Research article

# Agroecological Performance of Small-Market Gardens in Southern Sweden

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Abstract: Since the end of the Second World War, there has been a rapid increase in agricultural specialization and industrialization in Europe. Farms are growing in size with significant and increasing reliance on external inputs such as agrochemicals with most of the inputs and farm products being transported over long distances. Many consumers, however, prefer local and environment-friendly production which has led to the establishment of small-market gardens which provide vegetables directly to local communities in and around cities and towns in Sweden. To measure and understand the sustainability of these small-market gardens and the gardeners that manage them, a credible and holistic assessment in view of the three sustainability pillars, viz Social, Environmental, and Economic, was required. This exploratory study highlights the multidimensional benefits and trade-offs of small-market gardens assessed by the use of the 'Tool for Agroecology Performance Evaluation,' developed by the Food and Agriculture Organization of the United Nations, with results then compared with several large-scale reference farms in Sweden's Scania province. The results demonstrated that small-market gardens had greater crop diversity, more efficient resource use and management, and more synergies between components compared to large-scale reference farms. Additionally, the small-market gardens scored high in terms of responsible governance, co-creation, and sharing of knowledge, and they involved a significant number of young people through either direct employment or as interns. Small-market gardeners, however, tended to have lower incomes with higher workloads compared to the large-scale reference farms, which created a sense of insecurity for the long-term sustainability of small-market gardens. Market gardeners also reported a lack of direct government support and subsidies for their gardens. In conclusion, small-market gardens appear to be resilient, especially in relation to recent limitations in global trade due to the COVID-19 pandemic, high fuel and fertilizer costs, and changing weather patterns.

Keywords agroecology, local food, resilience, sustainability assessment, TAPE

#### INTRODUCTION

There has been a steady increase in global food production and yield since the end of World War II due to the increased input utilization and system specialization brought about by scientific and technological advancement (Gliessman, 2014). The current global food system and this specialization, industrialization, and resource-intensive agriculture that is occurring in most parts of the world is one of the largest drivers of climate change and environmental degradation. The global food system has also been linked to unfavorable social challenges and injustices as well as emerging ecological developments and challenges (Van Der Ploeg et al., 2000; Gliessman, 2014). Two different types of farm structures are found in Europe. Two-thirds of all farms have land holdings of less than 5.0 hectares (ha) and cultivate a very small area of land at less than 7% of the total agricultural land in the European Union. The remaining farms cultivate much larger areas with an ongoing trend of farm sizes continuing to grow larger (Eurostat, 2022).

To address the detrimental effects that modern corporate farming practices have on the environment and society, van Vliet et al. (2015) and Toma et al. (2021) reported on the de-

intensification of agriculture and the rise of small farms, such as market gardens, in several European nations. A noteworthy trend in Sweden is the rise in small-scale urban and peri-urban gardens that produce a variety of horticultural crops intending to sell directly to consumers (Drottberger et al., 2021). The Food and Agriculture Organization (FAO) of the United Nations (FAO et al., 2022) acknowledged that market gardens can both directly and indirectly facilitate the achievement of their Sustainable Development Goals, particularly Goals 1 and 2, addressing sustainable and positive impact on poverty alleviation and food security, Goal 11 referring to the sustainability of cities, and Goals 12 and 13 addressing environmental sustainability.

Studies have shown that market gardeners sited in and around cities who sell their products directly to consumers in local markets can generate higher profits compared to selling through middlemen or retailers (Navarrete, 2009), improving the local economy and consumer-producer interactions (Ostrom, 2006; Marsden, 2010). Avoiding long-distance transportation, local gardening, and direct selling may help lessen transportation's negative effects on the environment (Conner et al., 2010; LeRoux et al., 2010). Additionally, growing a variety of crops is associated with an increase in farmland biodiversity (Navarrete, 2009; Björklund et al., 2009).

