SINGLE-IMPACT FICHE
LANDSCAPE FEATURES

IMPACT: WATER QUALITY

Data extracted in May 2022

Note to the reader: This fiche summarises the impact of three landscape features (buffer strips, ditches, and small wetlands[1]) and landscape features in general (measured together as percentage of natural area) on WATER QUALITY. It is based on 5 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**):

- Landscape features in general (measured as percentage of natural area) have a positive effect on water quality compared to agricultural lands with lower percentage of natural area, according to 1 synthesis paper reviewed.
- 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 5 reviewed synthesis papers 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.

Impact	Intervention	Positive	Negative	No effect	Uncertain*
Increase water quality	Landscape features in general	1 (1)	0	0	0

[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.

	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.

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 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%
Duarte, GT; Santos, PM; Cornelissen, TG; Ribeiro, MC; Paglia, AP 2018	Terrestrial landscapes in rural, agricultural, mixed rural–urban or natural habitats regions	Global	121	High landscape complexity as percentage of natural area (landscape features in general)	Low landscape complexity (percentage of natural area)	Water quality measured as concentrations of nitrogen, phosphorus, and sediments, etc.	An increase in landscape characteristics such the percentage of natural habitat enhances the provision of services related to water quality. The meta-analyses reinforce the importance of considering landscape structure in assessing ecosystem services for management purposes and decision-making.	81%
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;	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	56%

Reference	Population	Scale	Num. papers	Intervention	Comparator	Metric	Conclusion	Quality score
Tournebize, J; Schulz, R 2011							physical and hydrological characteristics and on the properties of the pesticides entering these systems.	
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.