Journal of Natural Sciences Research www.iiste.org
ISSN 2224-3186 (Paper) ISSN 2225-0921 (Online)
Vol.14, No.7, 2023

Ensuring Smallholder Farmers' Food Security through Homegarden Agroforestry System in Ethiopia

Fikadu Kitaba Tola
Bako Agricultural Research Center of Oromia Agricultural Research Institute (IQQO), Agroforestry Research Team of Natural Resource Research Process, Haro Sabu, Finfinne, Oromia

Abstract
Homegarden is one form of traditional agroforestry systems and involving deliberate management of multipurpose trees and shrubs in close association with annual and perennial agricultural crops and livestock within the compounds of individual houses managed by family labor. The presence of trees in the homegarden agroforestry system gives multiple services of timber, firewood, food and fodder and improving ecosystems and nutrient cycle through litter fall and decomposition. Homegardens are characterized by high species diversity and usually 3-4 vertical canopy strata tree layers; upper story, herbaceous layer near the ground and intermediate layers in between with the main purpose of subsistence production and sale for cash income. The main objective of this paper is to highlight the multiple role of homegarden agroforestry system for ensuring and improving food security of smallholder farmers' in Ethiopia. The reason for homegarden agroforestry system includes; potential for climate change adaptation and mitigation, more diversity of species and their multifunctional roles, utilization efficiency, productivity and social value. Homegardens practice serves critical functions in fulfilling community and household needs ranging from food provision and food security to supplementing the family nutritional status, ensuring primary healthcare, income generation and other utility functions. It plays an important role in the food security by supplying of varied products throughout the seasons. Identify appropriate intervention strategies for the introduction and expansion of the homegarden to other crop producing areas; improving the production, processing, handling, and marketing of products from homegarden agroforestry systems, improving nutrition and health of households through fruit tree based homegarden agroforestry systems in the cereal dominated production system will need further consideration and integration of homegarden agroforestry systems.
Keywords: Agroforestry, Homegarden, Role of homegarden
DOI: 10.7176/JNSR/14-7-03
Publication date: May 31st 2023

Introduction

General Overview of Agroforestry

Agroforestry is define as a collective name for land use systems in which woody perennials (trees, shrubs) are grown in association with herbaceous plants (crops, pastures) and/or livestock in a spatial arrangement, a rotation or both, and in which there are both ecological and economic interactions between the tree and non-tree components of the system (Jonathan *et al.,* 2012).

The main components of agroforestry systems are trees, shrubs, crops, pastures and livestock, together with the environmental factors of climate, soils and landforms. It provides diverse benefits including inter alia enhancing biodiversity, climate change adaptation and mitigation, food security, and reducing rural poverty by increasing soil fertility and crop yields. Agroforestry has both ecological and economic benefits and can provide farming families with the 'five Fs': Food, Fuel, Fodder, Finance and Fertility (Anonymous, 2015).

In many parts of Africa, farmers traditionally practice agroforestry including Ethiopia. The traditional agroforestry system takes the form of trees scattered on crop fields, woodlots, homestead tree planting and multistory homegarden (Eyasu, 2002), alley cropping, homegarden agroforestry, forest farming, wind breaks, river banks, park land, crop land trees, buffer zones are some of agroforestry practices. Agroforestry practices can play an important role in minimizing burdens from natural forests (Cheikh *et al.,* 2013).

Homegarden

Homegarden agroforestry land uses have a long tradition in many tropical countries. According to (ICRAF, 2012), homegarden is defined as around a homestead, complex agroforestry system, species mixture, often women managed etc. It is commonly defined as; land use system involving deliberate management of multipurpose trees and shrubs in close association with annual and perennial agricultural crops and always livestock within the compounds of individual houses, the whole tree-crop, and animal unit is being intensively managed by family labor (Kumar and Nair, 2006). The whole tree-crop- animal units are being intensively managed by family labor. Homegardens are mixed species, age and multistory (David, 2000).

Food production is the primary function of most homegardens. Many species of trees, bushes, vegetables and other herbaceous plants are grown in dense and in random or spatial and temporal arrangements. Most homegardens also support a variety of animals (e.g Livestock, poultry). Fodder grass and legumes are also grown

to meet the fodder requirement of livestock (Sobola et al., 2015).

Homegarden with trees are one of agroforestry practices known to be ecologically sustainable and diversifies livelihood of local communities. Another related agroforestry practice, which sometimes forms a part of the homegarden, is the so called multistory tree garden. These are mixed tree plantations consisting of conventional forest species and other commercial tree species, usually tree spices, giving the appearance of a managed forest (Nair, 1993). Food crops such as banana, yams, and taro, and mango and various other fruit trees are common components of these homegardens.

