Zero Carbon Analytics

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The role of smallholder farmers in food security, agricultural sustainability and global food supply chains

Key points:

- Smallholder farms of two to five hectares produce 46% of the world's food on around one-third of the world's agricultural land. They are major producers of key global agricultural products, such as rice, peanut, coffee, cocoa, bananas and tea.
- Smallholder farms tend to have higher food yields per hectare than larger farms, attributed to dedicating a larger share of their land to food crops (rather than animal feed or fuel), employing family members (which lowers transaction costs and increases labour intensity per unit of land) and high fertiliser and seed use.
- Smallholder farms tend to have higher crop and non-crop biodiversity than larger farms. This is due to their use of varied crops and ecological land management practices, including limited insecticide use, more field edges providing a habitat and breeding ground for insects, and diverse land cover types, such as forests, fields and wetlands.
- Sustainable and climate-smart agricultural practices are already implemented in many smallholder farming systems. In Africa, organic manure, agroforestry, crop rotation and crop diversification are common practices.
- The availability of finance has been identified as one of the most significant variables influencing whether or not smallholder farmers in Africa adopt climate-smart agricultural practices.
- Ensuring that smallholder farmers can access modern agrifood chains is critical for ensuring food security, productivity and nutrition.
- Growth and investment in smallholder agriculture has significant potential to alleviate poverty for smallholder farmers while supporting global food security.

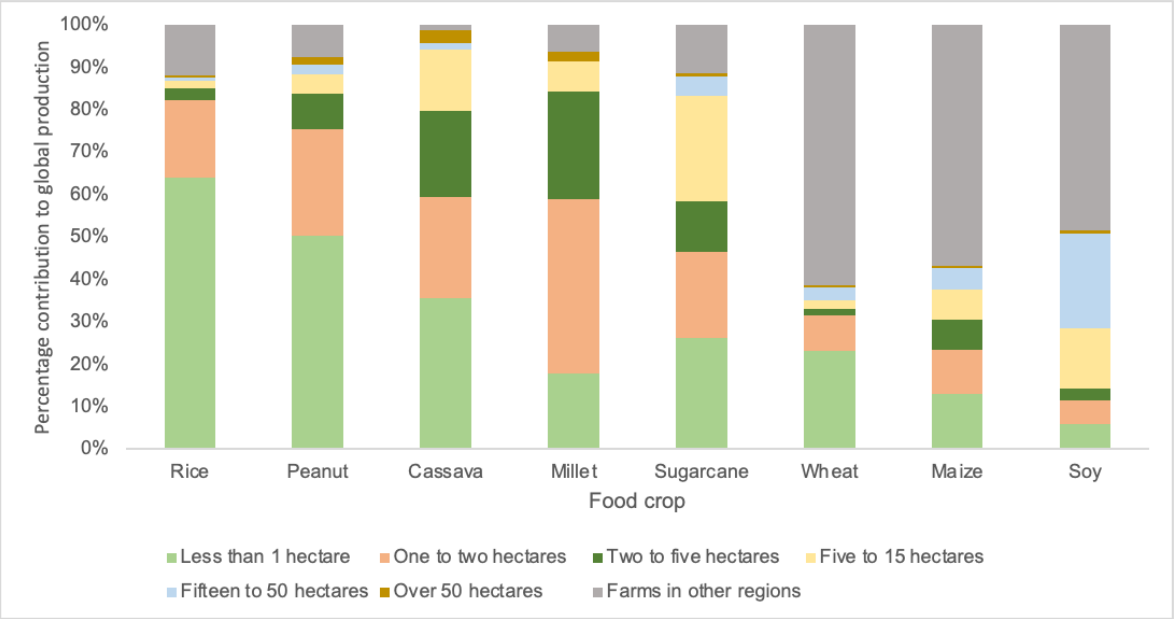
Smallholder farmers are important for rural and national economies, development and food security

Smallholder farming is the most common type of agriculture in the world.[1] Farms of less than two hectares in size produce around one-third of the world's food, while those two to five hectares in size produce almost half. Farms of less than five hectares located in developing countries account for more than half of the global production of nine staple crops – rice, peanut, cassava, millet, wheat, potato, maize, barley and rye – demonstrating

[1] Smallholder farmers are small-scale farmers, pastoralists, forest keepers and fishers who manage smaller tracts of land, using mainly family labour and dedicating at least some of the produce to household consumption.

their importance for global food security. As shown in Figure 1, farms of less than two hectares produce the majority of rice (>80%), peanut (75%), cassava and millet (~60%) globally. Smallholder farmers are also major producers of food that is consumed in their country. For example, smallholders in Tanzania meet around 69% of national food demand, and 2.7 million smallholder farmers in Nepal produce around 70% of their country's food.

