EDUARDO JAVIER PESÁNTEZ VALDIVIESO

THE INVISIBLE IMPORTANCE OF HOME GARDENS

Dissertação apresentada à Universidade Federal de Viçosa, como parte das exigências do Programa de Pós-Graduação em Agroecologia, para obtenção do título de *Magister Scientiae.*

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APROVADA: 31 de julho de 2017.

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Dedicatória

À minha esposa María Elizabeth e à minha filha Camila Isabel

À minha família toda

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SUMMARY

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ABSTRACT

PESÁNTEZ VALDIVIESO, Eduardo Javier, M.Sc., Universidade Federal de Viçosa, July, 2017. **The invisible importance of home gardens.** Advisor: Elpídio Inácio Fernandes Filho. Co-advisor: Irene Maria Cardoso.

Home gardens exist throughout the world and have been present since the beginning of human society. They are located near houses and are fundamentally dependent on female labor. One of their main characteristics is that they maintain high rates of agro-biodiversity and provide a constant and wide variety of products for the consumption of the families and for the generation of additional income: these products include food, medicine, wood, and forage. From a socio-ecological perspective the diversity of home gardens contributes to the conservation of endangered species, traditional varieties, and traditional farming practices. Despite being of great importance, these home gardens or yards do not always receive proper attention; and in order to value them accurately, it will be necessary to understand the contribution they make both to family farmers and to the environment. The aim of this study, divided into two parts, was to understand the environmental, economic, and socio-cultural importance of rural home gardens. The first part consisted in the analysis of secondary information containing production values generated on 30 farms located in the Zona da Mata of Minas Gerais. The methodology used is called "Agro-ecological Booklet," in which women collect the production data from the yards, their destination (consumption, sale, donation, and exchange) and their conversion into monetary values based on the prices of the local markets for each product. The second part consisted in actually visiting four home gardens in the Zona da Mata to estimate their agro-biodiversity through the identification and the uses of the species and families; and consequently to calculate the indexes of alfa-biodiversity (Index of Richness) and beta-biodiversity (Whittaker Index, Coefficient of Jaccard (CJ) and Coefficient of Sorensen (CS)). Finally, a scanning of one of the properties was performed using terrestrial laser scanner equipment that measured (average of three measurements) the height of random trees and shrubs in order to observe both the distribution and the vertical structure of the home garden.

The results showed that the Agro-ecological Booklet methodology was able to record the production of the home gardens and their location, as well as an estimate of their monetary value. The production of home gardens was diverse (140 products were recorded by the women), permanent throughout the year but variable every month. Monetarily, they represented an average percentage equivalent to 29% of the minimum wage in Brazil. The visited home gardens varied in area from 1,990 square meters to 8,830 square meters, with an age range between five and twenty years. With the participatory work it was known that the home gardens are spaces where the activities and decisions are led and made by women, albeit with the co-operation of the other members of the family. Neither pesticides nor chemical fertilizers were used in any of the home gardens, thus limiting the use of agricultural lime as a soil amendment to just one single property. The soil was fertilized with animal manure, crop residues, and organic garbage from the houses; and the control of spontaneous weeds was done by mowing and weeding, contributing with the coverage of the soil. It was found that 246 plant species were distributed in 81 families, and six animal species were distributed in an equal number of families. Most plant species are used for food (147 species), followed by medicinal (69 species), ornamental (56 species), fodder (four species), and others (13 species). The animal species are used for food (four species) and companionship (two species). Alfa-biodiversity showed a high diversity in each home garden; however, beta-biodiversity indicated that there is no similarity between the four properties. Finally, the laser scanner allowed calculating the height of the selected plants, obtaining a maximum coefficient of variation of 6,24%, with the observation that the majority of the highest individuals are in the orchard while the individuals of medium and smaller height are located around the house.

RESUMO

PESÁNTEZ VALDIVIESO, Eduardo Javier, M.Sc., Universidade Federal de Viçosa, julho de 2017. **A importância invisível dos quintais.** Orientador: Elpídio Inácio Fernandes Filho. Coorientadora: Irene Maria Cardoso.

Os quintais estão presentes na sociedade humana desde a sua origem e estão distribuídos mundialmente. Estes espaços de terra estão localizados perto das casas, e o trabalho feminino neles é fundamental. Uma característica principal deles é que mantêm altos índices de agrobiodiversidade, fornecendo constante e ampla variedade de produtos, como alimentos, remédios, madeira ou forragem, principalmente para o autoconsumo das famílias e também para a geração de renda adicional. Além disso, a diversidade dos quintais contribui para a conservação de espécies ameaçadas e variedades tradicionais, preservando práticas agrícolas tradicionais, confirmando sua importância sócio-ecológica. Apesar de serem de grande importância, os quintais nem sempre recebem a devida atenção e, para serem valorizados, é necessário entender sua contribuição para os agricultores familiares e para o meio ambiente. Esta pesquisa teve como objetivo avaliar a importância ambiental, econômica e sócio-cultural de quintais rurais, sendo realizada em duas partes: a primeira consistiu em visitar quatro quintais na Zona da Mata para estimar sua agrobiodiversidade através da identificação das espécies e famílias e, consequentemente, calcular os índices de biodiversidade alfa (Índice de Riqueza) e biodiversidade beta (índice de Whittaker, coeficiente de Jaccard (CJ) e coeficiente de Sorensen (CS)). Finalmente, foi realizado escaneamento de uma das propriedades com equipamento laser scanner terrestre, que permitiu medir (média de três leituras) as alturas de árvores e arbustos selecionados ao acaso e, assim, observar a distribuição e a estrutura vertical do quintal. A segunda parte consistiu na análise de dados secundários contendo os valores da produção gerada em 30 propriedades na Zona da Mata de Minas Gerais, utilizando a metodologia denominada "Caderneta Agroecológica", na qual as mulheres compilam os dados da produção dos quintais, seu destino (autoconsumo, venda, doação e troca) e sua transformação em valores monetários, de acordo com os preços nos mercados locais de cada produto. Os resultados demonstraram que

os quintais visitados variaram em tamanho, de 1990 metros quadrados para 8830 metros quadrados, com uma idade entre cinco e 20 anos. Através do trabalho participativo foi conhecido que os quintais são espaços onde as decisões são tomadas e as atividades são lideradas pelas mulheres, mas com a cooperação dos outros membros das famílias. Em nenhum dos quintais foram utilizados agrotóxicos ou fertilizantes químicos, limitando o uso de calcário como um corretivo do pH do solo em apenas uma propriedade. O solo foi adubado com esterco animal, resíduos de colheitas e resíduos orgânicos caseiros, e o controle de ervas foi feito com capina e roçado, contribuindo com a cobertura do solo. Encontraram-se 246 espécies de plantas distribuídas em 81 famílias, e seis espécies animais distribuídos em igual número de famílias. A maioria das espécies de plantas é utilizada como alimento (147 espécies), seguido de remédio (69), espécies ornamentais (56), forragem (quatro espécies) e outros usos (13 espécies). As espécies animais são utilizadas como alimento (quatro espécies) e companhia (duas espécies). A biodiversidade alfa mostrou uma elevada diversidade em cada quintal; no entanto, biodiversidade beta indicou que não há semelhança entre as quatro propriedades. O laser scanner permitiu calcular a altura das plantas selecionadas, observando coeficiente de variação máximo nas leituras de 6,24% que a maioria dos indivíduos mais altos está no pomar, e os indivíduos de médio e baixo porte estão localizados ao redor da casa. Finalmente, a Caderneta Agroecológica permitiu registrar a produção dos quintais e seu destino, assim como seu valor monetário estimado. A produção dos quintais foi diversificada (com 140 produtos registrados pelas mulheres), permanente ao longo dos 12 meses do ano, mas variável em cada mês. Monetariamente, representou uma porcentagem média equivalente a 29% do salário mínimo no Brasil.

CHAPTER I

1. GENERAL INTRODUCTION

Although the expression "family agriculture" is a concept used worldwide, there is no universal agreement about its meaning. Garner and de la O Campos (2014) identified more than 36 different definitions for the term family agriculture, 13 of which correspond to Latin American works. There are at least three common aspects among all the definitions: namely, the type of management of a property, with the predominance of family work in agricultural activities; the administration of the property by the family; and the size of the property (Garner & de la O Campos, 2014). In the Brazilian law a family farmer is defined as having no more than four fiscal modules[1], who predominantly uses the labor force of the family in the economic activities of the establishment or enterprise, a major percentage of the family income derived from these economic activities and that manages the establishment with the family (Lei n. 11.326, 2006).

Given the definitions listed above, considering more than 570 million farms in the world, more than 90% of them correspond to family agriculture, and these farms are responsible for the production of more than 80% of the world's food. In one hand, 72% of the agricultural properties are smaller than one hectare, and account for only eight percent of the agricultural land family. On the other hand, one percent of the world's farms have an area larger than 50 hectares, and these account for 65% of the world's agricultural land. (FAO, 2014). In Brazil family farms represent 84% of all rural production units, yet they only account for 24% of the country's farmlands (IBGE, 2009). According to the last census of agriculture of Brazil, in 2006, family agriculture constitutes the economic base of 90% of Brazilian municipalities with fewer than 20,000 inhabitants and contributes 35% of the gross domestic product, absorbing 40% of the country's workforce. Moreover, it is responsible for the production of 87% of cassava, 70% of beans, 46% of corn, 38% of coffee, 34% of rice, and 21% of wheat that are produced in Brazil (Brito, 2016; IBGE, 2009).

[1] Fiscal module is a unit of area measure (expressed in hectares) fixed differently for each municipality in Brazil.

Despite the current relevance and influence of this sector, not only in Brazil but in many other countries in Latin America, its recognition is recent and coincide in many cases with the end of military dictatorships in the region, and consequently to the reorganization of unions and the restructuring of those states that began to recognize the importance of family agriculture (Schneider & Cassol, 2013). However, even with new government policies that involve many aspects of family farming, the complex structure and diversity of size, production, access to markets, and the fact that agriculture in general has to face the phenomenon of globalization; all of these factors present a big challenge requiring complex systems of innovation (FAO, 2014). It needs political decisions of governments to develop public policies for the benefit of family agriculture, with the aim of creating conditions for farmers that enable them to stay in the countryside, producing food and generating income, as well as implementing practices that respect nature and value the ancestral knowledge of the peasants (Oliveira, 2015), whereas manage their agro-ecosystems.