Homegardens exemplify many agroforestry characteristics, i.e., the intimate mix of diversified agricultural crops and multipurpose trees fulfills most of the basic needs of the local population, while the multistoried configuration and high species diversity of the homegardens helps to reduce the environmental deterioration commonly associated with multicultural production systems. According to the classification of agroforestry systems based on the nature and type of components, most homegardens are agrosilvopastoral systems consisting of herbaceous crops, woody perennials, and animals while some are agrisilvicultural systems consisting only of the first two components. In addition to food production, fuel wood and environmental protections are the secondary outputs from the homegarden (Nair, 1993).

Homegarden agroforestry have been practiced in densely populated areas of Africa and Southeast Asia (Tesfaye, 2005). In Ethiopia, homegardens are maintained by 20 million populations in the south and southeast represent one possible strategy for biodiversity conservation and it play a vital role in providing firewood, fodder, medicine, fruit, and timber (Zebene, 2003).

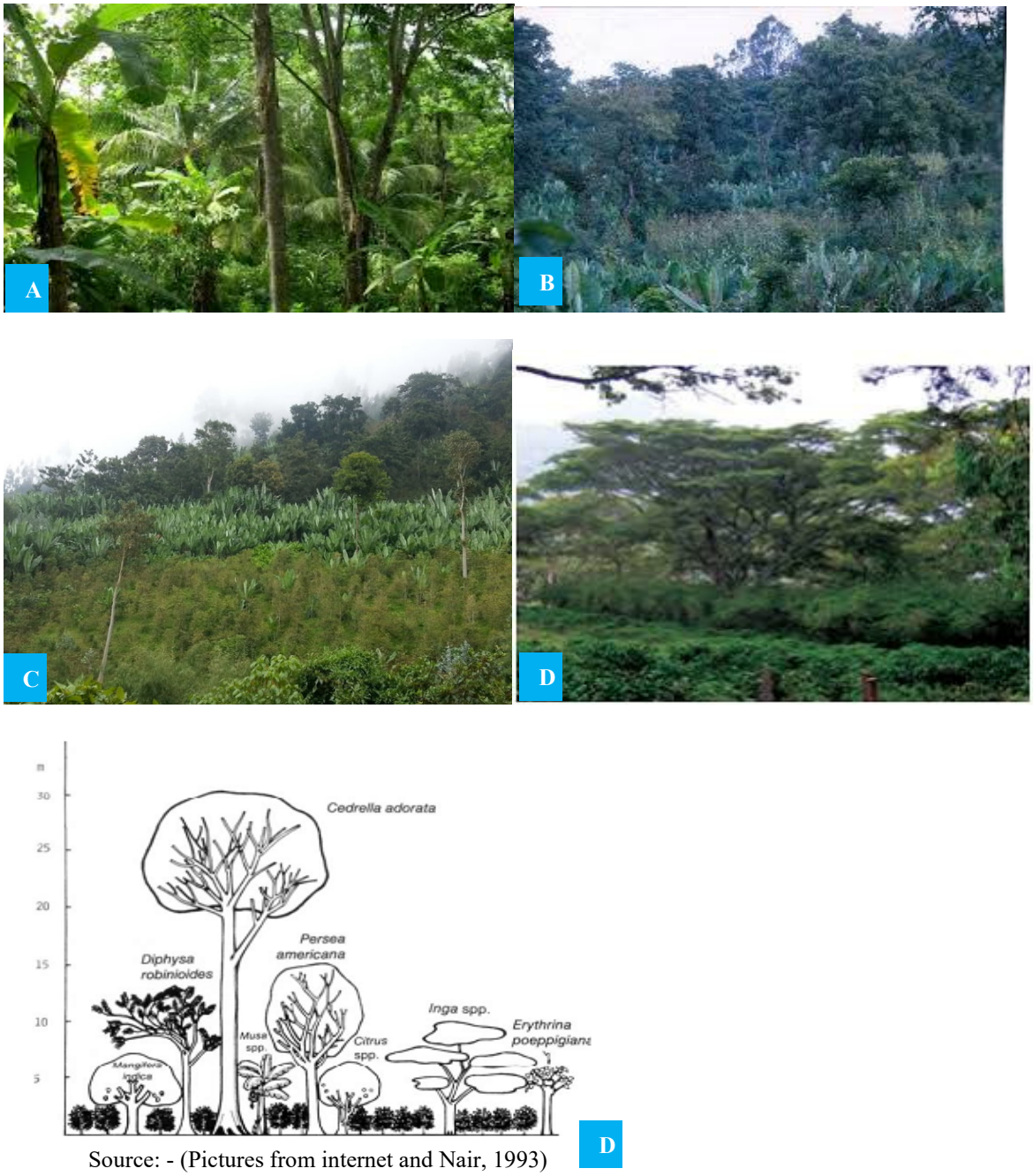
Ethiopia is one of the tropical countries where homegardens are prevalent in the highlands. In this country, both types of homegardens exist. In the cereal-crop based farming systems, staple food crops such as tef (*Eragrostis tef* (Zucc.) Trotter), barley (*Hordeum vulgare* L.), wheat (*Triticum sativum* L.) and Sorghum (*Sorghum bicolor* L.) are grown in outer farm fields, while supplementary vegetables, fruits and spices are grown in homegardens. Such gardens are also common in most of the urban areas in Ethiopia. The second category of homegardens is common in the perennial-crop based farming systems of the south and south-western highlands. Here, staple food crops (enset and maize) as well as other cash and food crops are grown in the homegardens and these garden farms make the principal means of livelihood for almost all the households. These homegardens, which function as a total rather than part of a farm system, are the focus of the present study (Tesfaye *et al*., 2005). Extensive areas of traditional agroforestry homegardens exist in the south and south-western parts of Ethiopia. Most of these gardens are located at altitudes of 1500–2300 meters above sea level where moisture and temperature conditions are favourable for agriculture.