Fig. 1: Share of global production of major food crops in developing countries according to farm size

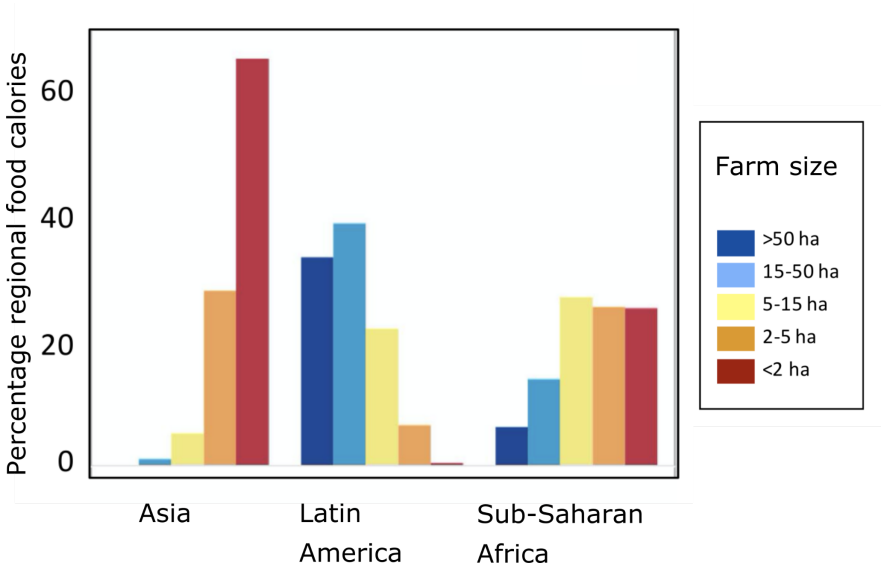


Source: Subnational distribution of average farm size and smallholder contributions to global food production.[2] Farms over 50 hectares are largely grazed lands.

The role different size smallholdings play in producing food calories varies by region (Figure 2). In Asia, farms of less than five hectares produce 90% of food calories, whereas in Sub-Saharan Africa, farms of this size produce around half of food calories and farms of 5-15 hectares produce another 26%. By contrast, 70% of food calories in Latin America are produced on larger farms (> 15 hectares), while only 7% are produced on farms of less than five hectares.[3]

[2] This study used data on smallholder farms from 83 countries in Latin America, Sub-Saharan Africa, and South and East Asia, which is where 90% of the world's farms are located.
[3] This estimate is based on 41 major food crops.

Fig. 2: Calories produced by farms of different sizes in Asia, Latin America and Sub-Saharan Africa



Source: Subnational distribution of average farm size and smallholder contributions to global food production.[4]

Despite their size, smallholder farms are highly productive

Farms of smaller than two hectares produce around one-third of the world's food on just one-quarter of the world's agricultural land and those two to five hectares in size produce 46% of food on one-third of agricultural land. Small-scale farms have been found to have higher land productivity – the farm's output per unit of land area – than larger farms. For example, in Kenya, a farmer farming on less than half a hectare of land produces USD 888 of food per hectare on average, whereas a farmer farming on two hectares of land produces food to the value of USD 330 per hectare.

On average, smallholder farms dedicate a larger share of their land to food crops – rather than animal feed or fuel – compared to larger farms. Around 70% of the calories produced on smallholder farms of less than five hectares are available as food, compared to 55% for the global agricultural system.[2]

Another reason smallholder farms are able to achieve high productivity is their high labour intensity. Employing family members allows for a higher number of labourers per hectare and keeps labour transaction costs low.