One of the components of their agro-ecosystems is the home garden. They are complex, diverse, and multi-stratified systems consisting of trees, shrubs, and annual and perennial crops. Some of them may still have animals living around the house (Fernandes & Nair, 1986; Huai & Hamilton, 2009). The study of home gardens from various ecological and socio-cultural perspectives began in the mid-1970s in the tropical region of Southeast Asia and from there spread to other parts of the planet (Galluzzi, Eyzaguirre, & Negri, 2010). Because of their important contribution to biodiversity conservation, their ecological and economic functions, and their contribution to improving the lifestyles of indigenous and rural communities (including modern agriculture), home gardens have received a special interest from researchers, although there is still much to learn (Huai & Hamilton, 2009).

Generally speaking, home gardens may include a vegetable garden (where vegetables, medicinal plants, spices, and plants used in rituals and traditional ceremonies are grown), orchard, apiary, compost, etc.(Asfaw, 2001). Home gardens are quite common and constitute an important part of the family farm. There is a close relationship between the home garden and the families that maintain and conserve them (Asfaw, 2001). The home gardens are, generally,

located near the houses, which facilitate the access and their management, done specially by women. Further, the active participation of women in these areas is basically conditioned by the proximity of the home garden to the home (Fernandes & Nair, 1986; Huai & Hamilton, 2009; Neto, Feital, Lopes, Almeida, & Telles, 2015; Oliveira, 2015).

However, home gardens are generally established in less favorable or marginal areas where big crops cannot be developed due to topography or difficulty of access. Their size varies from place to place, although in general they are smaller than arable land of the property (Galhena et al., 2013; Hoogerbrugge & Fresco, 1993). Because of their dynamic nature, boundaries can be either physical or based on mutual agreements (Hoogerbrugge & Fresco, 1993). Consequently, it is difficult to define an average size of home gardens and their analysis must be conducted from the point of view of the different agro-ecological and socioeconomic conditions (Galluzzi et al., 2010).

Although over time the functions of the home garden have been modified, their main contribution has been to improve the quality of life, because they ensure food security and sovereignty of rural communities and increase of incomes through the production of food. In the home gardens, the direct incomes are generated because of the sale of surpluses of vegetables and other food products, including medicinal and spice species (Harwood, 1986). Indirectly, farmers save money when producing their own food and when exchanging products with other farmers (Oliveira, 2015). Home gardens also provide refugees for biodiversity (Galluzzi et al., 2010), which is influenced by local climate. The biodiversity is also related to the preferences of the family and the community (Ávila et al., 2017; Hoogerbrugge & Fresco, 1993). Home gardens also are important for aesthetic, spiritual and leisure functions (Caballero-Serrano et al., 2016; Vieira & Lee, 2014). Thus, home gardens offer provisioning, regulatory, cultural, and support ecosystem services.

This study was carried out in home gardens located in the Zona da Mata of Minas Gerais, with farmers associated with the Center of Alternative Technologies of Zona da Mata (CTA-ZM), who are participants in the Agro-ecological projects, which seeks to analyze home

gardens and the benefit they bring to rural communities, and which serve as a basis for the development of public policies in favor of family farmers. This research was structured in four chapters, a general introduction (first chapter); the second chapter named ("Rural Home Gardens: Agrobiodiversity and Socio-cultural Importance" aimed to study the agro-biodiversity present on the home gardens, its use and the vertical structure of home gardens using laser scanner to measure plant height and distribution, the third chapter entitled "Rural Home Gardens and Their Invisible Contribution to Family Farms Economy" aimed to study and value the contribution of the home gardens to the family income using data collected through the Agro-ecological Booklet; and finally, a final chapter containing the final considerations. The research was approved by the Ethics Committee in research with human beings at the Federal University of Viçosa (58026216.6.0000.5153 on August 24, 2016).

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CHAPTER II

RURAL HOME GARDENS: AGROBIODIVERSITY AND SOCIO-CULTURAL IMPORTANCE

1. INTRODUCTION

The modern agricultural model proposed by the Green Revolution, in which the base of the production is monoculture, with intensive use of external inputs such as fertilizers, pesticides and seeds has been indicated by scientists (IAASTD, 2008) as responsible for an important socio-environmental crisis. Some of the symptoms of this crisis include loss of biodiversity, soil erosion, desertification, contamination of soils and water due to excessive use of fertilizers and pesticides, as well as a growing social inequality in developing countries (Altieri, 2000). The establishment of large monoculture and intensive use of fertilizers and pesticides lead to the loss of biodiversity, the simplification of the agro-ecosystems and loss of traditional knowledge acquired over generations (Chaves, 2016).

Differently, agroecology encourages using the resources of nature in an efficient way, reducing, on agriculture, the dependence of external inputs which are directly linked to the use of fossil energies. In the management of the agro-ecosystems, following the agro-ecological principles, the farmers seek to imitate natural ecosystems, promoting biodiversity of species and genetic resources, creating biological interactions between the components of agro-ecosystems, improving soil conditions due to the correct management of organic matter and the increase of soil biotic activity and reinforcing the recycling of nutrients and energy (De Schutter, 2010).

Agroecological systems, such as agroforestry systems, can be considered sustainable. They favor ecosystem functions, consequently environmental benefits, such as conservation of biodiversity, improvement of the characteristics of soil, water and air, sequestration of carbon and promotion of diversified food for human and animal. Agroforestry systems also diversify and can increase the income sources with stable productions (Altieri, 2000; Jose, 2009).

One kind of agroforestry system are home gardens (Fernandes & Nair, 1986; Jose, 2009; Torquebiau, 1992), and are common and important for the family farms. There is a close

relationship between the home gardens and the family that maintain and conserve them (Asfaw, 2001). The greater biodiversity found in the home gardens is linked to their major role as provider of food, medicine, fiber, timber, fuel, and other products (Asfaw, 2001; Fernandes & Nair, 1986; Gillespie, Knudson, & Geilfus, 1993), but their main purpose is to produce food and medicinal plants, especial for the family. Thus, home gardens are important for food security and sovereignty (Fernandes & Nair, 1986), but they can also generate income from the sale of surpluses of the production (Harwood, 1986). The production of the home gardens also play a vital role in cultural festival and religious activities (Huai & Hamilton, 2009). Many of these products are found mainly in the home gardens. Due to the highly diverse presence of herbal, shrubs and trees, annual and perennial species, the structure of the home gardens is generally very complex (Montagnini, 2006) and special such as terrestrial laser scanner (TLS) are valuable tools that can be used to facilitate their study.

The TLS was used to study the home gardens in Zona da Mata of Minas Gerais. Few studies are found about home gardens in the region. On the other way around, the studies are dedicated to full sun coffee, the cash crop in the region, and pastures, whose occupy greater amount of area in the area. The region is characterized by high presence of family farmers, and home gardens are present in most, or all, family unities. This is a region that combines very favorable biophysical conditions for the development of biomass (Dean, 2011), thus for agroforestry systems, such as homo gardens. The study of home gardens can indicate alternatives to the extensive full sun coffee and pasture systems implemented implanted in the region after deforestation, which generates an important loss of biodiversity, and leads to subsequent environmental and social problems.

The objective of this research was to identify and characterize the management of home gardens of the Zona da Mata of Minas Gerais, Brazil; to identify their biodiversity and its uses and; to analyze the structure of home gardens using terrestrial LiDAR technology.

2. MATERIAL AND METHODS

2.1. Study area

The study home gardens were located in the Mesoregion of Zona da Mata, in the southeastern part of the state of Minas Gerais, in the biome of Tropical Rain Forest, Brazil one of the 5th hotspot of biodiversity (Myers, Mittermeier, Mittermeier, Fonseca, & Kent, 2000). The Mesoregion Zona da Mata of Minas Gerais has a mean annual temperature of 18°C, with mean annual precipitations between 1200 and 1800 mm and a seasonal dry period between two and four months. The original biome is Atlantic Forest, classified as subtropical evergreen or sub-evergreen forest (Golfari, 1975), that due to human impacts nowadays its size has decrease, being replaced by pastures, croplands, mainly coffee, maize, beans, cassava, sugarcane, among others (Cardoso et al., 2001; Cardoso & Ferrari, 2006). The soils type are Oxisols, deep and well drained, but acidic and poor in nutrients (BDMG, 1989).

The region is characterized by the presence of various groups and organizations of family farmers who have been working since the end of the 1980s following the principles of agroecology in the region. This work has been developed in partnership with the Center of Alternative Technologies of Zona da Mata (CTA-ZM) and the Federal University of Viçosa (UFV), looking for strengthen the respect for the nature and for the ancient knowledge of peasants (Cardoso & Ferrari, 2006). The home gardens surveyed were previously chosen as reference points by the groups of women participating in the project "Women's home gardens and Agro-ecological booklet" (translated of the Portuguese "*Os quintais das mulheres e a caderneta agroecológica*"), implemented by the CTA-ZM, which seeks to monitor and systematize the production of the gardens of women farmers in different regions of Brazil and these reference units aim to analyze what investments are needed to increase the productive capacity of women in home gardens.

2.2. Data collect

The home gardens surveyed were located at the municipalities of Acaiaca, Espera Feliz, Simonésia and Viçosa (Figure 1), one home garden for each municipality. All the properties

were visited three times, except for Simonésia, which was visited just once. The visits were made together with the researchers of the project led by the CTA-ZM "Women's homegardens and Agro-ecological booklet". Women participated in the interviews. The researchers explained to the women what the research consisted of, the objectives and the activities to be carried out. The work of identification of species and uses took place in the subsequently visits.

