

SINGLE-IMPACT FICHE

ORGANIC FARMING SYSTEMS

IMPACT: LAND USE

Data extracted in October 2021

Note to the reader: This fiche summarises the impact of organic systems on LAND USE¹. It is based on 3 peer-reviewed synthesis research papers², including 9, 71 and 164 individual studies, respectively.

1. WEIGHT OF THE EVIDENCE

- **CONSISTENCY OF THE IMPACT:** organic farming systems, as compared to conventional systems require more LAND USE per unit of product, with 3 results showing negative effects for cropping systems and 2 for livestock/mixed farming systems. One synthesis paper included uncertain results for both cropping and livestock systems. One synthesis paper indicated that organic systems required 25%-110% more agricultural area, with the highest values for vegetables, meats, dairy and eggs production. The 3 synthesis papers included studies conducted in Europe.

Table 1. Summary of effects of agricultural land use. 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. Some synthesis papers reported effects for more than one type of system.

| Impact | Metric | Impacts per unit of agricultural land | | | | Impacts per unit of product | | | |
|--|--------|---------------------------------------|----------|-----------|-----------|-----------------------------|----------|-----------|-----------|
| | | Positive | Negative | No effect | Uncertain | Positive | Negative | No effect | Uncertain |
| Organic cropping systems | | | | | | | | | |
| Decrease Agricultural land use per unit of product | | | | | | 0 | 3 (3) | 0 | 1 (1) |
| Organic livestock systems | | | | | | | | | |
| Decrease Agricultural land use per unit of product | | | | | | 0 | 2 (2) | 0 | 1 (1) |

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

¹ Agricultural land use per unit of product (also called Agricultural land use efficiency) is calculated (typically by Life-cycle analysis approaches) as the ratio between the total land used and the total amount of target food products obtained along the whole production chain. For crops production systems only, this impact is nearly equivalent to crop yield.

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.

The main characteristics and results of the 3 synthesis papers¹ are summarized 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 on land use.

| Reference | Population | Geographical scale | Num. papers | Intervention | Comparator | Metric | Conclusion | Quality score |
|---|---|--------------------|-------------|---|----------------------|--|---|---------------|
| Clark, M; Tilman, D. 2017 | LCA studies assessing the performance of organic systems in comparison to conventional systems. Emissions are accounted for all 'cradle-to-farm gate' activities. | Global* | 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% |
| Tuomisto HL; Hodge ID; Riordana P; Macdonald DW 2012 | 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% |
| Mondelaers, K; Aertsens, J; Van Huylenbroeck, G. 2009 | 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% |

*The majority of LCA publications included 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. The results presented here are therefore indicative of highly industrialized systems and should be interpreted with this in mind.

3. KNOWLEDGE GAPS

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