As smallholder farmers need to optimise production on small tracts of land, they also tend to use more inputs, such as fertiliser and seeds, than larger farms.[5] For example, smallholder rice farmers in Bangladesh apply 181 kg of fertiliser on average per hectare, whereas larger farms only apply around 130 kg.

Though smaller farms are more productive than their larger counterparts in many developing countries, yields could be improved with the adoption of modern technologies and optimised inputs, such as fertiliser, manure and seeds. This 'yield gap' – the amount by which yields could be improved – ranges from 11% in East Asia to up to 76% in

[4] This study used data on smallholder farms from 83 countries in Latin America, Sub-Saharan Africa, and South and East Asia, which is where 90% of the world's farms are located
[5] This comparison is between small and large farms within the same country.

Sub-Saharan Africa, emphasising the significant potential for farmers in developing countries to contribute even further to rural and national food security.

Reaching this potential is contingent on smallholder farmers having access to and participating in modern food supply chains. For example, smallholder farmers may not have access to roads or transport to get their produce to market, they may lack access to suitable storage facilities to reduce food spoilage, or they may not have access to the technology needed to communicate with buyers or to learn about food safety and quality control requirements.

Smallholder farmers and global food supply chains

Ensuring that smallholder farmers can access modern agrifood supply chains is critical for ensuring food security, productivity and nutrition. Smallholder farmers produce some of the world's most important agricultural products. For example:

- Kenya is the third-largest exporter of avocados to Europe, with up to 6% share of total export volume in 2010. Avocados in Kenya are mainly grown by smallholder farmers and account for 17% of horticultural exports and more than 50% of the value of fruit exports.
- Bananas in Sub-Saharan Africa are predominantly grown by smallholder farmers on farms ranging from 0.2 to three hectares and account for around 60% of the total global banana and plantain production area and around 30% of the global output.
- Globally, around 73% of all coffee is produced by smallholder farmers. Farms of less than five hectares account for 95% of the 12.5 million coffee farms globally, and farms of less than two hectares account for 84%.
- Around 90% of cocoa growers are smallholder farmers, farming on land less than five hectares in size and employing 5-6 million people. Seventy percent of cocoa grown globally is exported.
- More than half of the tea produced globally is grown by smallholder farmers. Kenya is the fourth-largest producer of tea globally and 62% of this tea is grown by smallholder farmers.
- Tobacco leaf is the largest agricultural export of Malawi (66%) - around 60% of tobacco farmers in the country are smallholder farmers.

Smallholder farms have a potential competitive advantage over larger farms when producing labour-intensive and high-value products, though they face difficulties linking these products to modern value chains. Growth and investment in smallholder agriculture has significant potential to alleviate poverty for smallholder farmers while concurrently supporting global food security.

For example, obtaining an Ecocert Organic Standard certification allowed pineapple growers in Zimbabwe to sell their organic produce internationally. Accessing these supply chains will enhance the farmers' livelihoods - their pineapples could fetch as much as a 30% premium in European supermarkets. Obtaining this certification was made possible with assistance from organisations including the Committee linking Entrepreneurship - Agriculture - Development (COLEAD), the Embassy of Netherlands in Zimbabwe, the Netherlands-based Programma Uitzending Managers (PUM) and the Netherlands Enterprise Agency (RVO), highlighting the importance of collaboration in facilitating access of smallholder farmers to international food supply chains.

Similarly, smallholder avocado farmers in Tanzania were able to access the European export market through help from the private sector companies Africado and Rungwe Avocado Company, both supported by US food security initiative Feed the Future. Another example is macadamia nuts in Malawi, where a Dutch-Malawian partnership has facilitated the export of sustainably-produced macadamias to the European market.