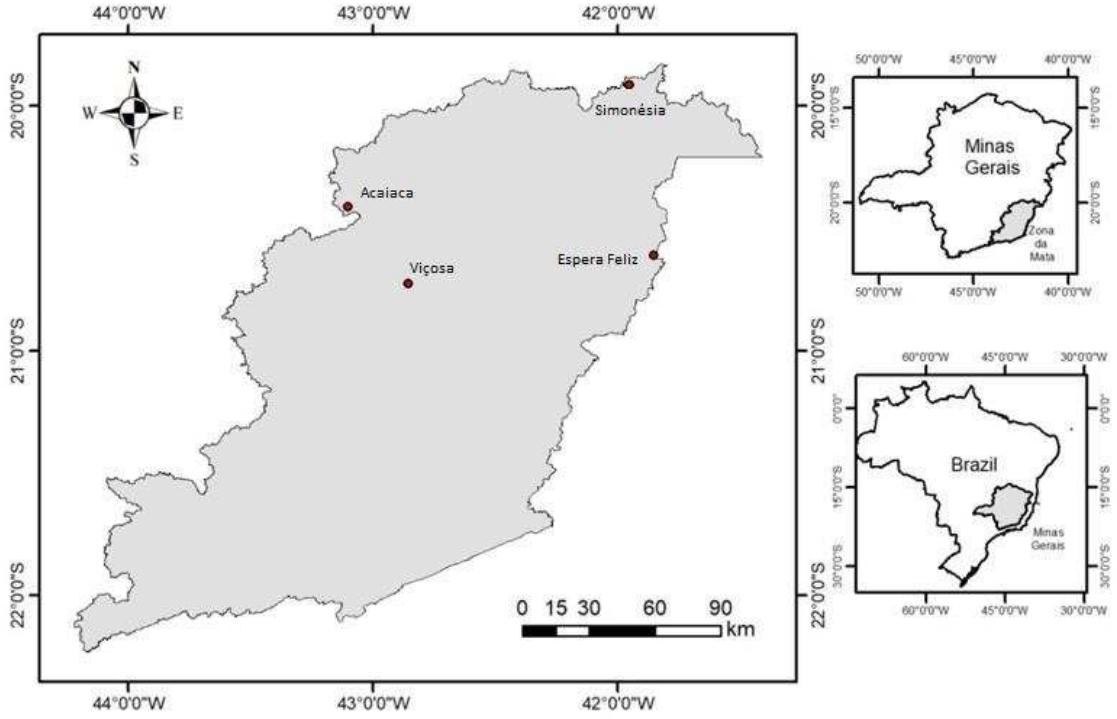

Figure 1. Map of the area of study with the location of the four home gardens

Data were collected from November 2016 to June 2017. The participants signed the Free and Informed Consent Form, as required by the Research Ethics Committee for studies involving human being participation. Semi-structured interview was used in order to know information of the family, characteristics of the properties, main agricultural practices and destination of the production of the home garden and the area of the property. The area of the home garden was estimated using Google Earth Pro.

2.3. Agrobiodiversity

The characterization of the agrobiodiversity was carried out with the methodology called guided excursion, with the presence of farmers, as informants. Vernacular names and uses of the plants were recorded. Plants specimens that could not be identified in the home

gardens were taken to the Herbarium of the UFV for identification. Plants were identified by comparison with herbarium specimens and, in some cases, with the assistance of specialists at the herbarium. The plants were categorized as food, medicinal, fodder and other (living fence, repellent, utensil, firewood, dye, wood, green manure). The domestic animals were identified by simple observation, and classified just in two possible categories: food and companionship.

Figure 2. Identification of the biodiversity in the home garden of Acaiaca, with the methodology guided excursion

After the identification of the species and, in order to evaluate alpha-biodiversity (α), specific richness was calculated for each property with the index of richness of biodiversity, (d=S/logA), where S is the species of the area and A is the surveyed area in m^2 in its natural base (Albuquerque & Lucena, 2004 as cited in Moura & Andrade, 2007). For the analysis of the beta-biodiversity (β), the Whittaker index (β^W= (S/α)-1) was calculated for all the possible comparisons between homegardens, where S is the total number of species in both areas and α is the mean diversity of species in both areas (Whittaker, 1960 as cited in Camargo, 1999). Also, the Jaccard (CJ=c/a+b-c) and the Sorensen (CS= 2c/a+b) indexes were calculated to evaluate

similarity or diversity among all the home gardens, where a is the number of species in home garden A, b in home garden B and c is the number of common species in both home gardens (Moreno, 2001).

2.4. Case study: Structure of the home garden

The home garden of Espera Feliz was scanned using a Riegl VZ-1000 TLS terrestrial laser scanner (TLS), calibrated with frequency 300 kHz, panorama 20 and a scope of 450 meters. It was installed eight laser stations inside the home garden, with the objective to get data of all the tree strata. The necessary coordinates for georeferencing the collected points were obtained by the Leica GS08 Plus GNSS receptor, and it was used as reference the GPS station Viçosa, located in the Federal University of Viçosa, available in the Brazilian Network for Continuous Systems Monitoring GNNS (RBMC) (from Portuguese *Rede Brasileira de Monitoramento Contínuo dos Sistemas* GNSS) processing the data with the software Leica Geo Office 5.1.. Registration and processing of the point cloud were executed in the software RiSCAN Pro 2.1. A filter was applied to decrease the number of points with the tool Increment.

The home garden was separated by component (house, *terreiro*, orchard-yard and a mixed area) in the RiSCAN Pro 2.1 software, and then, for each component five random individuals were chosen, for calculation of the total height with the tool Measurement Coordinate Points. Each individual was isolated in the software RiSCAN Pro 2.1, and then calculated the variable (an average of three measurements). The coefficient of variation was calculated for height of the individual. The plants were classified according to their height, in a small size (up to 1.5 m in height), medium size (between 1.5 m and 5 m in height) and high in size (above 5 m in height).

Figure 3. Riegl VZ-1000 TLS terrestrial laser scanner (TLS) in action, scanning the mixed-area section in the home garden of Espera Feliz

3. RESULTS

3.1. Characteristics of the homegardens

The age of the homegardens ranged from five to 20 years, the area from 1990 to 8830 m^2, and the altitude from 590 m to 903 m (Table 1). The size of the families varied from three to twelve with a mean of six people. All the women interviewed answered that all members of their families participate in the management activities of the homegardens, including the choice of the species of plant to be planted, decision that is made by preferences of the family, as well as in the search of an opportunity to sell products of high demand in the market. However, it can be appreciated a greater control by the women on the destiny of the products and on the management of the generated income.

Table 1. Characteristics of the surveyed properties where homegardens are located

Municipality	Community	Coordinates	Area of the property (m^2)	Area of the homegarden (m^2)	Altitude (m)
Acaiaca	Mata-cães	20°26'43.76"S 43°2'53.17"W	2,400	2,120	590
Espera Feliz	Assentamento Padre Jesus	20°36'35.67"S 41°51'19.12"W	48,400	3,150	903
Simonésia	Ribeirão Novo	19°54'47.54"S 41°57'10.97"W	24,200	1,990	729
Viçosa	Violeira	20°43'33.15"S 42°51'19.95"W	24,000	8,830	647

In the interviews, all the women indicated that the management of their homegardens intends to be based on Agro-ecological premises. None of the families uses pesticides or synthetic fertilizers in the management of homegardens. All families use kitchen organic litter and crop residues as a source of organic fertilizer to be incorporated into the soil. In addition, spontaneous vegetation is maintained in the soil, as well as leaf litter and tree branches, as a practice covering the soil to its conservation and control of spontaneous weeds. Also, despite being complex and varied cropping systems, all families have specific areas for, mainly, cultivation of trees and shrubs, vegetables, medicinal plants, ornamentals and animal breeding.

Figure 4. Soil coverage with corn scrap and husk (a) and some of the creole varieties of corn in the home garden of Acaiaca (b)

The home garden of Acaiaca is worked by all the members of the family. Their sources of income are the pension of the father and the mother, the sale of their products through the

National School Feeding Program - PNAE[2] and the occasional work of the father and the sons. The home garden of Espera Feliz is mainly worked by the woman with the collaboration of her mother. Prior to the establishment of the home garden, the land was dedicated to the production of coffee in monoculture. She has no access to local markets for selling her products of the homegarden, so all the production is destined to in-house consumption. The home garden in Simonésia is managed by all the family, but who leads the activities and spend most of the time in it is daughter; however, the mother is who decides what to plant. The production of the homegarden is mainly destined for family consumption, and the surpluses are sold through PNAE or directly to consumers. It is the only property surveyed that produces fish, being all the animal production (chickens, ducks and fish) destined to self-consume, except for eggs that are also for sale. The home garden of Viçosa is managed by the couple, but who spend most of the time in it is the woman and she decides what species to plant, especially for commercialization, since, apart from the production for family consumption, they give a very high emphasis to the production for commercialization of the products both to customers who are going to look for vegetables and fruits directly, as well as the sale in three local markets in Viçosa. As it is a large homegarden, they have to buy bovine manure for fertilization of the plants, despite the availability of chicken manure that is not enough to cover all the area.

3.2. Agrobiodiversity

We identified 246 different vegetal species distributed in 81 botanical families. In Acaiaca we found 118 species (51 families), in Espera Feliz 89 species (44 families), in Simonesia 62 species (35 families) and in Viçosa 156 species (66 families). The most diverse families are Asteraceae, with 22 species and Lamiaceae, with 21. Only 16 species were common for all the homegardens, representing 6.7% of the total. The species were classified according to their habit of growth in herbaceous, shrub and arboreal, of which the most numerous group is herbaceous, with 146 species, shrub with 38 species and arboreal with 62 species. In the case of animal species, six species in same number of families were identified, five of them in Acaiaca,

[2] PNAE is a social assistance program of the federal government of Brazil in charge of offering school feeding to students of all stages of public elementary education.

three in Espera Feliz, five in Simonésia and two in Viçosa. Two of them were common in all the homegardens (*Canis lupus familiaris* and *Gallus gallus domesticus)*.

Figure 5. Flower in the home garden of Espera Feliz (a) and a chicken coop in the home garden of Viçosa (b)

Considering the indexes of richness, it can be perceived that all homegardens have high values of richness (Table 2). With the values of the Whittaker index and the distances between the homegardens (Table 3). For similarity and diversity, both Sorensen and Jaccard indexes were calculated. Sorensen indexes (higher 0.460, lower 0.277) were higher than Jaccard's index (higher 0.299, lower 0.208), however, in both cases little similarity between the composition of the homegardens is demonstrated (Table 4).