South and southwestern Ethiopia is one of the tropics where homegarden agroforestry is common (Okigbo, 1990). A Study done by Tesfaye, (2005) shows that, more than 600 persons per square km for well managed homegardens of Gedeo and Sidama has been recorded. Because of its highest social utility of the generating highest rate of return to all available resources i.e. costs and benefits, most farmers adapt to practice homegarden agroforestry systems for a long period of time. They used for subsistence purposes of the households to generate cash income (Galfato *et al.*, 2015). Usually, they provide between 50% and 80% of total agricultural income (Tesfaye, 2005). It is a dominant land use practice in the Southern Nations, Nationalities and Peoples Regional State (SNNPRS) of Ethiopia. For centuries, it has been known for its diversity, ecosystem balance, sustainability, household food security and rural development of the region (Tesfaye *et al.,* 2010).

Homegardens offer a practical response to massive degradation and depletion of forest resources; the rural energy crisis; optimum utilization of already scarce land and environmental improvement and landscape enhancement challenges in Ethiopia (Tesfaye, 2005). According to Admasu and Struik, (2002), the main factors that contribute to the stability of the homegardens are the diversity and the ability of the main staple food in southwest Ethiopia, enset to produce a relatively large amount of food per unit area. Trees, crops and livestock are identified as main components of ecosystem stability in the homegarden agroforestry, which is relates to the three scientific disciplines of agronomy, forestry and animal husbandry (Tesfaye, 2005).

The presence of trees in homegarden agroforestry gives multiple services of timber, firewood, food and fodder (Kumer and Nair, 2004) and it is important for improving the ecosystem and its nutrient cycle through litter fall and decomposition. The livestock component in the system provides food for the household, and the manure is important for improving soil organic matter and fertility (Mersha, 2013). Homegardens play a useful role in the conservation of biological diversity and sustainable development strategies by improving household food production, nutritional status, income, and biodiversity management.

Homegardens are characterized by high species diversity and usually 3-4 vertical canopy strata tree layers; upper story, herbaceous layer near the ground and intermediate layers in between.



Source: - (Pictures from internet and Nair, 1993)

Figure 1: Some few views of homegarden agroforestry systems (A to C from Homegardens of Southern Nations, Nationalities and Peoples of Ethiopia and D from Nair, 1993 page 116).

The ensete-coffee-livestock tree system of south western Ethiopia represents a typical multistory homegarden. The upper story is dominated by broad leaved trees (e.g., *Cordia africana, Croton macrostachys, Millettia ferrugenia*), fruit crops (*Persia americana, Mangifera indica*), the middle story containing ensete, coffee and maize while vegetables, spices, and herbs cover the lower canopies. This results in a continuous food production throughout the year (Getachew, 2014). The objectives of this paper is to review the different role of homegarden agroforestry system for improving food security and ensuring smallholder farmers' food security through homegarden agroforestry system in Ethiopia.

Food Security

Food security and insecurity are terms used to describe whether or not households have access to sufficient quality and quantity of food. The concept of food security was originated in the mid-1970s during the international discussion on global food crisis. The initial focus of food security was primarily on food supply problems of assuring the availability and to some degree the price stability of basic food stuffs a t the international and national level (FAO, 2005). The negative impact of conflict on food security, nutrition and agriculture is an uncontested

and globally recognized phenomenon. Conflict is a leading cause of food insecurity and hunger in several parts of the world, undermining food security in multiple ways and creating access problems for governments and humanitarian agencies who often struggle to reach those most in need. The causes of food insecurity in conflicts are diverse but often coupled to disruptions in food production and food systems, plundering of crops and livestock, loss of assets and incomes or population displacement which all directly or indirectly impact availability, access and utilization of food. In general, in conflict affected areas, the lack of adequate access to food, combined with poor access to medical facilities – in some cases even a lack of access to clean water, has an immediate detrimental effect on malnutrition, especially for vulnerable groups such as children under five, and pregnant or breastfeeding women. Ethiopia, the impact of El Niño related drought on pastoralist livelihoods and the wider agriculture sector left an estimated 9.7 million people in need of urgent food assistance. In the Horn of Africa, drought in late 2016 could trigger rising food insecurity with impacts on nutrition and livelihoods (FSIN, 2017).

