SINGLE-IMPACT FICHE
LANDSCAPE FEATURES

IMPACT: NUTRIENT LEACHING AND RUN-OFF

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Note to the reader: This fiche summarises the effects of Landscape features on NUTRIENT LEACHING AND RUN-OFF. It is based on 3 synthesis papers[1], including from 11 to 60 primary studies.

1. WEIGHT OF THE EVIDENCE

CONSISTENCY OF THE IMPACT

Landscape features have a consistent positive effect on nutrient leaching and run-off (i.e. decrease of nutrient leaching and run-off) compared to cropland or grassland without landscape features.

The table below shows the number of synthesis papers with statistical tests reporting i) a significant difference between the Intervention and the Comparator, that is to say, a significant statistical effect, which can be positive or negative; or ii) a non-statistically significant difference between the Intervention and the Comparator. In addition, we include, if any, the number of synthesis papers reporting relevant results but without statistical test of the effects. Details on the quality assessment of the synthesis papers can be found in the methodology section of this WIKI.

- Buffer strips have a significantly positive effect on nutrient leaching and run-off compared to cropland or grassland without buffer strips, according to 1 synthesis paper. Another synthesis paper reported relevant results, but this evidence is not statistically tested.
- Field margins have a significantly positive effect on nutrient leaching and run-off compared to cropland or grassland without field margins, according to 1 synthesis paper.
- Hedgerows have a significantly positive effect on nutrient leaching and run-off compared to cropland or grassland without hedgerows, according to 1 synthesis paper.

All selected synthesis papers included studies conducted in Europe (see **Table 2**).

Table 1: Summary of effects. Number of synthesis papers reporting positive, negative or non-statistically significant effects on environmental and climate impacts. The number of synthesis papers reporting relevant results but without statistical test of the effects are also provided. When not all the synthesis papers reporting an effect are of high quality, the number of synthesis papers with a quality score of at least 50% is indicated in parentheses. The reference numbers of the synthesis papers reporting each of the effects are provided in **Table 3**. Some synthesis papers may report effects for more than one impact or more than one effect for the same impact.

				Statistically tested			Non-statistically tested
Impact	Metric	Intervention	Comparator	Significantly positive	Significantly negative	Non-significant	
Decrease nutrient leaching and run-off	Nutrient leaching	Buffer strips	No buffer strips	1	0	0	1 (0)
		Field margins	No field margins	1	0	0	0
		Hedgerows	No hedgerows	1	0	0	0

QUALITY OF THE SYNTHESIS PAPERS

The quality of each synthesis paper was assessed based on 16 criteria regarding three main aspects: 1) the literature search strategy and primary studies selection; 2) the statistical analysis conducted; and 3) the evaluation of potential bias. We assessed whether authors addressed and reported these criteria. Then, a quality score was calculated as the percentage of these 16 criteria properly addressed and reported in each synthesis paper. Details on quality criteria can be found in the methodology section of this WIKI.

2. IMPACTS

The main characteristics and results of the 3 synthesis papers are reported in **Table 2** with the terminology used in those papers, while **Table 3** shows the reference numbers of the synthesis papers reporting for each of the results shown in **Table 1**. Comprehensive 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, are provided in the **summaries of the synthesis papers** available in this WIKI.

Table 2: Main characteristics of the synthesis papers reporting effects on nutrient leaching and run-off. The references are ordered chronologically with the most recent publication date first.

[1] Synthesis research papers include either meta-analysis or systematic reviews with quantitative results. Details can be found in the methodology section of the WIKI.

Reference number	Population	Scale	Num. papers	Intervention	Comparator	Metric	Conclusion	Quality score
Ref14	Field studies where water run-off comes from agricultural fields for grass or cereal production, natural pasture or feedlots	Global	46	Buffer zone	No buffer zone	1) Nitrate-N surface run-off; 2) Nitrate-N groundwater; 3) Total-N surface run-off	Buffer zones more effectively reduced N in groundwater than in surface runoff, despite the large variation of results across the studies.	75%
Ref20	Arable crops	Global (temperate climate)	60	1) Grass strips; 2) Hedgerows	1) No grass strips; 2) No hedgerows	1) P interception; 2) Surface and subsurface N interception	Both grass strips and hedgerows increased P interception as well as surface and subsurface N interception.	75%
Ref36	Cultivated land	France	11	Grass buffer strips	No buffer strips and before buffers strips	1) Total phosphorus retention; 2) disolved phosphorus retention	Reviewers' note: We labelled the results for grassed buffer strips as uncertain due to the lack of statistical testing.	31%

Table 3: Reference numbers of the synthesis papers reporting for each of the results shown in **Table 1**.

				Statistically tested			Non-statistically tested
Impact	Metric	Intervention	Comparator	Significantly positive	Significantly negative	Non-significant	
Decrease nutrient leaching and run-off	Nutrient leaching	Buffer strips	No buffer strips	Ref14			Ref36
		Field margins	No field margins	Ref20			
		Hedgerows	No hedgerows	Ref20			

3. FACTORS INFLUENCING THE EFFECTS ON NUTRIENT LEACHING AND RUN-OFF

Table 4: List of factors reported to significantly affect the size and/or direction of the effects on nutrient leaching and run-off, according to the synthesis papers reviewed.

Factor	Reference number
Duration of treatment	Ref14
Field edge width	Ref20

4. KNOWLEDGE GAPS

Table 5: Knowledge gap(s) reported by the authors of the synthesis papers included in this review.

Ref Num	Gap
Ref36	Long-term benefits remain questionable given the relatively short-termuse of this approach in P reduction and the lack of long-term experimental results.

5. SYNTHESIS PAPERS INCLUDED IN THE REVIEW

Table 6: List of synthesis papers included in this review. More details can be found in the summaries of the meta-analyses.

Ref Num	Author(s)	Year	Title	Journal	DOI
Ref14	Valkama, E; Usva, K; Saarinen, M; Uusi-Kamppa, J	2019	A meta-analysis on nitrogen retention by buffer zones	JOURNAL OF ENVIRONMENTAL QUALITY, 48(2), 270-279.	10.2134/jeq2018.03.0120
Ref20	Van Vooren, L; Reubens, B; Broekx, S; De Frenne, P; Nelissen, V; Pardon, P; Verheyen, K	2017	Ecosystem service delivery of agri-environment measures: A synthesis for hedgerows and grass strips on arable land	AGRICULTURE ECOSYSTEMS AND ENVIRONMENT, 244 32-51.	10.1016/j.agee.2017.04.015
Ref36	Dorioz, JM; Wang, D; Poulenard, J; Trévisan, D	2006	The effect of grass buffer strips on phosphorus dynamics — a critical review and synthesis as a basis for application in agricultural landscapes in France	AGRICULTURE, ECOSYSTEMS AND ENVIRONMENT, 117(1), 4-21.	10.1016/j.agee.2006.03.029

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