Table 2. Relationship between the homegarden area (A) and plant species richness (S)

	Acaiaca	Espera Feliz	Simonésia	Viçosa
S (number of species)	118	89	62	156
A (area in m^2)	2.120	3.150	1.990	8.830
d	15,406	11,048	8,162	17,169

Table 3. Values of the Whittaker index (βW) and the distances (km) between the home gardens

Distance (km)	**Beta diversity (β^W)**			
	Acaiaca	Espera Feliz	Simonesia	Viçosa
Acaiaca	-	0,556	0,656	0,540
Espera Feliz	126	-	0,656	0,559
Simonesia	129	77	-	0,651
Viçosa	37	105	130	-

Table 4. Values of similarity coefficients expressed with the Jaccard and Sorensen indexes

		Jaccard (CJ)			
Sorensen (CS)		Acaiaca	Espera Feliz	Simonésia	Viçosa
	Acaica	-	0.286	0.208	0.299
	Espera Feliz	0.444	-	0.208	0.283
	Simonésia	0.344	0.344	-	0.211
	Viçosa	0.460	0.394	0.277	-

3.3. Uses

As seen in Table 5. **Plant species of herbaceous growth found in the homegardens of the four municipalities surveyed and their uses** for herbaceous species, Table 6 for shrubs and

Table 7 for trees and palms, the most common registered use is food, with 147 vegetal species distributed in 51 families, from which 87 species and 27 families were herbaceous, 16 species and 11 families were shrubs and 44 species and 23 families were trees and palms, The second most diverse category was medicinal, with 69 species, distributed in 32 families, from which 49 species and 21 families were herbaceous, 12 species and 9 families were shrubs and 8 species in7 families were trees. Then, the third most diverse category was ornamental, with 56 species distributed in 37 families, from which 31 species in 22 families were herbaceous, 15 species in 13 families were shrubs and 10 species in eight families were trees and palms. In the fodder category there were four species distributed in equal number of families, three of them herbaceous and one tree. The category "other uses" contained 13 species in 11 families, being three herbaceous in three families, four shrubs in four families and five trees in four families. The uses included in this category were living fence (five species distributed in five families), repellent (two species distributed in two families); green manure (two species distributed in one family) and dye, wood, firewood and utensil (one specie for each use). Some of the plant species were considered in more than one category, like food and medicinal (20 species), food and ornamental (12 species), ornamental and other (four species), ornamental and medicinal (three species), food and other (two species) and food and fodder (two species).

For animals, four species (*Sus scrofa domesticus, Carina moschata, Gallus gallus domesticus* and *Oreochromis niloticus)* were categorized as food and two (*Canis lupus familiaris* and *Felis silvestris catus)* as companionship. Just one family breeds *S. scrofa domesticus* and another breeds *O. niloticus.* On the other hand, *C. lupus familiaris* was recorded in all the home gardens (Table 8).

Despite participating in exchanges of experiences with other agroecological farmers, and storing seeds of some traditional species and varieties, one of the things that the farmers of Acaiaca, Espera Feliz and Viçosa indicated lack in their properties is an exclusive space to maintain a seed bank. The family of Acaiaca was the only one of the visited ones that keeps a bank of seeds, emphasizing the storage of 10 traditional varieties of corn, eight of bean and five of pumpkin (Table 9).

Figure 6. Some of the creole varieties of the seed bank in the home garden of Acaiaca

Table 5. Plant species of herbaceous growth found in the homegardens of the four municipalities surveyed and their uses

No.	Botanical Family	Scientific name	Vernacular name	Uses	Municipality[3]			
					ACA	ESP	SIM	VIC
1	Adiantaceae	*Adiantum* sp.	Avenca	Ornamental	x			
2	Agavaceae	*Agave americana* L.	Agave (Sin: *Piteira)*	Ornamental		x	x	
3	Amaranthaceae	*Alternanthera dentata* (Moench) Stuchlik	Terramicina	Medicinal		x		
4		*Amaranthus deflexus* L.	Caruru	Food		x		x
5		*Amaranthus spinosus* L.	Caruru Roxo	Food	x			
6		*Beta vulgaris* L.	Beterraba	Food				x
7		*Celosia argentea* L. var. cristata	Crista de Galo	Food/Ornamental			x	x
8		*Chenopodium ambrosioides* L. Vell	Santa Maria	Fodder	x	x		
9		*Pfaffia glomerata* (Kunth) Spreng	Ginsen brasileiro	Medicinal	x			
10		*Spinaceae oleracea* L.	Espinafre	Food				x
11	Amaryllidaceae	*Allium cepa L.*	Cebola de Cabeça	Food	x			
12		*Allium porrum* L.	Alho Poró	Food	x	x	x	x
13		*Allium sativum* L.	Alho	Food		x		x
14		*Allium schoenoprasum* L.	Cebolinha	Food/Medicinal	x	x	x	x
15		*Allium tuberosum* Rottler ex Spreng.	Nirá	Food	x			
16		*Nothoscordum striatum* (Jacq.) Kunth	Alho-de-folha	Food		x		
17		*Tulbaghia violacea*	Alho de Ano Todo	Food	x			
18	Apiaceae	*Apium graveolens*	Aipo	Food	x			
19		*Cyclospermum leptophyllum*	Aipo Chimarrão	Medicinal			x	
20		*Daucus carota* L.	Cenoura	Food	x			x
21		*Foeniculum vulgare* Mill.	Funcho	Medicinal				x

[3] ACA: Acaiaca; ESP: Espera Feliz, SIM: Simonésia; VIC: Viçosa

22		*Petroselinum crispum* (Miller) Nyman & A.W.Hill.	Salsinha	Food	x		x	x
23	Apocynaceae	*Catharanthus roseus* (L.) G. Don	Boa noite	Ornamental		x		x
24	Araceae	*Anthurium andraeanum*	Antulho	Ornamental			x	
25		*Colocasia esculenta* (Schott) F.T.Hubb. & Rehder	Inhame(sin: *Taro*)	Food	x		x	x
26		*Epipremnum aureum* L. (Engl)	Jibóia	Ornamental				x
27		*Xanthosoma riedelianum* (Schott) Schott	Mangarito	Food				x
28		*Xanthosoma taioba*E.G. Gonç.	Taioba	Food	x	x		x
29	Asphodelaceae	*Aloe vera* L.	Babosa	Medicinal	x	x		x
30	Asteraceae	*Achillea millefolium* L.	Mil Folhas (Sin: *Macela*)	Medicinal				x
31		*Achyrocline satureoides* (Lam.) DC.	Marcela	Medicinal	x			
32		*Artemisia absinthium* L.	Losna	Ornamental/Medicinal	x	x		
33		*Artemisia alba* Turra	Cânfora (Sin: *Recaída*)	Medicinal			x	
34		*Baccharis timera* (Less.) DC.	Carqueja	Medicinal			x	
35		*Chicorium intybus* L.	Almeirão	Food			x	x
36		*Chrysanthemum leucanthemum* L.	Crisântemo	Ornamental/Other		x		x
37		*Coreopsis grandiflora* Hogg ex Sweet.	Camomila Amarela	Medicinal			x	
38		*Cosmos bipinnatus* Cav.	Cosme	Ornamental	x			
39		*Dahlia pinnata* Cav.	Dália	Food/Ornamental	x	x		x
40		*Erechtites valerianifolius* (Link ex Spreng.) DC.	Capiçoba	Food	x			x
41		*Galinsoga parviflora* Cav.	Guasca	Food/Medicinal	x	x		
42		*Galinsoga quadriradiata* Ruiz & Pav.	Picão Branco	Food/Medicinal		x		x
43		*Hellianthus annus* L.	Girassol	Food	x	x		
44		*Lactuca canadensis* L.	Almeirão de Árvore	Food	x			
45		*Lactuca sativa*	Alface	Food				x
46		*Smallanthus sonchifolius* (Poeppig &	Yacon	Food	x			x

		Endlicher) H. Robinson						
47		*Solidago chilensis* Meyen	Arnica	Medicinal	x	x		
48		*Sonchus oleraceus* L.	Serralha	Food		x		x
49		*Tagetes filifolia* Lag.	Cravo	Food/Ornamental	x	x	x	x
50		*Taraxacum officinale* Wiggers	Dente de Leão	Food/Medicinal				x
51		*Zinnia elegans* (Jacq).	Moça Véia	Ornamental			x	
52	Balsaminaceae	*Impatiens walleriana* Hook. F.	Beijo	Food/Ornamental	x		x	x
53	Begoniaceae	*Begonia elatior* Hort. ex Steud	Begônia	Ornamental				x
54		*Begonia semperflorens* Link & Otto	Begoninha	Food/Ornamental				x
55	Bignoniaceae	*Frederica chica* (Humb. & Bonpl.) L. G. Lohmann	Pariri (Sin: *Crajiru*)	Medicinal	x			
56	Boraginaceae	*Symphytum officinale* L.	Confrei	Medicinal			x	
57	Brassicaceae	*Brassica juncea* (L.) Czern	Mostarda	Food	x		x	x
58		*Brassica oleracea* (L.) var. *capitata*	Repolho	Food		x	x	x
59		*Brassica oleracea* L. var. *acephala*	Couve	Food	x	x		x
60		*Brassica oleracea* L. var. *botrytis*	Couve Flor	Food				x
61		*Brassica oleracea* L. var. *capitata* f. *rubra*	Repolho Roxo	Food				x
62		*Brassica oleracea* L. var. *italica* Plenck	Brócolis	Food	x	x		x
63		*Brassica rapa* L.	Couve Chinesa	Food				x
64		*Eruca sativa* Mill.	Rúcula	Food		x		x
65	Bromeliaceae	*Ananas ananassoides* (Baker) L.B.Sm.	Abacaxi de Jardim	Food				x
66		*Annanas comosus* L. Merril	Abacaxi	Food	x	x	x	
67		*Bromelia antiacantha* Bertol.	Bromélia	Ornamental				x
68	Cactaceae	*Hylocereus undatus* (Haw.) Britton & Rose	Pitaia (Sin: *Saborosa*)	Food	x			x
69		*Pereskia aculeata* Mill.	Ora-pro-nobis (Sin:*Lobrobro*)	Food				x
70	Cannaceae	*Canna edulis* Ker Gawl.	Ararutão	Ornamental/Food				x
71	Caprifoliaceae	*Sambucos australis* Chan & Schltdl	Sabugueiro	Medicinal	x			