Food insecurity and malnutrition present key policy challenges in Ethiopia. During the first decade of the century, sub-Saharan Africa made sound progress in its fight against hunger with the region witnessing a decline in the prevalence and number of undernourished people. However, in 2015 and 2016, there was a reversal of this trend as even the prevalence of undernourished increased.

This trend reversal was attributable in many countries of the region to adverse climatic conditions, often linked to the El Niño phenomenon, which resulted in poor harvests and loss of livestock. Lower commodity prices and increasingly challenging global economic conditions, coupled with the outbreak of conflicts – at times concurrently with natural calamities such as droughts or floods further exacerbated the food security and nutrition situation across the continent.

In sub-Saharan Africa, the prevalence of undernourishment appears to have risen from 20.8 to 22.7 percent between 2015 and 2016, and the number of people undernourished rose from 200 to 224 million, accounting for 25 percent of the 815 million people undernourished in the world in 2016. At the same time, the proportion of the population that has experienced severe food insecurity because of their inability to access food has risen in the region. Adverse climatic conditions and conflict, often occurring concurrently, are key factors driving the recent increase in food insecurity in the region. A difficult global economic environment, reflected in falling prices of extractive and non-extractive commodities and weak growth, also contributed to increased food insecurity in many countries.

The improvements achieved by many countries manifests that cumulatively, the Comprehensive Africa Agriculture Development Programme has contributed significantly to raising agricultural public investment and growth, reducing poverty and advancing mutual accountability in sub-Saharan Africa. This momentum needs to be sustained through effective implementation and delivery on the goals of the Malabo Declaration on agriculture, integrating it with the 2030 Agenda on Sustainable Development and the Decade of Action on Nutrition.

For all countries in sub-Saharan Africa attaining food and nutrition security while addressing climate change and the degradation of the environment is a primary challenge. A further dimension is added to this challenge in countries that are in fragile situations and have weak institutions. In these countries food insecurity may itself be a trigger for conflict, and or prolong conflicts.

Conflict-sensitive and timely interventions aimed at improving food security and nutrition can contribute to building resilience and sustaining peace. A sustainable impact on peace is more likely when implemented as part of a broader set of multispectral humanitarian, developmental and peace related interventions at country, sub regional and regional level (FAO, 2017).

Food insecurity in Ethiopia are dynamic. The problem is compounded by back ward agriculture, land degradation, drought, population pressure, poor infrastructure facility and low level of off-farm/non-farm activities. In response to the problem, households vulnerable to food insecurity have developed sale of livestock, agricultural and nonagricultural employment, livelihood adjustment, reducing size and frequency of meal, consumption of wild plants, borrowing grains from relatives, migration and livelihood diversification as a coping mechanisms.

To ensure food security in Ethiopia, the development workers should create awareness for the community about family planning, soil conservation practice, personal and environmental hygiene, technology adoption and rainwater harvesting to reduce the problem caused by drought and erratic rain fall. Agricultural and non-agricultural employment, livelihood adjustment and livelihood diversification should be enhanced (Birara *et al*., 2015). Among livelihood diversification, practicing homegarden agroforestry is the best practice of getting more than two or more products at a time on a small piece of land resources.

Literature Review

Role of Homegarden

Homegardens exhibit remarkable variation in structure, species composition, and the area allocated for the production and level of dependency on this farming system. The structural characteristics vary from region to region depending on the local and regional physical environment, ecological characteristics, degree of commercialization, local socioeconomic and socio-cultural variations (Mahbubul and Furukawa, 2010).

Homegarden agroforestry plays an important role and unique land management system because of the potential role in addressing biophysical, economical and socio-ecological components (Ewuketu, 2014).

Environmental Sustainability

The physical presence of trees on farm boundaries serve as living fences and protect homegardens from free grazing livestock (Jeremias *et al.,* 2013). A homegarden system is sustainable when it maintains several characteristics: able to maintain productivity through diverse crops for meeting subsistence and cash needs of the households, enhance social and gender equity, based on traditional wisdom, and ameliorate the surrounding environment (Mahbubul and Furukawa, 2010). Homegardens are the result of the traditional human nature relationship within the rural landscape and their contribution to the country's overall food security and poverty alleviation through sustainable management and utilization of agriculture, forestry, animal husbandry, poultry and fishery is immense. Farmers' dependency on internal inputs is another indicator of system sustainability. Cow dung, corn straw and kitchen and agricultural residues are sources of organic manure for the agricultural lands.
Homegarden agroforestry systems make the environment suitable for life by reducing the deleterious effects of extreme wind, temperature, dust and improving the quality of life in general. Trees in the homesteads also provide good services by intercepting dust and other undesirable visitors (Habtamu and Zemede, 2011). Homegarden systems also provide a range of ecosystem services, such as soil erosion control, amelioration of microclimate, influencing local water table, provision of habitat for wild and domesticated flora and fauna, and the like (Mahbubul and Furukawa, 2010). Generally, the homegarden agroforestry system plays a crucial role in moderating microclimate (Lasco *et al*., 2011), ecological role (Mahbubul and Furukawa, 2010) and sustainable agriculture adapted to climate change (Anonymous, 2011).

