

IMPACT: SOIL NUTRIENTS

Data extracted in May 2022
Fiche created in December 2023

Note to the reader: This fiche summarises the effects of Landscape features on SOIL NUTRIENTS. It is based on 2 synthesis papers¹, including 53 and 300 primary studies.

1. WEIGHT OF THE EVIDENCE

CONSISTENCY OF THE IMPACT

Hedgerows and terraces have differing effects on soil nutrients when compared to cropland without these 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.

- Hedgerows have differing effects on soil nutrients compared to cropland with no hedgerows depending on the type of soil nutrient. 1 synthesis paper reported a significantly positive effect (i.e. increase of total nitrogen, total phosphorus, alkali nitrogen, available phosphorus, and available potassium), while 1 reported a non-significant effect on soil total potassium concentrations.
- Terraces are studied in one synthesis paper where authors report relevant results on their effect on soil nutrients compared to cropland with no terraces, but this evidence is not statistically tested.

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.

Impact	Metric	Intervention	Comparator	Statistically tested			Non-statistically tested
				Significantly positive	Significantly negative	Non-significant	
Increase soil nutrients	Soil nutrients	Hedgerows	No hedgerows	1	0	1	0
		Terraces	No terraces	0	0	0	1 (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 2 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 soil nutrients. The references are ordered chronologically with the most recent publication date first.

Reference number	Population	Scale	Num. papers	Intervention	Comparator	Metric	Conclusion	Quality score
Ref11	Croplands	Global	53	Hedgerows	no hedgerows	Soil total nitrogen, phosphorus, and potassium concentrations	Hedgerows showed significant positive effects on total nitrogen, total phosphorus, but no significant effects on soil total potassium concentrations.	81%

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
Ref22	Human-made terraces world wide (including crops of rice, grain, coffee, potato, viticulture or ancient cultivation)	Global	300	Terraces	No terraces	Soil nutrients (e.g., total N, total K, total P, available P, available K, NH ₄ , and organic matter)	This global synthesis suggested that diverse terracing practices played a positive role in ecosystem services provisions, particularly nutrient enhancement. Reviewers' note: We labelled the results as uncertain due to the lack of statistical testing.	44%

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

Impact	Metric	Intervention	Comparator	Statistically tested			Non-statistically tested
				Significantly positive	Significantly negative	Non-significant	
Increase soil nutrients	Soil nutrients	Hedgerows	No hedgerows	Ref11		Ref11	
		Terraces	No terraces				Ref22

3. FACTORS INFLUENCING THE EFFECTS ON SOIL NUTRIENTS

No factors were found.

4. KNOWLEDGE GAPS

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

Ref Num	Gap
Ref11	Given the heterogeneity of specific nutrient indicators, subgroup analyses must be performed in future studies to explore the source of heterogeneity.
Ref22	There is insufficient knowledge regarding design, construction and maintenance alternatives of terraces.

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
Ref11	Zheng, YL; Wang, HY; Qin, QQ; Wang, YG	2020	Effect of plant hedgerows on agricultural non-point source pollution: a meta-analysis	ENVIRONMENTAL SCIENCE AND POLLUTION RESEARCH, 27(20), 24831-24847.	10.1007/s11356-020-08988-7
Ref22	Wei, W; Chen, D; Wang, LX; Daryanto, S; Chen, LD; Yu, Y; Lu, YL; Sun, G; Feng, TJ	2016	Global synthesis of the classifications, distributions, benefits and issues of terracing	EARTH-SCIENCE REVIEWS, 159, 388-403.	10.1016/j.earscirev.2016.06.010

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