\* review\*" OR "evidence map" OR "global synthesis" OR "evidence synthesis" OR "research synthesis") AND TITLE-ABS-KEY: ("agric\*" OR "cultiv\*" OR "crop\*" OR "farm\*")

4) TS= ("strip\*" OR "margin\*" OR "hedge\*" OR "edge\*" OR "border\*" OR "band\*" OR "line\*" OR "verge\*" OR "row\*") near/3 ("flower\*" OR "vegetat\*" OR "tree\*" OR "shrub\*" OR "plant\*" OR "grass\*" OR "filter\*" OR "buffer\*" OR "wooded" OR "riparian" OR "field\*" OR "wildlife" OR "seminatural" OR "semi-natural" OR "semi natural") AND TS= ("meta-analy\*" OR "systematic\* review\*" OR "evidence map" OR "global synthesis" OR "evidence synthesis" OR "research synthesis") AND TS= ("agric\*" OR "cultiv\*" OR "crop\*" OR "farm\*")

merged with

TS= ("margin strip\*" OR "windbreak\*" OR "shelterbelt\*" OR "hedgerow\*" OR "road verge\*" OR "riparian buffer\*" OR "riparian vegetation" OR "riparian woodland\*" OR "buffer zone\*" OR "riparian zone\*" OR "vegetated filter strip\*") AND TS= ("meta-analy\*" OR "systematic\* review\*" OR "evidence map" OR "global synthesis" OR "evidence synthesis" OR "research synthesis") AND TS= ("agric\*" OR "cultiv\*" OR "crop\*" OR "farm\*")

or

TITLE-ABS-KEY: ("strip\*" OR "margin\*" OR "hedge\*" OR "edge\*" OR "border\*" OR "band\*" OR "line\*" OR "verge\*" OR "row\*") W/3 ("flower\*" OR "vegetat\*" OR "tree\*" OR "shrub\*" OR "plant\*" OR "grass\*" OR "filter\*" OR "buffer\*" OR "wooded" OR "riparian" OR "field\*" OR "wildlife" OR "seminatural" OR "semi-natural" OR "semi natural") AND TITLE-ABS-KEY: ("meta-analy\*" OR

"systematic\* review\*" OR "evidence map" OR "global synthesis" OR "evidence synthesis" OR "researchsynthesis") AND TITLE-ABS-KEY: ("agric\*" OR "cultiv\*" OR "crop\*" OR "farm\*")

merged with

TITLE-ABS-KEY: ("margin strip\*" OR "windbreak\*" OR "shelterbelt\*" OR "hedgerow\*" OR "road verge\*" OR "riparian buffer\*" OR "riparian vegetation" OR "riparian woodland\*" OR "buffer zone\*" OR "riparian zone\*" "vegetated filter strip\*") AND TITLE-ABS-KEY: ("meta-analy\*" OR "systematic\* review\*" OR "evidence map" OR "global synthesis" OR "evidence synthesis" OR "researchsynthesis") AND TITLE-ABS-KEY: ("agric\*" OR "cultiv\*" OR "crop\*" OR "farm\*")

5) TS=("patch\*" OR "islet\*" OR "island\*" OR "remnant\*" OR "group\*" OR "copse\*" OR "coppice\*") near/3 ("flower\*" OR "vegetat\*" OR "tree\*" OR "shrub\*" OR "grass\*" OR "forest\*" OR "wooded" OR "field\*" OR "wildlife" OR "seminatural" OR "semi-natural" OR "semi natural")) AND TS=("meta-analy\*" OR "systematic\* review\*" OR "evidence map" OR "global synthesis" OR "evidence synthesis" OR "research synthesis") AND TS= ("agric\*" OR "cultiv\*" OR "crop\*" OR "farm\*")

merged with

TS=("woodland creation\*" OR "mid-field islet\*" OR "environmental island\*" OR "refuge\*" OR "scattered tree\*" OR "shading tree\*") AND TS=("meta-analy\*" OR "systematic\* review\*" OR "evidence map" OR "global synthesis" OR "evidence synthesis" OR "researchsynthesis") AND TS= ("agric\*" OR "cultiv\*" OR "crop\*" OR "farm\*")

or

TITLE-ABS-KEY: (("patch\*" OR "islet\*" OR "island\*" OR "remnant\*" OR "group\*" OR "copse\*" OR "coppice\*") W/3 ("flower\*" OR "vegetat\*" OR "tree\*" OR "shrub\*" OR "grass\*" OR "forest\*" OR "wooded" OR "field\*" OR "wildlife" OR "seminatural" OR "semi-natural" OR "semi natural")) AND TITLE-ABS-KEY: ("meta-analy\*" OR "systematic\* review\*" OR "evidence map" OR "global synthesis" OR "evidence synthesis" OR "research synthesis") AND TITLE-ABS-KEY: ("agric\*" OR "cultiv\*" OR "crop\*" OR "farm\*")

merged with

TITLE-ABS-KEY: ("woodland creation\*" OR "mid-field islet\*" OR "environmental island\*" OR "refuge\*" OR "scattered tree\*" OR "shading tree\*") AND TITLE-ABS-KEY: ("meta-analy\*" OR "systematic\* review\*" OR "evidence map" OR "global synthesis" OR "evidence synthesis" OR "researchsynthesis") AND TITLE-ABS-KEY: ("agric\*" OR "cultiv\*" OR "crop\*" OR "farm\*")

6) TS= ("landscape feature\*" OR "landscape characteristic\*" OR "green infrastructure\*" OR "landscape connectivity" OR "landscape diversity" OR "landscape element\*" OR "landscape fragment\*" OR "landscape mosaic\*" OR "landscape structure\*" OR "nature-based feature\*" OR "linear feature\*") AND TS= ("meta-analy\*" OR "systematic\* review\*" OR "evidence map" OR "global synthesis" OR "evidence synthesis" OR "research synthesis") AND TS= ("agric\*" OR "cultiv\*" OR "crop\*" OR "farm\*")

or

	TITLE-ABS-KEY: ("landscape feature*" OR "landscape characteristic*" OR "green infrastructure*" OR "landscape connectivity" OR "landscape diversity" OR "landscape element*" OR "landscape fragment*" OR "landscape mosaic*" OR "landscape structure*" OR "nature-based feature*" OR "linear feature*") AND TITLE-ABS-KEY: ("meta-analy*" OR "systematic* review*" OR "evidence map" OR "global synthesis" OR "evidence synthesis" OR "research synthesis") AND TITLE-ABS-KEY: ("agric*" OR "cultiv*" OR "crop*" OR "farm*")
Search dates	No time restrictions
Databases	Web of Science and Scopus, run in October 2021
Selection criteria	<p>The main criteria that led to the exclusion of a synthesis paper were when the paper: 1) does not deal with any landscape feature; 2) does not synthesise pairwise comparisons on the effect of landscape features; 3) does not include results for cropland or grassland; 4) deals with agroforestry; 5) is either a non-systematic review, a non-quantitative systematic review, or a meta-regression without mean effect sizes; 6) is not written in English. Synthesis papers that passed the relevance criteria were subject to critical appraisal carried out on a paper-by-paper basis.</p> <p>The search returned 244 synthesis papers potentially relevant for the practice object of our fiche. From the 244 potentially relevant synthesis papers, 136 were excluded after reading the title and abstract, and 74 after reading the full text according to the above-mentioned criteria. Finally, 34 synthesis papers were selected for landscape features, from which 10 were relevant for this impact.</p>