Income and Economic Sustainability

Asinwa *et al.,* (2012) conducted a survey on the economics of some forest fruit trees and found out that harvesting, processing and marketing of products from economic forest trees plays an important role in food security, employment and income generation as cited by (Sobola *et al*., 2015). According to Olika and Zuberi, (2013) the average annual income per homestead is Birr 12,583.00 (= 630.00 US$); more than 50% being poor had lower income that having an average of less or equal to half a hectare of land. Field crops accounting for 41 % of this income, animals account for 15 %, 22% from homegardens (herbs), other agroforestry/trees contributing 12 %, while off farm income contributing to the rest 10% (Zuberi *et al.*, 2014). One study done by Zerihun *et al*., (2011) indicates that, income from homegarden increases an average household income of 2100 - 3784.11 Ethiopian Birr.

More than 61.2% homegardens serve as a source of cash and food for smallholder households. Smallholders can improve both their health and their incomes by growing fruit trees (ICRAF, 2008). From homegarden agroforestry, 67% consume fruit trees as cash income (Ewuketu, 2014). The production and trade of the homegarden products like the spice producing herbal species that involve small scale producers and low income consumers that benefits the small scale producers and consumers and also contributes to the market and the economy (Zuberi *et al.,* 2014).

Fruits (papaya, avocado, banana, orange, etc.) play an important role, especially during times of famine and other stress as food, nutrition and cash income. The sale of products from homegarden significantly improves family financial status, and cash income for buying of food, clothes, etc. The presence of fodder tree has also a crucial value, increases the number of livestock (important assets during times of crisis) (Ewuketu, 2014).

Most of the income from homegardens is from the marketable surplus derived from perennials such as fruit trees. The high degree of biodiversity present in homegardens is unique and totally distinct from the biodiversity present in natural forests. The biodiversity conserved in these highly interacting contexts is the result of generations of conscious selection made by farmers. Moreover, these components are in most cases the last refuges for species that are useful, but not commercially viable for cultivation (Mahbubul and Furukawa, 2010). Homegardens normally contain high commercial timber volume and fuel wood volume, which meet a substantial proportion of the society's demands. Homegardens also meet a significant portion of household energy requirements (Kumar and Nair, 2004).

Sustainable Diversification of Agricultural Systems

Diversification is an adjustment of the farm enterprise pattern in order to increase farm income or reduce income variability by reducing risk, exploiting new market opportunities and existing market niches, diversifying not only production, but also on farm processing and other farm based income generating activities (Dixon *et al.,* 2001). At the farm level, it is the adoption of multiple production activities that are complementary in economic and/or ecological dimensions involving crops, trees, livestock and post-harvest processing.

Across Africa, homegardens with a diverse range of vegetable and fruit yielding trees are quite popular and contribute significantly to food security by providing products year round (Mendez *et al.,* 2001). A global review on the contribution of homegardens to food and nutrition of households found that up to 44% of calorie and 32%

of protein uptake are met by the products from homegardens. Besides meeting the subsistence needs of households, the role of homegardens in generating additional cash income cannot also be overlooked (Mendez *et al.,* 2001).

The importance of homegarden for *in situ* conservation of the valuable agro-biodiversity and the sustainability of the surrounding ecosystem is well appreciated. Furthermore, homegardening can help maintain the biodiversity of important plant species around the homesteads (Teshager and Akrem, 2014).

The interventions of agroforestry have more to do with agricultural sustainability as it enhances higher yield, production stability, and others, such as livelihood support, positive environmental impacts as cited in (Madalcho and Tefera, 2016). *Persia americana* and *Mangifera indica* are chosen for both fertility maintenance and household income generation value, and its contribution continues all year round. Therefore, the criteria to select and plant trees in agroforestry practices are highly related to the local people's indigenous knowledge to select those good (suitable) trees. There are also other important roles of homegarden agroforestry system includes; fodder trees, soil conservation (Jeremias *et al*., 2013), agro-ecosystem (Climate Change Project, 2010) and social functions (Mahbubul and Furukawa, 2010).

Addressing Food Security

Food security exists when communities "have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for a healthy and active life" (Ramni Jamnadass *et al.*, 2015). Most of the food consumed in Eastern Africa is produced by smallholder farmers. However, their productivity has been falling, frequently as a result of declining soil fertility. Food insecurity, extreme poverty and environmental degradation nexus are the most challenging problems of developing countries. Low and erratic rainfall and soil fertility depletion are fundamental biophysical limitations responsible for declining productivity. Droughts, conflicts, famine and food insecurity are common features of the developing countries (Eyasu, 2002).

