

# SINGLE-IMPACT FICHE

## LANDSCAPE FEATURES



### IMPACT: PEST CONTROL

Data extracted in October 2021

**Note to the reader:** This fiche summarises the impact of three landscape features (field margins, flower strips, and hedgerows<sup>1</sup>) and landscape features in general (including hedgerows, field borders and lands taken out of production, considered together) on PEST CONTROL. It is based on 4 peer-reviewed synthesis research papers<sup>2</sup>, including from 35 to 60 individual studies.

## 1. WEIGHT OF THE EVIDENCE

- CONSISTENCY OF THE IMPACT:

The effect on pest control differs among landscape features (see **Table 1**):

- Landscape features in general (namely hedgerows, field borders and lands taken out of production) have a positive effect on the abundance of natural enemies and no effect on the abundance, diversity, population growth of pests or plant damage compared to agricultural lands without semi-natural habitat features, according to 1 synthesis paper reviewed.
- Field margins have a positive effect on pest control (i.e. increase of pest control) compared to cropland or grassland without field margins, according to the 2 synthesis papers reviewed.
- Flower strips have a positive effect on pest control compared to cropland or grassland without flower strips, according to 1 synthesis paper reviewed.
- Hedgerows have differing effects on pest control compared to cropland without hedgerows. 3 synthesis papers reported no effect while 2 reported a positive effects.

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 results for two landscape features.

Impact	Intervention	Positive	Negative	No effect	Uncertain
Increase pest control	Landscape features in general	<b>1 (1)</b>	0	<b>1 (1)</b>	0
	Field margins	<b>2 (2)</b>	0	0	0
	Flower strips	<b>1 (1)</b>	0	0	0
	Hedgerows	2 (2)	0	<b>3 (3)</b>	0

<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 [⇒](#).

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 4 synthesis papers retrieved ranged from 62% to 81%. The least frequently satisfied quality criteria were: “Individual effect sizes” and “Dataset available”.

## 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 pest control. The references are ordered chronologically with the most recent publication date first.

Reference	Population	Scale	Num. papers	Intervention	Comparator	Metric	Conclusion	Quality score
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 Zeland	35	1) Flower strips; 2) Hedgerows	No flower strips; 2) No Hedgerows	Natural pest control service	This synthesis demonstrates enhanced natural pest control services to crops adjacent flower strips plantings but not adjacent to hedgerows, across a broad suite of regions, cropping systems and types of flower strips studied.	62%
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	Predator density, predator diversity	Predator diversity and density are significantly higher and aphid density was reduced in the grass strips systems. Hedgerows increased predator diversity.	75%
Shackelford, G; Steward, PR; Benton, TG; Kunin, WE; Potts, SG; Biesmeijer, JC; Sait, SM 2013	Fields, orchards, and vineyards of food crops	Global	46	High compositional complexity (proximity or diversity of non-crop plants in margins of food crops) (field margins)	Low compositional complexity	Abundance and richness of crop pest natural enemies	Some pollinators and natural enemies seem to have compatible responses to complexity, and it might be possible to manage agroecosystems for the benefit of both.	81%
Chaplin-Kramer, R; O'Rourke, ME; Blitzer, EJ; Kremen, C 2011	Farmlands	Global	46	1) % natural habitats (landscape features in general); 2) Length woody edges (hedgerows)	No natural habitats; 2) No woody edges	Natural enemies; 2) Pests	The positive response of natural enemies does not necessarily translate into pest control, since pest abundances show no significant response to landscape complexity.	81%

## 3. KNOWLEDGE GAPS

- Van Vooren et al., 2017** To quantify and predict pest control on agricultural parcels, a very comprehensive analysis of both species' spatial distribution, mobility and lifecycle, at parcel and landscape levels is necessary.
- Shackelford et al., 2013** The authors identified the interactions between pollinators and natural enemies and their interacting effects on crop productivity as knowledge gaps.

#### 4. SYSTEMATIC REVIEW SEARCH STRATEGY

Keywords	<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> <p>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*")</p> <p>or</p> <p>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*")</p> <p>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*")</p> <p>or</p> <p>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</p>
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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 "researchsynthesis") 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 "researchsynthesis") 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

	<p>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*")</p> <p>merged with</p> <p>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 "research synthesis") AND TITLE-ABS-KEY: ("agric*" OR "cultiv*" OR "crop*" OR "farm*")</p> <p>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*")</p> <p>or</p> <p>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*")</p>
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>