72	Caryophyllaceae	*Dianthus chinensis* L.	Cravina	Ornamental		x		x
73	Celastraceae	*Maytennus illicifolia* (Schrad.) Planch.	Espinheira Santa	Medicinal		x		x
74	Commelinaceae	*Tripogandra diuretica* (Mart.) Handlos	Trapoeraba	Food		x		x
75	Convolvulaceae	*Ipomoea batatas* L.	Batata Doce Roxa	Food	x	x	x	x
76		*Struthanthus marginatus* (Ders.) G. Don	Erva de Passarinho	Medicinal				x
77	Costaceae	*Costus spicatus* (Jacq.)	Cana-de-macaco	Ornamental		x		
78	Crassulaceae	*Kalanchie pinnata* (Lam.) Pers.	Flor da Fortuna (Sin: *Saião*)	Medicinal	x			x
79		*Sedum dendroideum*Moc & Sessé ex DC.	Bálsamo	Medicinal	x			x
80	Cucurbitaceae	*Curcubita moschata* Duch.	Abóbora	Food		x		x
81		*Curcubita pepo* L.	Abobrinha	Food				x
82		*Cyclanthera pedata* (L.) Schrad.	Chuchu de Vento	Food	x			
83		*Luffa aegyptiaca* Mill.	Bucha Vegetal	Other	x			x
84		*Momordica charantia* L.	Melão de São Caetano	Food/Medicinal		x		x
85		*Sechium edule* (Jacq.) Swartz	Chuchu	Food		x		x
86	Davalliaceae	*Nephroleps exaltata* L. (Schott)	Samambaia	Ornamental	x			
87	Dioscoreaceae	*Dioscorea bulbifera* L.	Cará	Food	x			
88	Euphorbiaceae	*Codiaeum variegatum* (L.) A.Juss.	Brasileirinha	Ornamental			x	x
89	Fabaceae	*Arachis hypogaea* L.	Amendoin Preto	Food	x			
90		*Arachis pintoi* Krapov. & W.C. Greg.	Amendoin Forrageiro	Ornamental				x
91		*Lablab pupureus* (L.) Sweet	Lab-Lab	Food				x
92		*Phaseolus lunatus* L.	Fava branca	Food	x			
93		*Phaseolus vulgaris* L.	Feijão Rosinha	Food	x			
94		*Pisum sattivum* L.	Ervilha	Food				x
95		*Vigna unguiculata* (L.) Walp.	Vagem de Metro	Food			x	x
96	Iridaceae	*Iris germanica* L.	Iris (Sin: *Lirio Roxo)*	Ornamental	x	x		x
97	Lamiaceae	*Glechoma hederacea* L.	Erva Terrestre	Medicinal	x			
98		*Lavanda stoechas* Mill.	Alfazema	Food/Medicinal	x			

99		*Leonuros sibiricus* L.	Macaé	Medicinal	x			x
100		*Melissa officinalis* L.	Melissa (Sin: *Erva cidreira)*	Medicinal	x			
101		*Mentha arvense* L. var *piperaceum* Holmes.	Vique	Medicinal	x			
102		*Mentha spicata* L.	Hortelã	Food/Medicinal	x		x	x
103		*Mentha sylvestris* L.	Levante (Sin: *Hortelã Selvagem)*	Medicinal			x	
104		*Mentha* x *piperita* L.	Menta	Medicinal				x
105		*Ocimum bassilicum* L.	Manjericão	Food/Medicinal	x	x		x
106		*Ocimum suave* Wild.	Alfavaquinha	Medicinal		x		
107		*Ocimum gratissimum* L.	Alfavaca	Food/Medicinal	x			
108		*Origanum vulgare L.*	Orégano	Food/Medicinal	x	x		x
109		*Plecthanthus amboinicus* (Lour) Spreng	Hortelã Picante	Food/Medicinal	x			
110		*Plecthanthus grandis* (Cremer) R. H. Wellenze	Boldo	Medicinal	x	x		x
111		*Plecthanthus ornatus* Codd.	Boldo do Chile	Medicinal				x
112		*Salvia officinalis* L.	Sálvia	Medicinal	x	x		
113		*Stachys byzantina* K. Koch	Peixinho de Horta	Food				x
114	Laxmanniaceae	*Cordyline terminalis* (L.) Kunth	Dracena Vermelha	Ornamental			x	x
115	Liliaceae	*Lilium candidum* L.	Lírio	Ornamental	x	x		x
116	Malvaceae	*Alcea rosea* L.	Malva de Cheiro	Medicinal	x			
117		*Hibiscus acetosella* Welw. Ex Hiern	Vinagreira Roxa	Ornamental/Food				x
118		*Hibiscus sabdariffa* L.	Vinagreira	Ornamental/Food				x
119	Marantaceae	*Maranta arundinacea L.*	Araruta	Food	x			
120	Musaceae	*Musa x paradisiaca L.*	Banana	Food/Fodder	x	x	x	x
121	Orchideaceae	*Arundina bambusifolia*	Orquídea de Chão	Ornamental				x
122	Oxalidaceae	*Oxalis latifolia* Kunt	Trevo	Food/Medicinal	x		x	x
123	Phyllantaceae	*Phyllanthus niruri L.*	Quebra Pedra	Medicinal	x	x		x
124	Phytolaccaceae	*Petiveria alliacea* L.	Guiné	Medicinal	x			

125	Plantaginaceae	*Plantago australis L.*	Tanchagem	Medicinal	x	x		x
126	Poaceae	*Andropogon nardus* L.	Citronela	Other		x		x
127		*Cymbopogon citratus* (DC.) Stapf.	Capim Cidreira	Medicinal	x			x
128		*Saccharum officinarum* L.	Cana-de-açúcar	Food	x	x	x	x
129		*Zea mays L.*	Milho	Food/Fodder	x	x	x	x
130	Polygonaceae	*Polygonum acre* HB & Kunth	Cabiçoba	Food	x			
131		*Rumex acetosa* L.	Azedinha	Food				x
132	Portulacaceae	*Portulaca oleracea* L.	Beldroega	Food				x
133		*Rubus rosifolius Sm.*	Framboesa	Food				x
134		*Ruta graveolens L.*	Arruda	Medicinal	x			x
135	Solanaceae	*Capsicum annum* L.	Pimentão	Food	x		x	
136		*Lycopersicon pimpinellifolium L.*	Tomate Cereja	Food	x	x	x	x
137		*Solanum gilo* Raddi	Jiló	Food	x		x	x
138		*Solanum melongena* L.	Beringela	Food	x			x
139		*Solanum muricatum* Ait.	Melão Chileno	Food	x			x
140		*Solanum tuberosum* L.	Batata-Inglesa	Food		x		
141	Tropaeolaceae	*Tropaolum majus* L.	Capuchinha	Food				x
142	Violaceae	*Viola tricolor* L.	Amor Perfeito	Ornamental			x	
143	Zingiberaceae	*Curcuma longa L.*	Açafrão da Terra (Sin: *Cúrcuma)*	Food/Medicinal	x	x	x	
144		*Curcuma zedoaria* (Christm.) Roscoe	Zedoária	Food/Ornamental				x
145		*Etlingera elatior* (Jack) R.M. Sm.	Bastão do Imperador	Food/Ornamental		x		x
146		*Zingiber mioga* (Thumb.) Roscoe	Gengibre	Food/Medicinal	x			x

Table 6. Plant species of shrub growth found in the homegardens of the four municipalities surveyed and their uses

No.	Family	Scientific name	Vernacular name	Uses	Municipality[4]			
					ACA	ESP	SIM	VIC
1	Agavaceae	*Yucca guatemalensis* L.	Pata de Elefante	Ornamental				x
2	Apocynaceae	*Nerium oleander L.*	Espirradeira	Medicinal		x		
3		*Plumeria rubra* L.	Jasmin	Ornamental			x	x
4	Aspargaceae	*Dracaena sanderiana* Hort.	Dracena	Ornamental		x		
5	Asteraceae	*Vernonanthura phosphorica*	Assapeixe	Medicinal			x	
6	Bignoniaceae	*Pyrostegia venusta* (Ker Gawl.) Miers.	Cipó-de-São-João	Medicinal		x		
7	Euphorbiaceae	*Euphorbia pulcherrima* (Willd. Ex Klotzsch, 1834)	Poinsétia	Ornamental		x		
8		*Jatropha multifida*L.	Merthiolate (Sin: *Bálsamo)*	Medicinal				x
9		*Manihot esculenta*	Mandioca	Food	x	x	x	x
10		*Riccinus communis* L.	Mamona	Medicinal/Food	x	x	x	x
11	Fabaceae	*Cajanus cajan* (L.) Huth	Feijão Guandú	Food/Other	x			
12	Geraniaceae	*Pelargonium hortotum* L. H. Bailey	Jardineira (Sin: *Gerânio*)	Ornamental/Medicinal		x		x
13	Hydrangeaceae	*Hydrangea macrophylla* (Thunb.) Ser.	Hortência	Ornamental		x	x	
14	Lamiaceae	*Plectranthus madagascariensis* (Pers.)	Plantinha de Nossa Senhora	Medicinal		x		
15		*Rosmarinus officinalis* L.	Alecrim	Food/Medicinal	x	x		
16		*Rotheca myricoides* (Hochstetter)Steane & Mabberley.	Borboleteira	Ornamental	x			
17		*Salvia hispanica* L.	Chia	Food				x
18	Magnoliopsida	*Rhododendron simsii* (Planch.) L.H. Bailey	Azaléia	Ornamental				x
19	Malvaceae	*Abelmoschus esculentus (*L.) Moench	Quiabo	Food	x		x	x
20		*Hibiscus rosa-sinensis L.*	Hibisco	Ornamental/Other	x		x	x

[4] ACA: Acaiaca; ESP: Espera Feliz; SIM: Simonésia; VIC: Viçosa

21	Melastomataceae	*Tibouchina* sp.	Quaresma de casa	Ornamental		x		
22	Moraceae	*Rubus sellowii* Cham. & Schltdl	Amora do mato	Food	x			
23	Oleaceae	*Ligustrum sinense* Lour.	Ligustinha	Other				x
24	Passifloraceae	*Passiflora edulis* Sims.	Maracujá	Food	x	x		x
25		*Passiflora nitida*	Maracujá do mato	Food	x			
26	Piperaceae	*Piper aduncum* L.	João Brandinho	Medicinal			x	x
27	Rosaceae	*Malus domestica* Borkh	Maçã	Food		x		x
28		*Rosa centifolia* L.	Roseira	Ornamental	x	x	x	x
29	Rutaceae	*Coffea arabica* L.	Café	Food	x	x	x	
30	Solanaceae	*Capsicum baccatum* L.	Pimenta Comari	Food	x			x
31		*Cestrum nocturnum* L.	Dama da Noite	Ornamental				x
32		*Solanum betaceum* Cav.	Tomate de Árvore	Food	x			
33		*Solanum cernuum* Vell.	Panacéia	Medicinal		x		
34		*Solanum* sp.	Boldo elixir	Ornamental		x		
35	Verbenaceae	*Aloysia gratissima* (Gillies & Hook.).	Lavanda	Medicinal		x		
36		*Duranta repens* L.	Pingo de Ouro	Ornamental/Other		x	x	x
37		*Lantana camara* L.	Camará	Ornamental/Medicinal	x			
38	Vitaceae	*Vitis labrusca* L.	Videira	Food	x	x		x

Table 7. Plant species arboreal growth found in the homegardens of the four municipalities surveyed and their uses