In parts of Ethiopia, water scarcity, uncontrolled grazing and the high demand for tree products is leading to severe environmental degradation and declining yields. The magnitude and rate of production, as well as the ease and rhythm of maintenance, of the homegarden agroforestry system depend on its species composition. Although the choice of species is determined to a large extent by environmental and socioeconomic factors, as well as the dietary habits and market demands of the locality, there is a remarkable similarity with respect to species composition among different homegardens in various places, especially with respect to the herbaceous components. This is so because food production is the predominant role of most herbaceous species, and the presence of an overstory requires that the species are shade tolerant (Nair, 1993).

A conspicuous trait of the tree-crop component in homegardens is the predominance of fruit trees, and other food producing trees. Apart from providing a steady supply of various types of edible products, these fruit and food trees are compatible to both biologically and environmentally with other components of the system. Another aspect of food production in homegardens is the continuous production that occurs throughout the year (Ewuketu, 2014).

Depending upon the climate and other environmental characteristics, there may be peak and slack seasons for harvesting the various products (fruits like papaya, avocado, banana, fodder crops, fuel wood, timber, spices, vegetable, etc), but generally there is something to harvest daily from most homegardens. Most of this production is for home consumption, but any marketable surplus can provide a safeguard against future crop failures and security for the interval between the harvests (Nair, 1993).

Homegarden agroforestry systems often harbor high biodiversity and can deliver a wide array of tree foods, including fruits and leafy vegetables that are both cultivated and are remnants of natural forest. When established an agroforestry system with shade trees, food diversity and sustainability of tree crop systems increase. In Ethiopia, for example, the inclusion of fruit bearing trees as shade in coffee plantations provides farmers with access to additional foods, such as *Mangifera indica*, oranges, bananas and *Persia americana*, as well as fuel wood and timber (Muleta, 2007).

Homegarden directly contributes to improve household food security and nutrition (Vira *et al.*, 2015). An overall increase in the production through cultivation of a wide range of foods, including tree fruits and vegetables is required to bridge consumption shortfalls. Trees also provide other important products (e.g., fodder, green fertilizer, fuel) that support food production and use (Ramni Jamnadass *et al.,* 2015). From homegarden agroforestry, 77% consume fruit trees as a food source (Ewuketu, 2014).

Homegardens practice serves critical functions in fulfilling community and household needs ranging from food provision and food security to augment the family nutritional status, ensuring primary healthcare, income generation and fulfilling other utility functions (Teshager and Akrem, 2014). Getachew, (2014) reported that, in southwestern Ethiopia, agroforestry support households attain food security as a source of cash and food for 100% and 72% respectively.

According to Zerihun *et al.,* (2011) 88.8% of households are food secured throughout the year, while 84.5% of the households sufficient only for 10 months to feed their family by own producing and purchasing from the local market to attain food security. About 96.9% of households improve their livelihoods throughout the year by

practicing homegarden agroforestry system. Crops like enset ventricosum, cabbage and pulses are critical in July and August in filling the shortage of food at the household level and purchasing grain from the local market by selling avocado and Catha edulis.

Homegardens play an important role in the food security by supplying of varied products throughout the seasons. Tubers, vegetables, fruits and spices from homegardens make up a significant part of the nutritional requirements of the households. Diversity in crops from homesteads results in a range of outputs from a given area which increases self-sufficiency and reduces economic risks associated with adverse climatic, biological and market impacts on particular crops. In densely populated or heavily degraded areas without sufficient staple crop fields, homegardens also provide large portions of staple foods (Kehlenbeck *et al.,* 2007).

Species in the homegarden agroforestry supplement for household's food and income, i.e. tubers and vegetables replace the staple food of cereal crop and produce a reasonable amount of carbohydrate. According to Ewuketu, (2014), fruit trees are primarily served for food, especially during difficult time of drought like *Persia americana and Mangifera indica*. They are an indicator of the farmer's dependency on HGAF for food, in addition to cash income revenue in the North Western Ethiopia.

Fruit trees from homegarden agroforestry have a significant role during an environmental crisis of households. Although family/especially children's consume fruit trees, it is possible to avoid (buffer) frequency of hunger and decreases the number of meals/ day. So depending on other cereal food crops becomes minimal.

Summary and Conclusions

Agroforestry has both ecological and economic benefits and can provide farming families with the 'five Fs': Food, Fuel, Fodder, Finance and Fertility.

The main factors that contribute to the stability of the homegardens are the diversity and the ability of the main staple food like enset and coffee. Three scientific disciplines of agronomy, forestry and animal husbandry are the main components of ecosystem stability in homegarden agroforestry systems. The presence of trees in the homegarden agroforestry system gives multiple services of timber, firewood, food and fodder and improving ecosystems and nutrient cycle through litter fall and decomposition.

