

## Trees in Home Gardens: Making the Most of an Age-Old Practice to Improve Food Security and Nutrition

Home gardens have been vital to human societies for thousands of years: from clusters of beneficial trees and shrubs planted on forest edges in pre-historic times, to the lush edible gardens grown traditionally in many tropical regions, to the tiny, densely planted backyards that dot cities worldwide.

Home gardens play an important role in food security and nutrition, especially when food supplies are inadequate or unreliable. In urban areas, fresh produce may be costly and hard to find, and in rural areas, much of the agricultural land is devoted to staple-crop monocultures: maize, rice, soy, etc. – which are crucial, but not enough for a complete diet. Home gardens help fill the nutritional gaps: even a small plot can supply a variety of fruits and vegetables at a relatively low cost. In Sri Lanka, for example, urban home gardens produce an estimated 50-60% of the leafy vegetables and 20% of all the vegetables consumed by the households.<sup>1</sup> Excess produce can be sold or exchanged for other items.

Recognizing these benefits, many have sought to promote home gardening as part of efforts to improve food security and nutrition, strengthen livelihoods, and increase poor communities' resilience to a wide range of shocks, including climate change impacts. This brief seeks to contribute to those efforts by exploring the value of an agroforestry approach to home gardens, incorporating multiple layers of trees, shrubs and crops.<sup>2</sup> We examine the challenges and opportunities in taking such an approach in a development context, drawing on the literature as well as new case studies in Sri Lanka, Vietnam and Burkina Faso, and identify areas for further research and policy analysis.

### Maximizing nutritional benefits

Home gardens come in many different forms, depending both on gardeners' own choices, and on external conditions: local climate, soil quality, culturally defined dietary and agricultural practices, and access to land, water, seeds, fertilizer, tools and other key resources. Many households have simple vegetable gardens with mostly annual crops, perhaps with ornamentals or trees on the margins. Others, especially in the tropics, build dense, multi-layered landscapes with trees, shrubs, vines and shade-tolerant perennials; one study in Oaxaca, Mexico, found 87% of home gardens had at least four vertical layers.<sup>3</sup> Gardens can also vary dramatically in terms of biodiversity: some include just a few favoured crops, while others include dozens of species, and also livestock or a small fish pond.

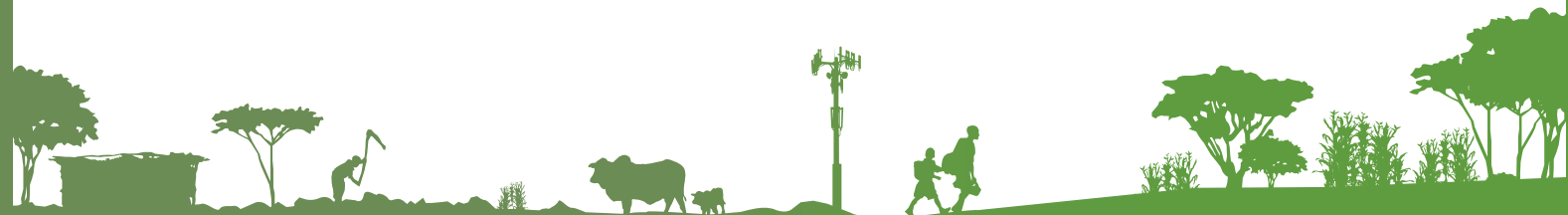


A wet-zone garden in Sri Lanka, where multi-layered edible gardens are a centuries-old tradition. Photo by Eskil Mattsson.

All these factors affect the nutritional benefits of the gardens. More density can mean more produce; more diversity can mean a more complete diet, with a wide array of fruits, nuts and vegetables – and harvests spread out across the growing season. Including livestock or fish can ensure access to animal protein, which might not otherwise be affordable. And mature trees, shrubs and perennials are often more resilient to droughts and other causes of crop failure, and can thus serve as a safety net.

For example, a qualitative study of Bonogo, in the parklands region of Burkina Faso, revealed that the harvest yields of staple crops rarely last for more than a few months; when the food runs out, fruits, nuts and leaves from trees may be the only nutrient source available to the poorest households. Villagers interviewed said they valued mango trees particularly, because the fruits ripen in the dry season, when food shortages are common; if there are mangoes, the children will not go hungry.<sup>4</sup>

In Sri Lanka, where growing home gardens is a centuries-old tradition, and gardens are kept in families over several generations, research has shown that home gardens' benefits increase with intensification and diversification and with the inclusion of livestock. While harvests might go up and down



seasonally, keeping a large number of crop, tree and animal species can help ensure a steady supply of food. Being able to harvest fuelwood in the garden has also been shown to be important, as available cooking fuels are often low-quality and increasingly scarce.<sup>5</sup>



Children in the village of Bonogo, in Burkina Faso, eat green mangoes from a home garden tree. Photo by Jenny Friman.