No.	Family	Scientific name	Vernacular name	Uses	Municipality[5]			
					ACA	ESP	SIM	VIC
1	Anacardiaceae	*Mangifera indica* L.	Manga	Food	x	x	x	x
2		*Shinus terebinthifolius* Raddi	Aroeira Pimenteira	Food	x			
3		*Spondias purpurea* L.	Siriguela	Food				x
4	Annonaceae	*Annona crassiflora* Mart.	Articum	Food				x
5		*Annona mucosa* Jacq.	Biribá	Food		x		
6		*Annona muricata*	Graviola	Food	x			x
7		*Annona squamosa* L.	Fruta do Conde	Food	x			x
8	Arecaceae	*Archontophoenix cunninghamiana* H.Wendl. & Drude	Palmeira Real	Ornamental/Other				x
9		*Areca* sp.	Areca	Ornamental				x
10		*Cocos nucifera* L.	Coco	Food				x
11		*Euterpe edulis*	Palmeira Jussara	Food	x			
12		*Phoenix roebelenii* O'Brien	Palmeira Phoenix	Ornamental				x
13	Arecaceae	*Syagrus romanzoffiana* (Cham.) Glassman	Jerivá (Sin*: Coquinho babão*)	Food				x
14	Bignoniaceae	*Handroanthus albus*	Ipê-amarelo	Ornamental				x
15	Bixaceae	*Bixa orellana*	Urucum	Other		x		x
16	Bombacaceae	*Pachira aquatica* Abul.	Munguba	Food	x	x		
17	Caricaceae	*Carica papaya* L.	Mamão	Food	x		x	x
18	Cupressaceae	*Cupressus lusitanica* Miller.	Cipreste	Ornamental				x
19	Euphorbiaceae	*Euphorbia tirucalli*	Avelós	Medicinal	x			
20		*Sapium glandulosum* (L.) Morong	Leitera	Other		x		
21	Fabaceae	*Inga edulis* Mart.	Ingá	Food				x

[5] ACA: Acaiaca; ESP: Espera Feliz; SIM: Simonésia; VIC: Viçosa

22		*Piptadenia gonoacantha* (Mart.) J. F. Macbr.	Pau Jacaré	Other			x	
23		*Schizolobium parahyba* (Vell.) S.F. Blake	Guapuruvu	Ornamental			x	
24		*Senna macranthera* (DC. ex Collad.) H.S.Irwin & Barneby	Fedegoso	Other				x
25	Lauraceae	*Laurus nobilis* L.	Louro	Food/Medicinal	x			x
26		*Persea americana*	Abacateiro	Food	x	x	x	x
27	Lecythidaceae	*Lecythis pisonis* Cambess.	Sapucaia	Food	x			
28	Lythraceae	*Lagerstroemia indica* L.	Resedá (Sin: *Minerva*)	Ornamental	x			
29		*Punica granatum* L.	Romã	Food/Medicinal			x	x
30	Malpighiaceae	*Bunchosia armeniaca* (Cav.) DC.	Caferana (Sin: *Ciruela*)	Food			x	
31		*Malpighia emarginata* DC.	Acerola	Food	x	x		x
32	Melastomataceae	*Tibouchina granulosa* (Desr.) Cogn	Quaresmeira	Food/Ornamental			x	x
33	Moraceae	*Ficus carica* L.	Figo	Food/Medicinal	x			x
34		*Morus nigra* L.	Amora Preta	Food/Medicinal	x	x		x
35	Myrtaceae	*Eucaliptus* sp.	Eucalipto	Other		x	x	
36		*Eugenia uniflora* L.	Pitangueira	Food	x	x	x	
37		*Plinia cauliflora* (Mart.) Kausel	Jabuticaba	Food		x		x
38		*Psidium guajava* L.	Goiabera	Food	x	x	x	x
39		*Psidium guineense* S.W.	Araçá	Food	x			x
40		*Siyzygium cumini* (L.) Skeels	Jamelão	Food			x	
41		*Syzygium malaccense (L.) Merr & L.M.Perry*	Eugênia (Sin: *Jambo)*	Food	x			
42	Nyctaginaceae	*Bougainvillea glabra* Choisy.	Bouganville	Ornamental/Food				x
43	Oleaceae	*Olea europeia* L.	Azeitona	Food			x	
44	Oxalidaceae	*Averrhoa carambola*	Carambola	Food			x	x
45	Pinaceae	*Pinus* sp.	Pinheiro	Ornamental		x		
46	Proteaceae	*Macadamia ternifolia* Maiden & Betche	Macadâmia	Food				x
47	Rhamnaceae	*Hovenia dulcis* Thunb	Ovena (Sin: *Uva do Japão*)	Food				x

48	Rosaceae	*Eriobotrya japonica*	Ameixa Amarela (Sin: *Nêspera)*	Food	x	x		x
49		*Prunus salicina* Lindl.	Ameixa Japonesa	Food		x		x
50		*Pyrus communis* L.	Pêra	Food				x
51	Rubiaceae	*Morinda citrifolia* L.	Noni	Medicinal				x
52	Rutaceae	*Citrus limon* L. Burman F.	Limão	Food	x			x
53		*Citrus limonia Osbeck*	Limão Cravo	Food		x	x	x
54		*Citrus medica* L.	Cidra	Medicinal				x
55		*Citrus reticulata* Blanco	Mexerica	Food	x	x	x	x
56		*Citrus sinensis* Macfad.	Laranja	Food	x	x		x
57		*Citrus tangerine*	Tangerina	Food				x
58		*Citrus x limonia*	Limão doce	Food				x
59	Sapindaceae	*Litchi chinensis* Sonn.	Lychia	Food				x
60	Sapoteceae	*Pouteria caimito* (Ruiz & Pav.) Radlk.	Abiu	Food				x
61	Solanaceae	*Solanum bullatum* Vell.	Capoeira Branca	Fodder	x	x	x	
62	Tiliaceae	*Luhea divaricata* Mart.	Açoita Cavalo	Medicinal	x			

Table 8 Animal species founded in the surveyed homegardens

No.	Family	Scientific name	Vernacular name	Uses	Municipality[6]			
					ACA	ESP	SIM	VIC
1	Canidae	*Canis lupus familiaris* Linnaeus, 1758	Cachorro	Companionship	x	x	x	x
2	Felidae	*Felis silvestris catus* Schreber, 1775	Gato	Companionship	x	x	x	
3	Suidae	*Sus scrofa domesticus* Linnaeus, 1758	Porco	Food	x			
4	Anatidae	*Carina moschata* Linnaeus, 1758	Pato	Food	x		x	
5	Phasianidae	*Gallus gallus domesticus* Linnaeus, 1758	Frango, galinha e ou galo	Food	x	x	x	x
6	Cichlidae	*Oreochromis niloticus* Linnaeus, 1758	Tilápia	Food			x	

[6] ACA: Acaiaca; ESP: Espera Feliz; SIM: Simonésia; VIC: Viçosa

Table 9. Species and traditional varieties of the bank of seed of the home garden in Acaiaca

Family	Scientific name	Vernacular name	Varieties
Fabaceae	*Cajanus cajan*	Feijão guandu	-
	Phaseoulus vulgaris	Feijão	Travessia, vermelho, roxinho, carioca, divino espírito santo, verde, vermelho-amarelo e fartura.
	Glycine max		Branca e preta
Poaceae	*Zea mays*	Milho	Pipoca arco-iris, riscado, ciana sobrália roxo, vermelho, pipoca branco, pipoca roxo, branco, roxo, preto e pipoca amarelo
Apiaceae	*Pimpinella anisum*	Erva doce	-
Cucurbitaceae Asteraceae	*Cucurbita* sp.	Abóbora/moranga	Coração de boi, gigante, moranga grande amarela, cabaça, moranga gigante.
	Trichosanthes cucumerina	Quiabo de metro	-
	Hellianthus annus	Girassol	Preto e miudo
Amaranthaceae	*Amaranthus* sp.	Uurucum	-
Sapindaceae	*Litchi chinensis*	Lichia	-
Rubiaceae	*Morinda citrifolia*	Noni	-

3.4. Structure

The processing of the point clouds generated by the terrestrial laser scanner showed a standard deviation ranging from 0.0424 to 0.0687 meters, which is slightly above the maximum value recommended by the manufacturer (for static surfaces), which is 0.03 meters. Based on the eight points scanned in the field, seven polydatas were processed which, together, generated a three-dimensional model representing the home garden studied. Due to the equipment was calibrated with panorama 20 and then, the point cloud of the three-dimensional model of the home garden was so big, making it difficult to analyze it, so it had to be filtered with the tool "Increment", passing from a distance of 0.02 meters to 0.1 meters between points and then

dividing the original polydata into four new smaller polydatas in order to facilitate the visibility and prior identification of the structures that compose the home garden.

Figure 7. Calibration of the TLS before scanning the home garden of Espera Feliz

With the creation of four new smaller polydates, each one representing a different area of the home garden (house, *terreiro*, orchard-yard and mixed area), the total height of random plants was calculated (Figure 8). The orchard-yard area presented a greater number of points, being directly related to the volume of its vegetal mass. The house polydata presented low number of point related with biomass.