Based on these findings, it appears that the justifications for purchasing locally produced food are clear-cut and straightforward: reduced long-distance travel and strengthened food sovereignty. However, to convey the advantages of market gardens to a broader audience and decision-makers, the arguments must be supported by a deep level of knowledge and focused communication versus reliance on simple narratives such as "local is good" or "small is beautiful" which may not be sufficient. Communication regarding increased agricultural biodiversity, less susceptibility to internal and external influences, positive societal impact, multiple economic advantages, and related, facilitates farmers' ability to make rational decisions, politicians to write favorable policies, and further support and grow consumers' confidence in local food production. To assess small-market gardens, multi-criteria evaluation tools like the FAO's 'Tool for Agroecology Performance Evaluation, (TAPE) are essential because there may be multiple potential advantages and anticipated trade-offs between agronomic, environmental, economic, and societal goals (FAO, 2019). By using 10 elements of agroecology in Step 1, TAPE assesses systems' transition, identifying strengths, weaknesses, and future action points. In Step 2, 10 core criteria of performance are used to quantify the impact of the level of transition to agroecology. Therefore, it is necessary to demonstrate how small-market gardens perform against various reference farms, large-scale, organic, conventional, with and without animals, etc., in the study region.

#### **OBJECTIVE**

To define and understand the sustainability of small-market gardens, this exploratory study will measure and highlight the multidimensional performance of small-market gardens in Scania province in southern Sweden, using the FAO's *Tool for Agroecology Performance Evaluation* (TAPE). These data will provide a credible and holistic assessment in terms of the three sustainability pillars and dimensions, *viz* Social, Environmental, and Economic. Trade-offs among the three pillars of sustainability concerning small-market gardens are not well understood and our data will inform future development and sustainability efforts.

## METHODOLOGY

The TAPE tool was used to evaluate eight farms in Scania province in southern Sweden. As shown in Table 1, the farms were divided into four small-scale market gardens, one large-scale livestock/mixed farm, and three large-scale arable farms. Farms were selected to represent the types of farming systems present in the study region and to provide reference to the small–scale market gardens, the focus of this study. Men were primarily in charge of the farms, except for Farm B. The questions, methodological information, grading and assessment of core criteria required for the TAPE assessment were rigorously followed. The assessment was conducted in 2022–2023, via face-to-face, semi-structured interviews with each farm manager. Data collection with each farm manager lasted

between 2 and 3 hours. Apart from the closed-end and specific questions required for TAPE, there were follow-up discussions with all eight farm managers conducted by the same assessor for several questions to gain an understanding of the "how" and "why" of their farm management. These probing questions also provided insights into important aspects of the farm that the TAPE tool is not designed to capture. All interviews were recorded and transcribed. In addition to following up the survey questions via listening, coding was carried out to quickly identify key terms so that information could be effectively extracted from the transcripts.

TAPE data collection consisted of two steps: 1) Characterization of agroecological transition, and 2.) Assessing the performance of ten core performance criteria. Two core criteria, "Dietary Diversity of Women" and "Soil Health" were not fully assessed, and they were excluded from the study as it was assumed that Swedish women eat diverse diets and there was a lack of time and resources available for assessing Soil Health. The eight remaining core performance criteria assessed in this study form an innovative multidimensional framework for assessing agricultural performance, integrating both qualitative and quantitative measures. This approach moves beyond relying on one or a few indicators, such as yield or income. Each core criterion is paired with simple indicators identified by the FAO and is gathered through a farm survey based on established metrics relevant to the specific criteria. Performance is evaluated using a "traffic light" system, where red indicates critically unsustainable conditions, green reflects desirable conditions, and yellow represents intermediate conditions that are acceptable but in need of improvement. A detailed description of the elements, the indicators for each criterion, and the scoring schemes can be found in the TAPE tool description (FAO, 2019).