## Beyond food: home gardens' diverse benefits

Home gardens are kept primarily for the food they produce, but densely planted gardens that include trees and shrubs can bring many other benefits as well. The mango trees so cherished in Bonogo, for example, are widely used as shade trees all across the tropics, sheltering the house and garden from the hot sun. Tree roots pull rainwater deeper into the ground, helping to maintain moisture and boosting resilience to drought. And multi-layered gardens with trees and shrubs can provide crucial protection during storms, buffering the impact of heavy winds and rains.

Home gardens can also provide a wide range of environmental services. Because they often include a wide array of plants, they can greatly contribute to biodiversity – both directly and by providing habitats for a wide array of wildlife. In Sri Lanka, where forest cover shrank from 44% in 1956 to 21% in 1997, home gardens (which covered 13% of the land in 1995) have provided refuge for plants, small mammals, birds, bats and insects that play essential roles in ecosystems; they also help connect fragments of natural forest.<sup>6</sup> In addition, home gardens contribute to carbon capture.

It is important to note, however, that both biodiversity and carbon capture can vary dramatically; a study of 45 dry-region home gardens in Moneragala district, in southeastern Sri Lanka,<sup>7</sup> for example, found the above-ground biomass stock of the gardens ranged from 1 to 56 Mg C ha<sup>-1</sup>. The smallest gardens, which were

the most densely planted and most biodiverse, had the highest carbon stocks, averaging 26 Mg C ha<sup>-1</sup>, while the gardens over 1 ha that were sampled averaged only 8 Mg C ha<sup>-1</sup>.

Of course for the households growing home gardens, what matters most is providing food – not ecosystem services. Yet from a policy perspective, understanding home gardens' broader range of benefits could expand opportunities to expand and intensify home gardening – for example, through carbon finance or payments for environmental services. Indeed, the study in Moneragala aimed to inform discussions about the potential for Sri Lanka's fledgling REDD+ programme to include home gardens, which already receive extensive government support.<sup>8</sup>

## What do home gardeners need?

A key question to ask in this context is, what do home gardeners need? What constraints do they face in planting home gardens – particularly the dense, biodiverse, multi-layered gardens that bring the greatest benefits? And how might being part of a REDD+ scheme or other programmes affect households' ability to maximize the nutritional benefits of their gardens?

In arid Bonogo, in Burkina Faso, Focali researchers found that access to water was a major constraint. Groundwater levels are so low that wells can no longer be dug by hand, and existing wells run dry shortly after the end of the rainy season. The village also restricts the use of water from deeper, pumped wells; it cannot be used for irrigation or for livestock. This affects all kinds of plantings, but especially trees, which often require generous amounts of water until their roots are established.<sup>9</sup>

A study in the Eastern Cape, one of South Africa's poorest provinces, also found that water availability limited the kinds of crops that home gardeners could grow, reducing their gardens' nutritional benefits.<sup>10</sup> In Sri Lanka, meanwhile, households have access to irrigation water from centralized village wells and storage tanks – one of several policy measures to support home gardens. Water is still a constraint in dry regions, especially because rice paddies take priority over home gardens, but farmers interviewed report the limited water available is a big help.

Land tenure is an even greater constraint to home garden development. Perennials, shrubs and especially trees take time to get established; trees can take several years to mature. A household that doesn't own the land it cultivates, and may be displaced within a year or two, has no reason to plant anything that can't be harvested promptly. This means the poorest people, for whom having trees in the garden could make the biggest difference, are often the least likely to have them. Poverty also limits access to seeds, fertilizers and other inputs, making it difficult for households to maximize the diversity, intensity and productivity of their gardens.

Government programmes can help fill resource gaps, providing free or reduced-cost supplies – and indeed, households in many countries have benefited from such interventions. Legal reforms, in turn, can help overcome land-related barriers. Sri Lanka, for example, chose to entitle peasants to land, enabling households to grow gardens that they could pass on

to their children and grandchildren. In Vietnam, where insecure land tenure had led to unsustainable, ever-shifting land use, reforms that awarded land rights for 50-year periods have provided farmers with the certainty they need to make longer-term investments such as planting trees.<sup>11</sup>

Still, land tenure regulation can be very complicated, especially when multiple agencies are involved in overseeing agriculture and forestry. And even after substantial land reforms, women can be at a profound disadvantage, as their property rights are often restricted by law and/or social norms, and even if they are the ones cultivating their home gardens, they may lack control over key resources.<sup>12</sup>