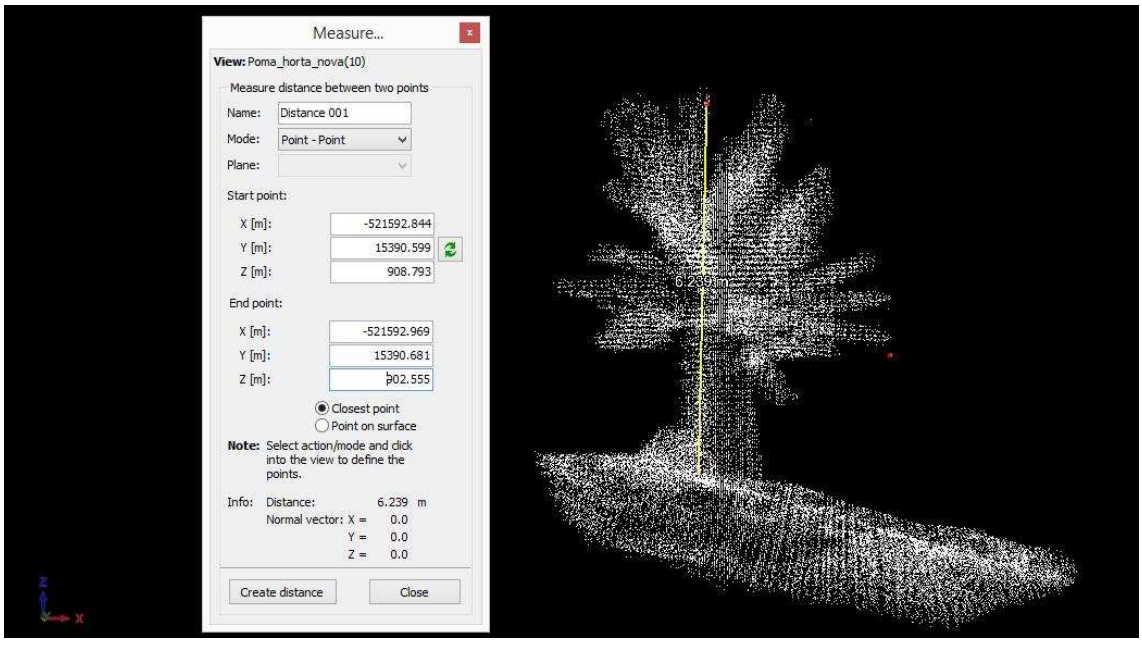

Figure 8. Image generated by the software RiscanPRO in the process of isolation and verification of the height of a random individual

After isolating and measuring the height of the plants, a red color was given to plants of low size, yellow to medium-sized plants and blue to the tall plants, to visualize them in the polydata generated from the entire home garden. There was no uniformity related to presence of plant species and it was not possible, using plant height, to identify the strata (

Table 10).

Table 10. Measurements of total heights (m) of random plants by each sector of the home garden, and their average value

Plant	Sector	Height 1 (m)	Height 1 (m)	Height 1 (m)	Average height (m)	CV[7] %
1	House	0,842	0,869	0,879	0,863	2,22
2	House	1,283	1,264	1,265	1,271	0,84
3	House	2,634	2,627	2,62	2,627	0,27
4	House	1,958	2,025	2,024	2,002	1,92
5	House	2,743	2,694	2,684	2,707	1,17
1	Mixed area	1,3	1,293	1,305	1,299	0,46
2	Mixed area	2,03	2,102	2,064	2,065	1,74
3	Mixed area	3,128	3,096	3,132	3,119	0,63
4	Mixed area	3,028	3,166	3,014	3,069	2,74
5	Mixed area	2,81	2,85	2,82	2,827	0,74
1	Orchard-yard	7,815	7,689	7,4413	7,648	2,49
2	Orchard-yard	6,239	6,673	6,774	6,562	4,33
3	Orchard-yard	8,105	8,089	8,139	8,111	0,31
4	Orchard-yard	6,59	6,618	6,553	6,587	0,49
5	Orchard-yard	2,228	2,252	2,239	2,240	0,54
1	*Terreiro*	5,381	5,413	5,461	5,418	0,74
2	*Terreiro*	3,09	2,889	3,174	3,051	4,80
3	*Terreiro*	1,392	1,556	1,552	1,500	6,24
4	*Terreiro*	1,012	0,992	1,037	1,014	2,22
5	*Terreiro*	3,134	3,196	3,157	3,162	0,99

[7] CV: Coefficient of variation

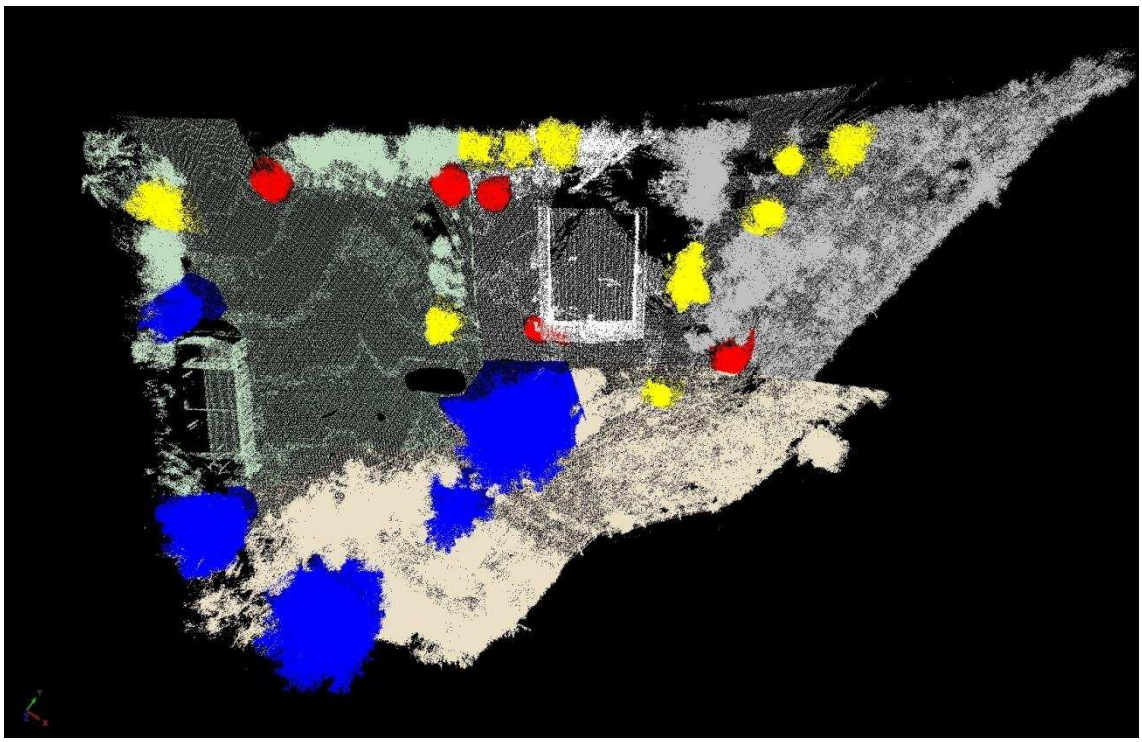

Figure 9. Top view of the home garden with plants sorted by color according to their height. (Red color for plants of low size, yellow to medium-sized plants and blue to the tall plants).

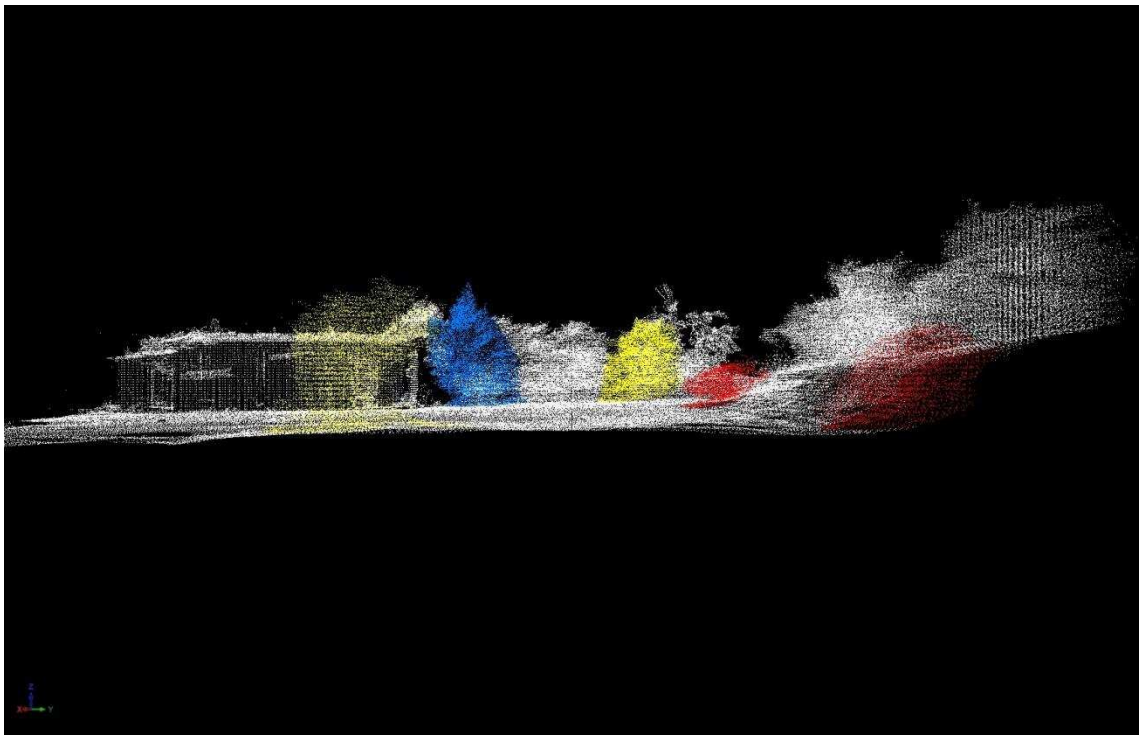

Figure 10. Lateral view of the home garden with plants sorted by color according to their height. (Red color for plants of low size, yellow to medium-sized plants and blue to the tall plants).

4. DISCUSSION

One of the advantages of participatory research methodologies, through visits, dialogues and interviews to farmers is that, in addition to being a tool for the exchange of information between researchers and farmers, away from the vision of classical science, in which the farmers are only seen as receivers of knowledge, it allows the rescue and valorization of ancestral and traditional knowledge promoting the use of more sustainable practices and trying to understand the real needs of peasant communities, going hand in hand with the precepts encouraged by agroecology (Cardoso & Ferrari, 2006).

Rural families confer high importance to homegardens, and this is demonstrated mainly in the type of management given to these areas. The home gardens of Minas Gerais are spaces that allow the diversification of food and also the union of families. It seeks to supply and satisfy the needs of the families of the families of Minas Gerais. Historically it is a space linked to female rural activity, and it is they who have the decision power to choose which plant species for family consumption and how to handle this production. In this sense, in seeking to produce healthy and safe food for the consumption of the couple and the children, the production form is based on the precepts of agroecology (Meneses, 2014).

It is important to focus that the conception that farmers have of the home garden area includes components that are much further from the house, as the classic definition indicates. This is reflected in the Viçosa home garden, which has a size much larger than the rest, which grew in area due to the needs, both food and economic family, which perceived that diversify, expand the garden and planting more fruit tree plants helps meet their food needs and generates significant income that helps family finances. Home gardens do not only have work functions. They are also places of contact with the neighborhood, of coexistence with people and that gather a collection of elements of the culture of rural communities.