The following consideration and integration of the homegarden agroforestry system will be needed for the future:

- Identify appropriate intervention strategies for the introduction and expansion of the homegarden to other crop producing areas;
- Improving the production, processing, handling, and marketing of products from homegarden agroforestry systems, introducing a new germplasm for homegarden agroforestry systems with a focus on economically useful trees for agroforestry development for typical agro-ecological zones of Ethiopia.
- It has been demonstrated that homegarden agroforestry systems provide options for reducing poverty, improving food and income security and sustaining environmental quality. Homegardens, woodlots and coffee farms are the potential agroforestry intervention area in the future.
- Improving nutrition and health of households through fruit tree based homegarden agroforestry systems in the cereal dominated production system.
- Optimizing and assessing the bio-carbon stock of the traditional multi-story homegarden of south western and homegarden practicing areas of Ethiopia and developing market strategies.

References

Admasu Tsegaye and Struik, P. C., 2001. Enset (Enset ventricosum (Welw.) Cheesman) 'Kocho' yield under different crop establishment methods as compared to yields of other carbohydrate-rich food crops. Netherlands Journal of Agricultural Science, 49, 81–94.

Anonymous, 2011. Where Trees Grow, People Grow. VI Agroforestry. , p.48.

Anonymous, 2015. Vi Agroforestry Strategy. , pp.1–28.

Asinwa, I.O., Jegede, O.C., Ebiniro, D.S., Akerele, J.O. and Akanmu O.O., 2012. Assessment of the contribution of Parkia biglobosa (JACQ) BENTH to Rural livelihood in Oyo state Nigeria. Continental journals 6(2): Pp9-17.

Billes luka nzilano. 2013. Contribution of agroforestry homegardens to household food security and income generation among communities in mbeya rural district, Tanzania.

Birara E., Gashaw T., Solomon B., 2015. State of Household Food Insecurity in Ethiopia: Review. A Journal of Radix International Educational and Research Consortium, 4(12).

Cheikh M., Pete S., David S., Lalisa D. and, Mercedes B., 2013. Achieving mitigation and adaptation to climate change through sustainable agroforestry practices in Africa. Published by Elsevier Ltd.

Climate change project, 2010. The Use of Agro-biodiversity by Indigenous and Traditional Agricultural Communities in : Adapting to Climate. , p.32.

David E. Thomas, 2000. Agroforestry Systems Research : Evolving Concepts and Approaches. Agricultural