Farms	Area (Ha)	Main crops/production	Management system			
Farm A	>3	Horticulture seeds and Vegetables	Conventional, but little/no agrochemicals			
Farm B	>3	Vegetables and Flowers	Conventional, but little/no agrochemicals			
Farm C	>3	Vegetables	Conventional, but little/no agrochemicals			
Farm D	>3	Vegetables	Organic			
Farm E	150	Beef, Sheep and Cereals, Onions	Organic			
Farm F	50	Grain legumes, Cereals, Vegetable seeds	Organic			
Farm G	80	Cereals, Rapeseed	Conventional			
Farm H	120	Grain legumes, Cereals	Organic			

Table 1 General characteristics of eight farms studied in Scania Province

## **RESULTS AND DISCUSSION**

Of the four small-market gardens studied, only one, Farm D, used certified organic farming methods. According to Farm B, obtaining certification was a nuisance and Farm B's system was organic by default, meaning that they never used agrochemicals (Table 1). Additionally, the farmer stated that none of their customers were aware that the farm did not use agrochemicals and as such obtaining the "organic stamp" was not necessary because it would not lead to raising the price of vegetables. The remaining two market gardeners, Farms A and C also reported that they seldomly used any agrochemicals and that there was no need for organic farming certification as the buyers were interested in local and sustainably produced products which were sold directly to consumers or restaurants and not necessarily related to an organic farming certification. Two large-scale farms (Farm E and Farm G) sold their products both in their farm shops as well as to large buyers and processors. All products from Farm F and H were sold through large intermediaries.

Regardless of whether they were large-scale farmers or small-market gardeners, it appears that farmers who sold their products directly to consumers could command a higher price even if they were not certified organic. Farmers who sell their goods directly to consumers reported that more and more consumers, particularly young people under 40 years of age, were interested in eating local and sustainably produced food. Consumers also wish to develop a relationship and trust with the farmers by learning about the farmers, the farm history, and the production processes. Face-to-face interactions between farmers and consumers facilitate understanding and learning from each other

and motivate both the farmers and consumers to increase the production and consumption of locally produced food (Milestad et al., 2010). Furthermore, Grebitus et al. (2017) reported that Generation Y respondents in the USA having subjective knowledge regarding market gardens had a favorable attitude towards market gardens and tended to buy food from local market gardeners. Results of the TAPE assessment of the eight farms are grouped into two steps and are described in the following sub-sections, A and B.

#### A. Characterization of Farms and Ten Elements in Terms of Agroecological Transition Stage

The transition stages related to the agroecological system of the studied farms are reported in Fig. 1. Several agroecological elements of the four market gardens (Farms A, B, C, and D) are in an advanced agroecological stage (scores more than 70%).

For the *Diversity* element, all four small-market gardens and Farm E were in the advanced transition stage. These farms produced a high diversity of crops that were well integrated with trees and other perennials through multi-, poly- or intercropping. In addition, these farms offered diverse farm products, services, and activities such as farm fairs, and school visits trainings. The remaining three large-scale arable farms were in the transition stage (scores between 50-70%) as they had a low diversity of crops, livestock, and activities as illustrated in Fig. 1. Figure 2 presents the average scores of the market gardens in relation to the four large-scale reference farms. Bernholt et al. (2009) reported similar findings about high diversity in urban and peri-urban farms. The high plant diversity in urban gardens has been found to have positive effects on soil fauna and soil multi-functionality (Tresch et al., 2019).

Farm E's performance was high in terms of *Synergies* and *Efficiency* in the farm, and it was even better than most small-market gardens. The main reasons were that this farm had livestock, i.e., cattle, beef, and sheep, and used their manure in fertilizing crops, and most of the crops produced in the farm were used for feeding the livestock. Such a system maintains a high degree of circularity of resources within the farm boundary, which helps to reduce external inputs. The other arable farms, Farms F, G, and H were in the transition stage to agroecology and scored lower than the small-market gardens, as there was low synergy between the farm components and these farms depended heavily on external inputs. None of the studied farms were in an advanced agroecological stage with regards to *Recycling* mainly due to the lack of use of renewable energy and lack of use of their seeds/breeds. However, the average score of small-market gardens was higher than the score of large-scale farms as depicted in Fig. 2. A recent study by Drottberger et al. (2021) with 14 young, aged 18-37 years, vegetable producers in south and central Sweden shared a similar message that people who engage in small-market gardening were strongly motivated by dual incentives, namely entrepreneurship and improving environmental and social sustainability. Additionally, local marketing was reported to have a positive impact on farm biodiversity and farmers' income in central Sweden (Björklund et al., 2009).