Smallholder farming is important for GDP

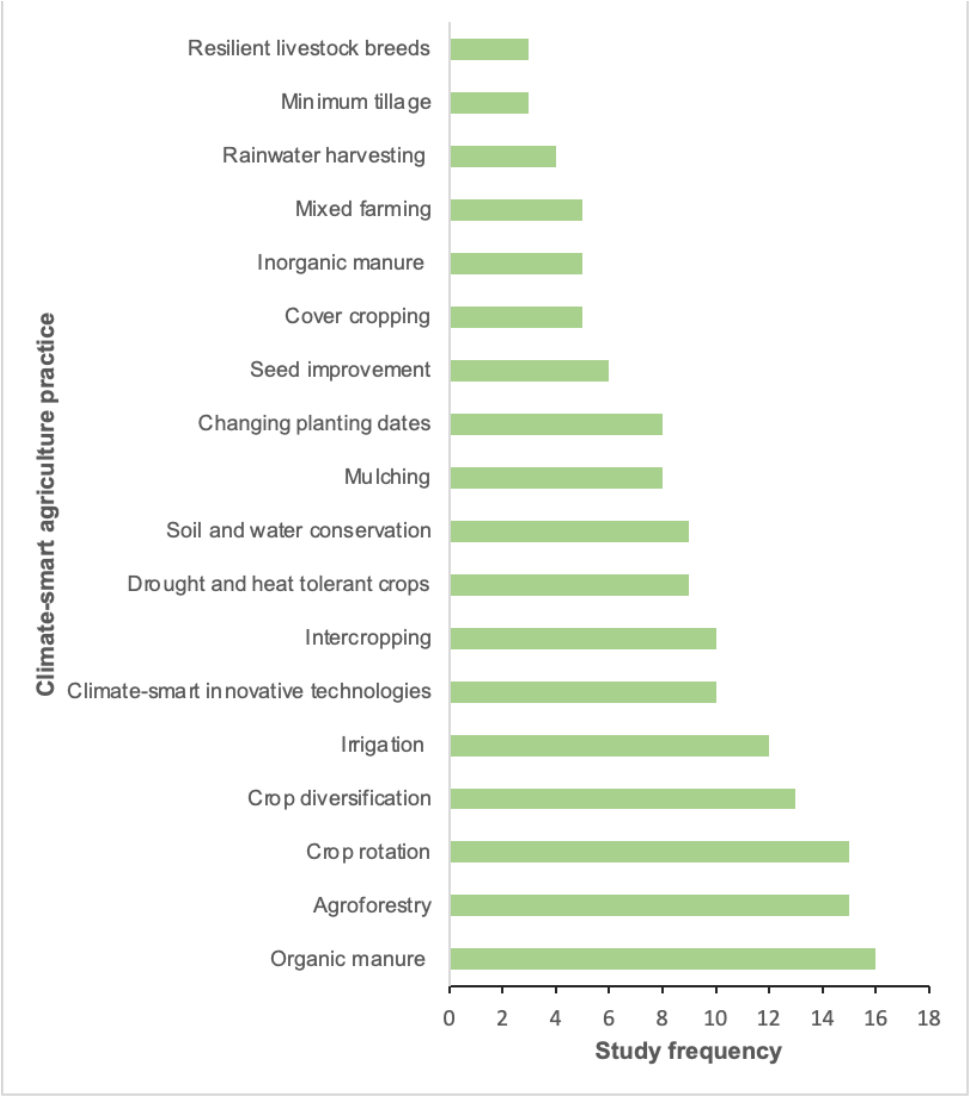
Agriculture contributes substantially to the GDP of many developing nations, with smallholder farming playing a significant role. For instance, in Sub-Saharan Africa, where the majority (up to 80%) of farming is done by smallholder farmers, agriculture contributes 23% to GDP. Agriculture GDP values are even higher for certain African countries - for example, 41% of the GDP of Liberia and 31% of the GDP of Guinea-Bissau is attributed to agriculture.

In Sub-Saharan Africa, more than 60% of the population are smallholder farmers and smallholder farms employ up to 65% of the labour force. Around 73% of the population of Tanzania lives in rural areas, where 3.7 million smallholdings support up to 19 million people. In Malawi, smallholder farmers produce 80% of the country's food and more than 80% of the working population are employed in agriculture.

Smallholder farmers practise climate resilient and sustainable agriculture

Sustainable and climate-smart agricultural practices are already an integral part of many indigenous farming systems. For example, traditional fallow systems, crop rotation and water harvesting practices in the Sahel aim to improve crop yields and livelihoods, and conserve water. In Nigeria, indigenous knowledge and practices are implemented by farmers to improve agricultural productivity and food availability, including mulching, using organic manure, using locally made pesticide, no-tillage and treating seeds with ash for long-term preservation. In South Africa, subsistence farmers use indigenous knowledge and practices such as planting in different soil types, fertilising soil with manure, selecting seeds by colour and size, and storing seeds in ash in clay pots and baskets to preserve them.