The size of the plot also matters. Many of the home gardens visited in the Burkina Faso study were too small to support even one tree. A study for the Food and Agriculture Organization of the United Nations (FAO) estimated that to grow three to five trees, a household would need at least 167 m<sup>2</sup> of land.<sup>13</sup> If space is at a premium and the household wants to grow sun-loving vegetables such as tomatoes, peppers, carrots, and squash, they need to be careful not to plant trees that will block all the sun. Dwarf trees can help, however, as can various technologies pioneered in urban settings, such as vertical gardening, rooftop gardening, cultivation towers and cultivation bags. To maximize nutritional benefits, the ratio of edible to ornamental species can also be increased.<sup>14</sup>

Finally, households may need additional labour in order to be able to grow viable home gardens. As vital as gardens may be for food security, they tend to be cultivated in households' free time, in-between regular farming, outside jobs and household chores. This is a particular challenge during the planting and harvesting seasons, when households may already struggle to keep up with their farms. People who are older and physically impaired face particular difficulties, and may not be able to harvest the fruits, nuts and leaves from their trees – for their own consumption or for sale.

## Skills and knowledge

Even in developed countries, where households have access to a wealth of information and support services, growing a home garden can be challenging, and it's even more so for poor households. Many people interviewed in the Bonogo case study, for example, said they wanted to grow more trees, but couldn't afford to buy seedlings and didn't know how to grow their own.<sup>15</sup>

Agricultural extension services can thus play a crucial role in helping households with home gardens, introducing them to new techniques and providing information about different species' needs (water, light, soil and nutrient requirements), how to combine and layer species for optimal results, how to introduce animals, etc. In many places, however, home gardens are not recognized as part of agricultural systems and thus are not included in outreach efforts; changing that mindset should be a policy priority. Research has also highlighted the importance of combining agricultural education and technical support with health and nutrition education. Different fruits and vegetables provide different vitamins, minerals and micro-nutrients; when households understand their nutritional



Keeping livestock, as in this home garden in Vietnam, can provide animal protein to families that could not otherwise afford it. Photo by Matilda Palm.

needs and what they need to grow to help them, they can make better use of their land.<sup>16</sup>

It is important to stress, however, that home gardeners can be experts, too – cultivating land over generations builds an enormous amount of knowledge, both about horticulture and about the benefits of each plant. Research on the role of home gardens for socio-ecological resilience in Trinidad de Cuba, for example, found a wealth of traditional knowledge about medicinal plants in home gardens; households also shared useful plants with friends and neighbours, building resilience as a community.<sup>17</sup> Similarly, a study in Oaxaca, Mexico, found that home gardeners learned extensively from one another, diversifying their gardens by exchanging plants and seeds.<sup>18</sup> This highlights the value of participatory interventions that engage households in a dialogue with scientists and with one another, to build knowledge together.<sup>19</sup>

## Knowledge gaps and open questions

As much as we know about how to maximize the benefits of home gardens, there is much that we still need to explore, especially when it comes to policy interventions. For example, in countries with limited resources to help poor households, climate finance could be an important new source of funds – via REDD+ or other programmes focused on reforestation or soil carbon capture. Yet how would being part of such a programme affect a household? It is hard to imagine the choice of species, for example, being unaffected; will that mean a trade-off between nutritional and financial benefits? If a home garden is redefined as a “forest”, will the owner still be able to get timber and fuelwood?

Further research is also needed on the constraints to home garden cultivation in different places, and the reasons why households select or omit particular species, intensify production or don't, etc. While some constraints, such as lack of secure land tenure, are fairly obvious, others – such as cultural norms and logistical challenges – may not be. Our own



A typical patio in Jala, Nayarit, on Mexico's Pacific coast, with maize growing alongside fruit trees, herbs, chillies, and flowers. Photo by Eloise Phipps, CIMMYT (Flickr).

comparative studies and literature reviews suggest that is very hard to generalize; conditions vary too much across locations. Even the well-studied subject of land tenure reform requires further research, to test the viability of different approaches and compare the pros and cons of promoting home gardens vs. community gardens, for example.

This brings us to a final area that requires more research: the benefits of home gardens. It is easy to estimate the value of the crops grown, but far more difficult to quantify non-economic benefits: from healthier ecosystems, to intangibles such as cultural value and emotional well-being. Much of the research on home gardens to date has been done by single-discipline specialists; for a richer and more complete picture, we will need a broader, multi-disciplinary perspective.