Fig. 1 Stage of transition to agroecology of the eight farms studied in relation to the 10 elements of agroecology

Farm types	Small- market gardens				Large-scale farms			
Agroecology elements/Farms studied	Farm A	Farm B	Farm C	Farm D	Farm E	Farm F	Farm G	Farm H
Diversity	81	81	75	69	81	63	50	44
Synergies	81	75	63	63	75	56	50	63
Efficiency	69	88	63	75	88	69	63	63
Recycling	69	63	65	70	55	56	50	45
Resilience	63	81	44	56	75	63	81	75
Culture & food traditions	75	83	75	83	83	58	75	75
Co-creation & sharing of knowledge	92	100	75	75	50	50	58	42
Human & Social values	88	88	50	63	94	69	63	63
Circular & solidarity economy	83	83	75	67	83	58	50	42
Responsible governance	75	83	75	67	83	67	67	58

 Table 2 Stage of transition to agroecology of the eight farms studied in relation to the 10 elements of agroecology

Note: Scores below 50 % are in the non-agroecological stage, 51-70 % are in transition to the agroecology stage, and above 71% are in an advanced agroecological stage.

Small-market gardens tended to score lower in *Resilience* compared to large-scale farms as small-market gardens had stable but low incomes and lacked mechanisms to reduce vulnerability and high indebtedness. Farm C had the lowest score of 44% for *Resilience* with the main attributing factors of very low income and high indebtedness. Market gardeners reported that they always fell through the holes of known safety nets as their farm sizes were too small to obtain governmental subsidies and other beneficial schemes. These findings are in line with several other authors, Bellows and Hamm (2001), Born and Purcell (2006), and Silva et al. (2014), which associated small-scale farming and local marketing with low production volume, low profitability, high labour costs, and often less efficiency in selling and distribution, compared to large scale specialized farms that are oriented for retail marketing. An important social aspect observed was that all small-market gardens were in the advanced agroecological stage for the element, Co-creation and Sharing of Knowledge. The reason is that they all actively participate in networks and organizations to share knowledge and practices among themselves. Moreover, the networks have easy access to agroecological knowledge and all of them are interested in directing and managing their farms towards agroecology. Fostering social contacts and learning from each other between producers-producers and producers-consumers are key outcomes of local food systems (Nilsson, 2009).

Farm C was the only small-market garden that was in the non-agroecological stage for the *Human and Social Values* element. All of the market gardeners stated that, in addition to empowering women and youth, they gardened because they supported the following three goals: to give consumers access to locally grown food, to enhance the environment (biodiversity, lower greenhouse gas emissions, etc.), and to foster stronger relationships between producers and consumers. They claimed that working long hours for meager pay was the largest obstacle. Unfortunately, other indicators within the same element have mostly obscured this issue, which the TAPE tool is unable to fully reflect. One of the market gardeners exclaimed as such:

"... work for very long hours and mostly with hands using simple tools which is very tiring. From spring until early autumn, we cannot have any holidays but when we see and hear consumers appreciate our vegetables, we feel satisfied. Now, I am young and have energy and time, but as I get older and if the long and hard-working hours coupled with low wages continue, I may not be able to continue the farm. We need support (from the government) to sustain the farm" ...