Systems for Sustainable Resources Management and Community Organization Development Proceedings of the First Thailand National Agricultural Systems Seminar, Bangkok.
Dixon JA., Gibbon DP. and Gulliver A., 2001. Farming Systems and Poverty: Improving Farmers' Livelihoods in a Changing World. Rome: FAO; Washington, D.C.: World Bank.
Ewuketu Linger, 2014. Agro-ecosystem and socio-economic role of homegarden agroforestry in Jabithenan District, North-Western Ethiopia: implication for climate change adaptation. Linger Springer Plus, 3(1), p.154.
Eyasu Elias, 2002. Farmers' perceptions of soil fertility change and management. SOS Sahel and ISD, Addis Ababa.
FAO, 2005. Assessment of the World Food Security Situation. Committee on World Food Security, Thirty-First Session, Rome, May 23-26, 2005.
FAO, 2017. Food and Agriculture Organization of the United Nations, Accra. Africa, Regional overview of food security and nutrition.
Food Security Information Network (FSIN, 2017). Global Report on Food Crises, 2017.
Galfato, G., Tesfaye, A. & Tefera, T., 2015. Women in home garden agroforestry system of Sidama, SNNPRS, Ethiopia. Scholarly Journal of Agricultural Sciences, 5(4), pp.103–111.
Getachew, M., 2014. Evergreen Agriculture: Agroforestry for Food Security and Climate Change Resilience. Journal of Natural Sciences Research, 4(11), pp.80–90.
Habtamu Hailu and Zemede Asfaw, 2011. Homegardens and Agro-biodiversity Conservation in Sebeta Town, Oromia Regional state, Ethiopia. SINET: Ethiop. J. Sci., 34(1), pp.1–16.
ICRAF, 2008. World Agroforestry Center, Annual Report 2007-2008. Agroforestry for food security and healthy ecosystems. Nairobi, Kenya: World Agroforestry Centre (ICRAF).
ICRAF, 2012. World Agroforestry Centre. Agroforestry: a tool for sustainable nutrition?
ICRAF. 1993. International Centre for Research in Agroforestry: Annual Report 1993. Nairobi, Kenya. pp 208.
Jeremias Mowo, Badege Bishaw, A.A., 2013. Farmers' strategies for adapting to and mitigating climate variability and change through agroforestry in Ethiopia and Kenya. , pp.39–42.
Jonathan Muriuki, Hamisi Dulla, Saidi MKomwa, J.M., 2012. Conservation Agriculture with (CAWT) project : Scaling up the Science and Practice of Conservation Agriculture in Sub-Saharan Africa. World Agroforestry Centre (ICRAF).
Kehlenbeck, K., Arifin, H.S., and Maass, B.L., 2007. Plant diversity in homegardens in a socio-economic and agro-ecological context In Tscharntke T, Leuschner C, Zeller M, Guhardja E, Bidin A (eds), The stability of tropical rainforest margins, linking ecological, economic and social constraints of land use and conservation, Springer Verlag Berlin 2007, pp 297-319.
Kumar BM, Nair PKR, 2004. The enigma of tropical homegardens. Agroforestry System 61:135–152.
Kumar BM, Nair PKR, 2006. Tropical Home Gardens: A Time-Tested Example of Sustainable Agroforestry. Environmental Experts, India.
Lasco RD., Habito CMD., Delfi no RJP., Pulhin FB., C.R., 2011. Climate Change Adaptation for Smallholder Farmers in Southeast Asia. World Agroforestry Centre, Philippines. , p.65.
Madalcho AB, T.M., 2016. Management of Traditional Agroforestry Practices in Gununo Watershed in Wolaita Zone, Ethiopia. Forest Research: Open Access, 05(01), pp.1–6.
Mahbubul Alam and and Furukawa Yasushi, 2010. Agroforestry homegardens in rural landscapes of Bangladesh.
Mendez VE., Lok R., and Somarriba E., 2001. Interdisciplinary analysis of homegardens in Nicaragua: microzonation, plant use and socioeconomic importance. Agroforestry System, 51:85–96.
Mersha Gebrehiwot, 2013. Recent Transitions in Ethiopian Homegarden Agroforestry : Driving Forces and Changing Gender Relations.
Muleta, D., 2007. Microbial inputs in coffee (Coffee arabica L.) production systems, southwestern Ethiopia - implications for promotion of bio fertilizers and biocontrol agents. Doctoral thesis. Swedish University of Agricultural Sciences/Uppsala.
Nair P.K. Ramachandran, 1993. An introduction to agroforestry. In International Center for Research in Agroforestry, ICRAF. pp. 21–38.
Okigbo NB., 1990. Home gardens in tropical Africa. In: Tropical home gardens, pp. 21-40 (Landauer, K. and Brazil, M., (eds.). United Nations University Press, Tokyo.
Olika B, Zuberi MI., 2013 Impacts of Climate Change on Small Holder Farmers: Case of Maruf Kebele, Central Oromia, Ethiopia, paper presented in International Conference Climate Change and Sustainable Agriculture, Ambo University, Ethiopia.
Ramni Jamnadass, Stepha, Miyuki Iiyama, Ian K., Bronwen Powell, Celine Termote, Amy Ickowitz, Katja Kehlenbeck, Barbara Vinceti, Nathalie van Vliet, Gudrun Keding, Barbara Stadlmayr, Patrick Van Damme, Sammy Carsan, Terry Sunderland, Mary Njenga, Amos Gya, A.D. and A.S., 2015. Understanding the Roles of Forests and Tree-based Systems in Food Provision, pp.29–72.
Sobola O. O., Amadi D. C., Jamala, G.Y., 2015. The Role of Agroforestry in Environmental Sustainability. IOSR

Journal of Agriculture and Veterinary Science Ver. I, 8(5), pp.20–25.
Tesfaye A., 2005. Diversity in home garden agroforestry systems of southern Ethiopia. Wageningen Agricultural University. Ph.D. Dissertation. Wageningen, p.143.
Tesfaye, A., Wiersum, K.F. and Bongers, F., 2010. Spatial and temporal variation in crop diversity in agroforestry homegardens of southern Ethiopia. Agroforest Syst, 78, 309-322.
Teshager Biruk Tewabech and Akrem Ephrem, 2014. The Flora make-up and Agroforestry practices in backyard in Hiwane, Hintalo Wejerat of Tigray, Northern Ethiopia. International Journal of Agroforestry and Silviculture, 1(9), pp.101–109.
Vira, Bhaskar, Wildburger, Christoph and Mansourian, S., 2015. Forests and Food: Addressing Hunger and Nutrition across Sustainable Landscapes.
Zebene, A., 2003. Tree species diversity, topsoil conditions and arbuscular mycorrhizal association in the Sidama traditional agroforestry land-use, southern Ethiopia. Swedish University of Agricultural Sciences. Ph.D. Dissertation.
Zerihun Kebebew, Weyessa Garedew and Adugna Debela, 2011. Understanding homegarden in household food security strategy: Case study around Jimma, Southwestern Ethiopia. Research Journal of Applied Sciences, 6(1), pp.38–43.
Zomer RJ, Trabucco A, C.R. and P.F., 2009. Trees on Farm: Analysis of Global Extent and Geographical Patterns of Agroforestry. Nairobi, Kenya: World Agroforestry Centre. ICRAF Working Paper, (89).
Zuberi M.I., Birhanu Kebede, Teklu Gosaye, O.B., 2014. Species of herbal spices grown in the poor farmers' home gardens of West Shoa, Highlands of Ethiopia : an Ethno-botanical account. Journal of Biodiversity and Environmental Sciences (JBES), 4(4), pp.164–185.