## Endnotes

- 1 See Pushpakumara, D.K.N.G., Marambe, B., Silva, G.L.L.P., Weeraweha, J. and Punyawardena, B.V.R. (2012). A review of research on homegardens in Sri Lanka: the status, importance and future perspective. *Tropical Agriculturist*, 160. 55–125.
- 2 In much of the literature, the term "homegarden" refers only to that type of gardens: "intimate, multistory combinations of various trees and crops, sometimes in association with domestic animals, around homesteads". They are also known by local names such as *talun-kebun* and *pekarangan* in Java, Indonesia; *shamba* and *chagga* in East Africa, and *huertos familiares* in Latin America. For an in-depth discussion, see Kumar, B. M. and Nair, P. K. R., eds. (2006). *Tropical Homegardens - A Time-Tested Example of Sustainable Agroforestry*. *Advances in Agroforestry*, Vol. 3. Springer. <http://www.springer.com/life+sciences/agriculture/book/978-1-4020-4947-7>.

The permaculture pioneer Robert Hart developed a modern version of the same idea for temperate zones, "forest gardens".

He identified seven layers: a "canopy" of mature fruit trees; a "low tree" layer of smaller trees; a shrub layer; a "herbaceous layer" of perennial vegetables and herbs; a "ground cover" layer; a "rhizosphere" of plants grown for their roots and tubers; and a "vertical layer" of upward-growing vines. While Hart focused on edible plants, however, his primary focus was not food security, and he noted that many common vegetables, such as carrots, are sun-loving and would not thrive in such a setting. See Hart, R. (1991). *Forest Gardening: Rediscovering Nature & Community in a Post-Industrial Age*. Green Books.

- 3 See Aguilar-Støen, M., Moe, S. R. and Camargo-Ricalde, S. L. (2009). Home Gardens Sustain Crop Diversity and Improve Farm Resilience in Candelaria Loxicha, Oaxaca, Mexico. *Human Ecology*, 37(1). 55–77. DOI:10.1007/s10745-008-9197-y.
- 4 See Knutsson, P. and Friman, J. (2014). Human security or resilience? The role of trees for climate change adaptation in the Burkina Faso parklands. Poster presented at the World Congress on Agroforestry, New Delhi, India, 10-14 February. <http://www.focali.se/en/articles/artikelarkiv/WCA-Burkina-Faso-poster.pdf>.
- 5 See Pushpakumara et al. (2012), op.cit.
- 6 See Pushpakumara et al. (2012), op.cit.
- 7 See Mattsson, E. (2014). Carbon stock and tree diversity of dry-zone homegardens in southern Sri Lanka. Presented at the World Congress on Agroforestry, New Delhi, India, 10-14 February.
- 8 Our analysis suggests that home gardens could be a good fit for the REDD+ programme. See Mattsson (2014), op.cit.
- 9 See Knutsson, P. and Friman, J. (2014), op.cit.
- 10 See Adekunle, O. O. (2013). The Role of Home Gardens in Household Food Security in Eastern Cape: A Case Study of Three Villages in Nkonkobe Municipality. *Journal of Agricultural Science*, 5(10). DOI:10.5539/jas.v5n10p67.
- 11 See Palm, M. and Mattsson, E. (2014). Cultivating resilient landscapes - opportunities for restoring degraded and vulnerable lands with agroforestry systems. Presented at the World Congress on Agroforestry, New Delhi, India, 10-14 February.
- 12 This has direct implications for food security in sub-Saharan Africa, for example, where women grow the majority of food for household consumption. For an in-depth discussion of these issues, see Farnworth, C. R., Sundell, M. F., Nzioki, A., Shivutse, V. and Davis, M. (2013). *Transforming Gender Relations in Agriculture in Sub-Saharan Africa*. Swedish International Agricultural Network Initiative, Stockholm, Sweden. [http://www.siani.se/book/gender\\_relations](http://www.siani.se/book/gender_relations).
- 13 See Mitchell, R. and Hanstad, T. (2004). *Small Homegarden Plots and Sustainable Livelihoods for the Poor*. Access to Natural Resources Sub-Programme, LSP Working Paper 11. Rural Development Institute, prepared under contract for the Food and Agriculture Organization of the United Nations, Rome, Italy. <http://www.fao.org/docrep/007/j2545e/j2545e00.HTM>.
- 14 See Pushpakumara et al. (2012), op.cit.
- 15 See Knutsson, P. and Friman, J. (2014), op.cit.
- 16 See Pushpakumara et al. (2012), op.cit.
- 17 See Buchmann, C. (2009). Cuban Home Gardens and Their Role in Social-Ecological Resilience. *Human Ecology*, 37(6). 705–21. DOI:10.1007/s10745-009-9283-9.
- 18 See Aguilar-Støen et al. (2009), op.cit.
- 19 See, for example, Simelton, E. (2014). How to find 'the right tree for the right place'? *World Congress on Agroforestry 2014 Blog*. <http://www.wca2014.org/how-to-find-the-right-tree-for-the-right-place/#.Uu8L2bRB19p>.

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