For the *Circular and solidarity economy* elements, all small-market gardens and Farm E were in an advanced state of agroecology. These farmers developed close personal ties with their customers and offered their goods and services locally. Additionally, they were part of numerous networks and organizations that support and exchange information. Compared to the market gardeners, the other three large-scale farmers had weaker relationships with local customers and were less involved in networks and groups. Regarding the aspect of *Responsible Governance*, the market gardens had a higher score than the three large-scale arable farms (Farms F, G, and H). This results from the insufficient participation and engagement of arable farmers in agricultural organizations. Despite the numerous advantages of market gardens in several agroecological elements in this study, the price of products from the market gardens were relatively higher than products sold in supermarkets, yet the farmers felt that they should receive even higher prices and incomes because of their strong contributions to improving the environment and society.



# Fig. 2 Agroecological performance of the average scores of the four market gardens in relation to the four large-scale reference farms

Note: Scores below 50 percent are in the non-agroecological stage, 51-70 percent are in transition to the ecology stage, and above 71 percent are in advanced agroecological stage.

Young individuals who appear to have significant environmental consciousness, high incomes, a strong sense of local identity, and a penchant for upscale dining establishments were the primary market gardeners' customers and consumers. According to Guthman (2008), this type of food system separates people into social classes within local communities, giving the comparatively wealthy access to "better" local food while the rest of society is left with food that is mostly produced in large quantities for convenient distribution such as in supermarkets. Given that most places are only appropriate for a small variety of crops, it has also been questioned whether it is feasible to rely too much on local food systems (Grey, 2000).

#### **B.** Assessing Core Criteria for Performance in the Eight Farms

To understand the multidimensional performance of agroecological measures relevant to sustainable food and agriculture in the studied farms, eight of 10 core performance criteria in the TAPE tool were assessed and are presented in Table 3.

Assessing the farms with the eight core criteria creates robust data that helps to explain the performance linked with the results of the characterization of farms described in section A. The results show that all farms have *Secured Land Tenure* except for Farm C, which used Municipal land for growing market vegetables. However, the farm had legal documents specifying the right to farm and secured access to the land and hence its score was *Acceptable* (yellow colour). In terms of *Productivity*, two organic arable farms (Farm F and H) had an *Acceptable* rating because of lower productivity per unit land area in comparison with the regional average. The reasons are that most farmers in southern Sweden are conventional and cereal yields in conventional systems are significantly higher than in organic systems.

Three of the small-market gardens had an *Acceptable* level of *Income* while Farm B had an *Unacceptable* (red colour) *Income* per unit production system (in Table 1). Despite the large turnover per unit area in market gardens, the land area where they grew horticulture crops were relatively small, and as such, the annual farm income (accounting for their wages) was low to very low. A similar trend was observed in terms of *Added Value* to the income as these farms did not receive any subsidies and they spent a considerable proportion of their income in paying off debts and against interest expenses. When asked about the economic situation, all market gardeners opined that they were doing it for their passion to produce food for local people using environmentally friendly

practices and not so much for earning high income. However, they also seem to acknowledge that the income from their farms may not be sufficient for their long-term livelihood unless they have additional sources of income. However, if labor costs are included using the current average hourly rates, the profit margins in all market gardens are extremely low. Glavan et al., (2018) shared similar findings that market gardening as an economic activity on its own with average areas, productivity, and labor inputs had lower income compared to an average income of farmers in three European countries.

 Table 3 Situation of the farms in relation to the eight core criteria of performance using the traffic light approach

Core criteria of performance	Farm A	Farm B	Farm C	Farm D	Farm E	Farm F	Farm G	Farm H
Secure land tenure		$\bigcirc$						
Productivity	$\bigcirc$							
Income	$\bigcirc$		$\bigcirc$	$\bigcirc$	$\bigcirc$	$\bigcirc$	$\bigcirc$	$\bigcirc$
Added value	$\bigcirc$							
Pesticide Exposure	$\bigcirc$							
Women empowerment	$\bigcirc$							
Youth employment	$\bigcirc$							
Agricultural biodiversity	$\bigcirc$		$\bigcirc$	$\bigcirc$	$\bigcirc$	$\bigcirc$	$\bigcirc$	$\bigcirc$

Desirable: O Acceptable: O Unacceptable:

Note: Red indicates critically unsustainable conditions, Green signifies desirable conditions, and Yellow represents intermediate conditions that are acceptable but require improvement. The thresholds for each of the eight criteria are based on the guidelines proposed in the FAO, 2019 document.

