

IMPACT: LAND USE (LCA)

Data extracted in October 2021
Fiche created in March 2024

Note to the reader: This fiche summarises the effects of Organic farming systems on LAND USE (LCA). It is based on 3 synthesis papers¹, including from 9 to 164 primary studies.

1. WEIGHT OF THE EVIDENCE

CONSISTENCY OF THE IMPACT

The effect of organic farming systems on land use per unit of product (as calculated in LCA-modelling studies) is reported in **Table 1**.

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.

- Organic cropping systems, as compared to conventional systems show negative effect on land use (i.e. require more land use per unit of product), with 2 results showing negative effects.
- Another 1 synthesis paper reported negative effect for organic livestock products.
- Other 2 synthesis papers concluded negative effect for organic systems (as broad category without distinction on different types).
- 1 synthesis paper included non-statistically tested results for both cropping and livestock systems.
- In particular, 1 synthesis paper indicated that organic systems required 25%-110% more agricultural area, with the highest values for vegetables, meats, dairy and eggs production. All these results, however, consider single products along their production chain, from cradle to farmgate, without taking into account co-production of different products (e.g. due to crop rotations, intercrops or mixed farming systems) within the same farming system.

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	
Decrease land use (lca)	Agricultural land use per unit of product	Organic cropping systems	Conventional	0	2	0	1
		Organic livestock products	Conventional	0	1	0	1
	Agricultural land use per unit of product	Organic systems	Conventional	0	2	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.

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.

Table 2: Main characteristics of the synthesis papers reporting effects on Land use (LCA). 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	LCA studies assessing the performance of organic systems in comparison to conventional systems. Emissions are accounted for all 'cradle-to-farm gate' activities.	Global. The majority of LCA publications included in these analyses are from agricultural systems in Europe, North America, and Australia and New Zealand (86% of systems are from these regions). Systems from China (2%), Japan (2%), the rest of Asia (5%), South America (4%), and Africa (4%) are much less common.	164	Organic Cereals, Organic pulses and oil crops, Organic fruits, Organic Vegetables, Organic meats, Organic dairy products and eggs	Conventional systems	Agricultural land use per unit of product	Organic systems, as average, require 25%–110% more land use ($p < 0.001$; $n = 37$), than conventional systems. Significantly higher land use for all types of organic products: cereals, fruits, vegetables, dairy products, meats, oil crops and pulses.	62%
Ref27	Field studies, modelling studies and Life Cycle Assessment studies assessing the performance of organic systems in comparison to conventional systems in Europe.	Europe	71	Organic production of milk, cereals, beef, pork	Conventional systems	Agricultural land use per unit of product (LCA approach)	This meta-analysis showed that organic farming requires more land than conventional farming.	69%
Ref30	Studies assessing the performance of organic systems in comparison to conventional systems.	Global	9	Organic systems	Conventional systems	Agricultural land use efficiency per unit of product	Based on the general results of ten studies of organic farming in developed countries, land use efficiency of 83 per cent for organic farming compared with conventional farming.	50%

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	
Decrease land use (lca)	Agricultural land use per unit of product	Organic cropping systems	Conventional	Ref11 and Ref30			Ref27
		Organic livestock products	Conventional	Ref11			Ref27
Increase land use (lca)	Agricultural land use per unit of product	Organic systems	Conventional	Ref27 and Ref30			

3. FACTORS INFLUENCING THE EFFECTS ON LAND USE (LCA)

No factors were found.

4. KNOWLEDGE GAPS

The authors did not report knowledge gaps in the reviewed synthesis papers.

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	Clark, M; Tilman, D.	2017	Comparative analysis of environmental impacts of agricultural production systems, agricultural input efficiency, and food choice.	ENVIRONMENTAL RESEARCH LETTERS 12 6	10.1088/1748-9326/aa6cd5
Ref27	Tuomisto HL; Hodge ID; Riordana P; Macdonald DW	2012	Does organic farming reduce environmental impacts? – A meta-analysis of European research	Journal of Environmental Management 112, 309-320	10.1016/j.jenvman.2012.08.018
Ref30	Mondelaers, K; Aertsens, J; Van Huylenbroeck, G.	2009	A meta-analysis of the differences in environmental impacts between organic and conventional farming	BRITISH FOOD JOURNAL 111 10, 1098-1119	10.1108/00070700910992925

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