Fig. 3: Climate-smart agricultural practices used by smallholder farmers in Sub-Saharan Africa



Source: Contribution of smallholder farmers to food security and opportunities for resilient farming systems. See our explainer on sustainable agriculture in small-scale farming.

Figure 3 shows 17 different climate-smart farming practices that are used by farmers in Sub-Saharan Africa.[6] The most widely-adopted practice is using organic manure, followed by agroforestry (where annual crops or pastures are farmed together with trees or shrubs), crop rotation and crop diversification. In Ghana, smallholder farmers use a range of climate-smart agricultural practices, including timely harvesting and storing of produce, crop rotation, appropriate and timely weed and pest control, appropriate fertiliser use, mixed cropping (where two or more crops are grown simultaneously), planting legumes among crops, conservation agriculture (agriculture focused on regenerating degraded lands and preserving arable land) and agroforestry, among others. The primary motivations for adopting these practices are improving household food security, reducing pests and diseases, increasing yields and farm income, and controlling erosion and protecting soil. In

[6] Fourteen Sub-Saharan African countries were included in the analysis: South Africa, Zimbabwe, Malawi, Zambia, Tanzania, Kenya, Uganda, Ethiopia, Cameroon, Nigeria, Niger, Burkina Faso, Ghana and Senegal.

Nicaragua, smallholder coffee producers implement agroforestry to reduce production costs, improve livelihoods and diversify income.

Table 1: Comparison of the yield, crop and non-crop biodiversity and efficiency of small farms and large farms

Variable	Result	Mechanisms favouring small farms	Mechanisms favouring large farms
Yield	Smaller farms have higher yields	Reliance on family labour (for example, Fig. 2).	Mechanization enables higher yields with less labour but is only cost-effective on larger fields[57].
Biodiversity (non-crop)	Smaller farms have higher biodiversity	Smaller fields have more edges that provide habitat[5,36,58]. Independently managed smaller fields and farms may create a more heterogeneous landscape[59].	The link between field and farm size is relatively understudied; large farms with small fields may also benefit biodiversity but this was untested in the reviewed literature.
Crop diversity	Smaller farms have higher crop diversity	Subsistence farmers plant a greater diversity of traditional crops to meet nutritional needs[30]. Small farms are incentivized to cultivate landraces when there are niche markets for traditional crops[31].	Varietal diversity requires a minimum amount of space to prevent genetic erosion for wind-pollinated crops[60,61]. Diversified crops can reduce long-term risk at the expense of short-term profit, which may require financial buffers[62,63].

Source: Higher yields and more biodiversity on smaller farms

Smallholder farmers tend to plant a greater diversity of crops than larger farms in order to improve nutrition, mitigate drought risk and for market diversification (Table 1). Smallholder farms also have higher non-crop biodiversity than larger farms, which has been attributed to the use of ecological management practices, such as limited insecticide use, the presence of field edges – which provide a habitat and breeding ground for insects – and diverse land-cover types, such as forests, fields and wetlands. Smallholder farms within and around cities can also improve the environment by reducing urban heat island effects and can improve access to easy and affordable nutritious foods for city dwellers.

Encouraging climate-smart agriculture for smallholders farmers

The availability of finance has been identified as one of the most significant factors influencing whether smallholder farmers in Africa adopt climate-smart agricultural practices. In Malawi, access to credit was found to be a major factor dictating the adoption of climate-smart agriculture. In Ghana, maize farmers farming smaller lands face more credit constraints than those farming larger lands. Both private and public financing approaches are needed to encourage the adoption of sustainable agricultural practices by smallholder farmers, who are often lacking the necessary financial resources.

In Kenya, farmers that are more likely to adopt climate-resilient farming practices are those that sell their produce to markets (as opposed to farming entirely for subsistence) and have off-farm activities related to agricultural supply chains, such as milling their grains to add value to their produce or hiring out their farm equipment. Having individual land tenure rights and having middle to high school education were also found to be factors.