Farm G grew several arable crops such as cereals and rapeseed with agrochemicals. Since the agrochemicals were allowed and applied in controlled quantity, it was perceived that the *Pesticide Exposure* was *Acceptable*. The small-market gardeners who were not certified organic reported that they either did not use any agrochemicals at all or used few naturally sourced benign crop protection inputs. Because of this, they received green colour (Desirable). The role of women (Women *Empowerment*) in Farm F and H were *Acceptable* and scored lower than other farms (*Desirable*) because in these two farms, despite, being owned by both the husband and wife, it was the man (husband) who made the main decision on the farms and related activities. All the small-market gardeners were hosting several young interns for internships, with or without payment. Many interns came to learn sustainable farming practices, which they may use for their education or for establishing their farms, and hence the Youth Employment criteria were Desirable. In addition to growing a variety of vegetable crops and flowers, market gardens use benign substances such as manures and neem extract, which promote beneficial organisms. Consequently, their performance in terms of Agricultural Biodiversity is more **Desirable** compared to large-scale farms, which grow very few crops. From the results of the Evaluation of core criteria of performance, small-market gardens tended to have lower Income and Added Value than large-scale farms. The trade-offs of low income, but providing high youth employment and increased biodiversity in small-market gardens have also been reported in Sweden and Europe by Navarrete (2009), Babai et al. (2015), and Drottberger et al. (2021). Among the large-scale farms, Farm E scored high in all core criteria, including Agricultural Biodiversity because of diverse farm products, crops, vegetables, livestock, and honey, selling directly through farm shops, farmers' markets, and organizing farm events. These have positive effects on the social and environmental criteria.

Small-market gardeners stated that they were not significantly impacted by the COVID-19 pandemic and the recent rise in input prices brought on by conflicts and wars since they sold their goods directly to local customers and had normal production costs because they used fewer fuels and agrochemicals. Additionally, local farming and selling may lessen environmental effects by minimizing long-distance transportation (Ostrom, 2006; Conner et al., 2010; LeRoux et al., 2010) and enhancing farm biodiversity (Navarrete, 2009; Björklund et al., 2009). Overall, the TAPE assessment tool revealed advantages and trade-offs of agricultural performance across a wide range

of variables, enabling a shift beyond traditional productivity indicators such as profit or yield per hectare.

#### CONCLUSIONS

Small-market gardens offered more synergies between components and a higher diversity of crops, among other environmental benefits. Additionally, they made a significant contribution to social sustainability by encouraging better communication between producers and consumers, accountable governance, knowledge sharing, and youth involvement. However, compared to the large-scale farms, small-market gardeners typically had lower incomes and higher workloads, which raised concerns about their long-term viability. However, if small-market gardens are scaled up to increase income, there is also a risk of losing their unique values and characteristics as an alternative food system and might result in the same category as mainstream large-scale farms. Large-scale farms can also be diversified and have strong connections with consumers (*e.g.* Farm E) to play a large role in the agroecological transition.

Small-market gardens appear to have a high degree of resilience, particularly related to recent challenges such as the COVID-19 pandemic, high input costs, and shifting weather patterns. This is because they have a variety of crops, depend less on outside inputs, and depend on local customers. Small-market gardens may experience less financial hardship if direct subsidies are provided, opportunities and assistance are given for off-season income-generating activities (e.g. during winter) by the government, and a higher premium is paid by the consumers for locally grown, sustainably produced crops.

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