SINGLE-IMPACT FICHE
LANDSCAPE FEATURES

IMPACT: WATER QUALITY

Data extracted in October 2021

Note to the reader: This fiche summarises the impact of three landscape features (buffer strips, ditches, and small wetlands[1]) on WATER QUALITY. It is based on 4 peer-reviewed synthesis research papers[2], each of them including from 24 to 140 individual studies.

1. WEIGHT OF THE EVIDENCE

- CONSISTENCY OF THE IMPACT:

The effect of landscape features on water quality is overall positive (i.e. increase of water quality), there are also some uncertain results. The table below shows the number of synthesis papers reporting positive, negative or no effect, based on the statistical comparison of the intervention and the control. In addition, we include the number of systematic reviews reporting relevant results, but without statistical test of the effects ("uncertain") (see **Table 1**):

- Buffer strips have a positive effect on water quality compared to cropland or grassland without buffer strips, according to 1 of the synthesis papers reviewed. The other synthesis paper reviewed 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.
- Ditches have an uncertain effect on water quality compared to cropland or grassland without ditches. The only synthesis paper reviewed 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.
- Small wetlands, and more specifically constructed small wetlands, have a positive effect on water quality compared to cropland or grassland without wetlands, according to the only synthesis paper reviewed.

All 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 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.

Impact	Intervention	Positive	Negative	No effect	Uncertain*
Increase water quality	Buffer strips	**1 (1)**	0	0	1 (0)
	Ditches	0	0	0	**1 (0)**
	Small wetlands	**1 (1)**	0	0	0

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

[1] Described in the General Fiche.

[2] 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 level ranged from 25% and 56%. The least frequently satisfied quality criteria were "Search string", "Number of studies at each step", "Individual studies weight", "Dataset available", "Confidence interval", "Heterogeneity of results". None of the studies satisfied "individual effect sizes and "Publication bias analyzed".

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 water quality. 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	Riparian plantings (buffer strips)	Grazed dairy pasture without trees	Run-off of sediment, nutrient or faecal bacteria	Riparian plantings reduce runoff of sediment, nutrients and/or faecal bacteria, resulting in improved water quality in streams. *Reviewers' note: We labelled the results as uncertain due to the lack of statistical testing.*	38%
Dollinger, J; Dagès, C; Bailly, JS; Lagacherie, P; Voltz, M 2015	Cropland	Global	140	Outflow from ditches (ditches)	Inflow into ditches	Pesticide mitigation power	*Reviewers' note: We labelled the results for ditches as uncertain due to the lack of statistical testing.*	25%
Stehle, S; Elsaesser, D; Gregoire, C; Imfeld, G; Niehaus, E; Passeport, E; Payraudeau, S; Schafer, RB; Tournebize, J; Schulz, R 2011	Cropland	Global	24	Vegetated treatment systems (VTS) (small wetlands)	Pesticide concentration before the VTS	Reduction of acute ecotoxicity	Results from this meta-analysis confirm that VTSs constitute an effective risk mitigation method for reducing exposure levels of pesticides in downstream surface waters. However, their performance was variable, depending on their physical and hydrological characteristics and on the properties of the pesticides entering these systems.	56%
Zhang, XY; Liu, XM; Zhang, MH; Dahlgren, RA; Eitzel, M 2010	Agricultural fields	Global	73	Outflow from vegetated buffers (buffer strips)	Inflow into vegetated buffers	Efficacy pesticide mass retention	Vegetated buffers showed high removal efficacy for pesticides. Based on our model, a buffer of 30 m could remove 93% of the pesticides from runoff. Buffers wider than 30 m do not appreciably improve the removal efficacy.	56%

3. KNOWLEDGE GAPS

England et al., 2020	The number of publications supporting a given relationship between on-farm woody systems and ecosystem services was often relatively low.
Zhang et al., 2010	The models would be greatly improved had there been enough information on buffer slope available in the literature.

4. SYSTEMATIC REVIEW SEARCH STRATEGY

Keywords	Different searches were conducted with the following search strings: 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*) or 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*) 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 "wild life" 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 "research synthesis") 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 "research synthesis") 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 "research synthesis") 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	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 synthetise 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. 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.