

# SINGLE-IMPACT FICHE

## LANDSCAPE FEATURES



### IMPACT: BIODIVERSITY

Data extracted in October 2021

**Note to the reader:** This fiche summarises the impact of four landscape features (buffer strips; flower strips; hedgerows; isolated trees; and trees in group<sup>1</sup>) and landscape features in general (including hedgerows, field margins, lands taken out of production, isolated trees or bushes, ponds, trees in line, stone walls or terraces, considered together in different combinations) on BIODIVERSITY. It is based on 4 peer-reviewed synthesis research papers<sup>2</sup>, including from 32 to 218 individual studies. The impacts of landscape features on biodiversity of pollinators and natural enemies are analysed separately in other single-impact fiches (see pollination and pest control impacts fiches, respectively).

## 1. WEIGHT OF THE EVIDENCE

- **CONSISTENCY OF THE IMPACT:**

One meta-analysis reports a positive effect of landscape features in general on biodiversity (i.e, increase of biodiversity) and other 3 synthesis papers report positive effects on some biodiversity metrics with various degrees of confidence. However, despite these relevant results reported in these three latter synthesis papers, as they lack statistical test of the effects, here they are labelled as uncertain. Details are provided below in Table 2 and in the summary reports. Table 2 shows the number of synthesis papers reporting positive, negative or no effect, based on the statistical comparison of the intervention and the control. The systematic reviews reporting relevant results, but without statistical test of the effects are labelled as "uncertain".

- Landscape features in general (namely hedgerows, field margins and lands taken out of production) increase biodiversity (statistically significant effect) compared to farmlands without remaining semi-natural habitat features, according to the only meta-analysis reviewed. In another systematic review authors report positive effects of different combinations of landscape features (namely isolated trees or bushes, ponds, hedgerows, trees in line, herbaceous field margins, dry-stone walls, terraces, and buffer strips) on biodiversity of birds, arthropods and plants in vineyards, 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.
- Buffer strips in grasslands are studied in one systematic review where authors report a general positive effect on macroinvertebrate biodiversity, although with medium confidence level. This systematic review 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.
- Flower strips in croplands are studied in one systematic review where authors report a positive effect on insect abundance and diversity. This systematic review 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.

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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 [➤](#).

- Hedgerows in grasslands are studied in one systematic review where authors report increased invertebrate biodiversity, although with medium confidence level. This systematic review 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 in grasslands are studied in one systematic review where authors report increased invertebrate biodiversity, although with medium confidence level. This systematic review 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 in grasslands are studied in one systematic review where authors report increased invertebrate biodiversity, although with medium confidence level. This systematic review 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.

The 4 reviewed synthesis papers 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 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. One synthesis paper reported effects for more than one landscape feature.

Impact	Intervention	Positive	Negative	No effect	Uncertain*
	Landscape features in general	<b>1 (1)</b>	0	0	1 (1)
	Buffer strips	0	0	0	<b>1 (0)</b>
	Flower strips	0	0	0	<b>1 (0)</b>
	Hedgerows	0	0	0	<b>1 (0)</b>
	Isolated trees	0	0	0	<b>1 (0)</b>
	Trees in group	0	0	0	<b>1 (0)</b>

\* 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 3 synthesis papers retrieved ranged between 38% to 88%. The least frequently satisfied quality criteria were: "Number of studies at each step", "Quantitative results described", "Statistical methods described", "Individual effect sizes", "Individual studies weighted", "Dataset available", "Confidence intervals", "Method of data extraction", "Heterogeneity of results analysed" and "Publication bias analysed".

## 2. IMPACTS

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

**Table 2.** Main characteristics of the synthesis papers reporting impacts of landscape features on biodiversity. The references are ordered chronologically with the most recent publication date first.

Reference	Population	Scale	Num. papers	Intervention	Comparator	Metric	Conclusion	Quality score
England, JR; OGrady, AP; Fleming, A; Marais, Z; Mendham, D 2020	Grazed dairy systems	Global	83	1) Shelterbelts (hedgerows); 2) Riparian plantings (buffer strips); 3) Pasture trees (isolated trees); 4) Vegetation remnants (trees in group)	Grazed dairy pasture without trees	Invertebrate, stream macroinvertebrate and vertebrate biodiversity, habitat quality and function	The only relationship with high confidence was the provision of habitat by remnant native vegetation resulting in increased vertebrate biodiversity. Relationships for the provision of habitat resulting in increased invertebrate biodiversity had medium confidence for shelterbelts and pasture trees, and only low confidence for remnant native vegetation. <i>Reviewers' note: We labelled the results as uncertain due to the lack of statistical testing.</i>	38%
Paiola, A; Assandri, G; Brambilla, M; Zottini, M; Pedrini, P; Nascimbene, J 2020	Vineyards	Global	218	1) Punctual and 2) linear structural elements in the surrounding agricultural landscape; 2) Linear structural elements in the farm	1) No landscape features in the surrounding agricultural landscape; 2) No landscape features in the farm	1) Aves, Arthropoda and Plantae abundance; 2) Aves and Arthropoda and Plantae richness; 2) Arthropoda abundance	The results of the studies are often contrasting and taxon- and scale-dependent, thus hindering conclusions at the global scale. However, habitat heterogeneity at the landscape and local scales is a key element for biodiversity. <i>Reviewers' note: We labelled the results for grassed buffer strips as uncertain due to the lack of statistical testing.</i>	63%
Batáry, P; Dicks, LV; Kleijn, D; Sutherland, WJ 2015	Farmlands	Europe	103	Agri-environmental schemes :hedgerows, field margins or lands taken out of production (landscape features in general)	No semi-natural habitat features	Species diversity	Schemes aimed at areas out of production (such as field margins and hedgerows) are more effective at enhancing species richness than those aimed at productive areas (such as arable crops or grasslands).	88%

Haaland, C; Naisbit, RE; Bersier, LF 2011	Croplands and grasslands	Central and Northern Europe	32	Wild flowers strips	Crop (or crop edge) or grasslands	Abundance and diversity of insects	Sown wildflower strips support higher insect abundances and diversity than cropped habitats, and sown wildflower strips have comparable insect numbers and diversity to that in extensively used grasslands, despite the fact that they are recently established habitats. <i>Reviewers' note: We labelled the results as uncertain due to the lack of statistical testing.</i>	38%
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### 3. KNOWLEDGE GAPS

- Batáry et al., 2015** There is a strong geographic bias of study areas towards Northern and Western Europe.
- England et al., 2020** There were a small number of studies that considered habitat quality and function, particularly in riparian systems.
- Paiola et al., 2020** Important geographical areas for wine production, as well as several organism groups, have been completely neglected. Studies at the landscape level are still scarce (specifically those addressing landscape configuration).

### 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*" OR "evidence map" OR "global synthesis" OR "evidence synthesis" OR "research synthesis") AND TITLE-ABS-KEY: (agric* OR cultiv* OR crop* OR farm*)</p>
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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\*" "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 "research synthesis") 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 -ABSTRACT: ("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 4 were relevant for this impact.</p>