In this way, the home garden of Minas Gerais maintains several common elements that allow us to understand the importance of them to meet the needs of families. In general, their structure is composed by the vegetable yard and the orchard that allow the supply of vegetables, legumes, medicinal plants and spices for condiments. The chicken coop and pigsty are often the pride of the farmers, given the importance of animal protein in the rural diet and although they are not present in all the home gardens of the region, they are important components of the local landscape. The *terreiro* is also an important area of the home garden, since that is where most of the encounters with neighbors and friends take place, as well as drying the coffee beans, a crop of high importance in the region. Finally, the house, surrounded by ornamental plants, act as the central component of the structure the home garden, which is where many products from the different areas that make it up and from which other products come from.

High biodiversity rates suggest that home gardens are productive systems alienated from environmentally friendly agro-ecological practices and less dependent on external inputs. The high biodiversity of species is almost always seen from the point of view of food supply for families; however, the high number of species of medicinal use points to the importance of traditional therapeutic practices (Ávila et al., 2017; Zank, 2015). Although the four home gardens are located in the same mesoregion, there is little similarity of biodiversity present in the four properties. The selection of species to include in the home garden is conditioned to the needs and preferences of food, availability of medicine, construction material, etc., typical of each family (Ávila et al., 2017; Fernandes & Nair, 1986; Poot–Pool, van der Wal, Flores–Guido, Pat–Fernández, & Esparza–Olguín, 2015). The agro-ecological exchanges, promoted by the CTA-ZM, contribute to the high biodiversity of home gardens and to highlight the differences between the different properties, since they allow the farmers to obtain different varieties and species chosen by themselves in the seed exchanges according to their particular needs.

Another important aspect to be rescued is the important number of species declared as medicinal plants. Within the definition of the World Health Organization (WHO, 2002) for traditional medicine is the use of herbal medicines that include herbs and herb materials. They also highlight the importance of the use of medicinal plants and ancestral medicine, first as a result of historical and cultural beliefs, and also as an effective tool to treat, diagnose and prevent diseases. Thus, they call on the authorities of the countries to emphasize research in traditional medicine and include it in the national plans of public policies.

It is possible that many of these species are used even for many more activities than those declared by the farmers in the interviews, and that could be evidenced in the visits, as for example, an important number of vegetables (*L. sativa, B. oleraceae, S. oleraceous, D. carota*, among others) are given to animals as fodder.

The high agrobiodiversity of the home gardens of Minas Gerais also has historical connotations. Due to the isolation by the great distances between the communities that began to populate the state from the XVII century were the home gardens the spaces of vegetables, fruit, tubers, condiments and medicinal plants supply for the families of Minas Gerais. In addition, home gardens are places highly related to the kitchen of the houses, since its main function is to provide food to families, to the neighborhood and to the communities. Being strategically located next to the houses allowed satisfying the daily needs of the family, the same that practically did not need to go to the markets or shops of the town and it has been the women who are the ones who command the activities within them. The trips to the town usually occurred on a specific day of the week, where the interpersonal relations of the community were strengthened through the exchange of products (Meneses, 2015; Torres, Martins, & Raposo, 2016). In addition, the variety of ornamental species, besides beautifying the property with its varied and colorful flowers, is a refuge for several species of pollinators that are part of non-harvested species that compose the agrobiodiversity in the home gardens, helping to increase the production of the several crops in the yard and the orchard (FAO, 2004; FAO, 2014).

Although the homegarden of Acaiaca is the only family that has a seed bank, and that in Simonésia agricultural lime is used as corrective of the soil, the other practices are aligned to the agroecological precepts of minimizing the dependence of external inputs, being the most notorious fertilizing with organic material generated in the property, keeping the soil covered with plant litter and having a high number of species. Oliveira, 2015 and Tonini, 2013 in their works in Zona da Mata, also mention that, among the experiences of the farmers visited, the homegardens is characterized by conservation practices that not only ensure soil conservation, but also promote the conservation of biodiversity.

The use of LIDAR technologies for the study of forest systems allows for a wide range of non-invasive activities in these ecosystems and, despite the fact that most research revolves around extractive activities, the study for conservation purposes is taking off (Nadkarni, Parker, & Lowman, 2011; Whitehurst, Swatantran, Blair, Hofton, & Dubayah, 2013). The height estimation of randomly selected plants in the home garden studied showed the existence of material belonging, according to most classifications of the strata, to understory and midstory (Whitehurst et al., 2013). The absence of overstory (trees over 15 meters) in the vertical structure the home garden could be justified by the young age of this (six years of being constituted) and to the fact that previously the place where the home garden currently stands was intended for the production of coffee in monoculture. As there are no previous experiences with laser scanner work in agro-ecological home gardens, it is possible to indicate that there is a high potential for the study of these production units. The applicability of this tool would allow the study of different topics related to the conservation of agro-ecosystems such as evaluation of soil cover, volume of biomass produced, influence of solar energy in different canopies, etc. (Parker & Brown, 2000).

5. CONCLUSIONS

There is a very strong link between home gardens and women. The closeness to the house has made that women are the ones who lead the management activities and the decision

making about what should be done in them, additional to the domestic work. However, all members of the family participate in the work in the home garden.

The choice of the species to be planted and kept in the home garden is basically based on food preferences and need for medicine for family consumption, household ornament, as well as species that can be sold in order to produce additional income to the family.The contribution of external inputs is minimal in home gardens. There is no use of pesticides or synthetic fertilizers, and nutrient recycling and soil cover conservation are the main agricultural practices.

In home gardens, the agrobiodiversity is great, demonstrating the importance of this to meet the needs of the family. In addition, home gardens function as places that favor the in situ conservation of traditional species and varieties, not only of food species, but also allows the rescue and conservation of ancestral knowledge by perpetuating the use of medicinal plants for healing of diseases, demonstrated by the high presence of plants for medicinal use. Also the high presence of ornamental plants indicates that the home gardens are spaces for recreation and rest of the families.

Home gardens of Minas Gerais have a historical tradition that dates back to colonial times. The distance between the new settlements arising from the exploitation of minerals and large urban centers forced families to maintain spaces of land called home gardens destined for the production of a wide variety of easily available and easy to produce food. The home gardens of the Zona da Mata of Minas Gerais have a similar structure among them, with important areas such as yard, orchard, chicken coop, *terreiro*, around a house where the products are consumed, stored and processed.

Finally, the laser scanner proved to be a tool with a high potential to work in home gardens, both in the areas of botany, environmental conservation, ecology, etc. Being a new work, it is recommended to deepen the research with digital tools such as the laser scanner to study and understand the structure and distribution of the components of the home gardens and different agro environments.

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CHAPTER III

THE INVISIBILIZED CONTRIBUTION OF RURAL HOME GARDENS TO THE FAMILY FARMS INCOME

1. INTRODUCTION

Home gardens are common and important to the family farms and there is a close relationship between the yard and the family in charge of maintaining and conserving them (Asfaw, 2001). They can be considered as a type of agroforestry systems (Jose, 2009; Montagnini, 2006), because they are complex, diverse and multi-stratified, constituted of trees, shrubs and several annual and perennial crops, and may still have animals, located around the house (Fernandes & Nair, 1986; Huai & Hamilton, 2009). Generally, the home gardens include vegetable garden (where vegetables, medicinal plants, spices and plants used in rituals and traditional ceremonies are grown), orchard, apiary, compost and others (Asfaw, 2001). The main purpose of this coupling "crops-trees-animals" is the production of food and medical needs for the family, functioning as systems for consume (Fernandes & Nair, 1986), thus important for food security and sovereignty . However, the home gardens can also generate income when selling the surpluses of the production, such as vegetables, fruits, medicinal, spices and eggs (Harwood, 1986). The surpluses can also be exchanged with other farmers (Oliveira, 2015).

Home gardens differ of the systems managed using the Green Revolution technologies, in monoculture systems, which means simplification and homogenization of the landscape and the loss of biodiversity. Monoculture makes farmers increasingly dependent on external inputs (Gutiérrez, Aguilera, & González, 2008) and not necessarily more productive.

Monoculture simplify the agroecosystems and cause loss of biodiversity, responsible for the ecosystems services such as food, raw materials, water (provisioning services) biological control, erosion prevention and maintenance of soil fertility, carbon sequestration and storage (regulating services), habitat for species and maintenance of genetic diversity (supporting

services) (Caballero-Serrano et al., 2016; Cornejo-Latorre, Calderón-Patrón, & Suarez-Ramírez, 2014), making plantations more vulnerable to pests and diseases, and increasing dependence on external inputs such as fertilizers, agrochemicals and genetic material (Altieri, 2009). Therefore, green revolution generated unsustainability in agriculture. Loss of biodiversity also cause food and nutritional insecurity, due to reduction of food diversity and quality

Differently, home gardens, in general, follow the principles of agroecology and are considered to be sustainable agroecosystems. They make efficient use of the existing resources, promote the development of biological interactions between the different elements of the system, maintain and increase biodiversity, and facilitate the use of easily available supplies and practices that ensure human health and ecosystem conservation (Torquebiau, 1992).

Despite of their importance, home gardens are invisible. This invisibility can be linked to the, also invisible, work of women. Women are, quite often, responsible for work in the home garden, and this activity is considered as an extension of domestic work. Women work, is considered complementary to the work of the male (Gimenes, 2003), even though the participation of their labors is equal to the men's, which demonstrates the discrimination against women.

The study of home gardens can be useful to the processes of transition to sustainable and environmentally friendly practices. Many farmers around the world are involving with the process of transition, incorporating a variety of ecologically sound approaches, as well as adopting the agro-ecological production philosophy, that involves the strengthens of local and ancient knowledge, disseminating traditional and creole varieties, soil and water conservation, and protecting agrobiodiversity (Gliessman, 2014).

Also, in the face of the so-called modern agriculture model, based on monoculture and in Brazil, especially with attention to exports, the home gardens are invisible, although its importance for the subsistence and development of the rural communities. This invisibility is often justified by the fact that it is primarily women who are responsible for work in the home garden, and this activity is considered as an extension of domestic work and spaces of

socialization and cultural recreation for the peasant families, reflected in the absence of public policies in favor of these productive spaces.

The studies can also help in develop policies that can support family famers. In Brazil, for instance, programs such as the Food Acquisition Program and the National School Feeding Program, favored family farming and the home garden production. In the scope of the National Policy on Agroecology and Organic Production the Program for the Productive Organization of Rural Women was designed. The project is in consonance with this Policy that seek to promote agrobiodiversity and socio-biodiversity, to stimulate local experiences in the use, conservation and management of plant and animal genetic resources and to promote the economic autonomy of women (CIAPO, 2013).

Agroecology attempts to decrease the dependence of external inputs on property, fort that it is necessary to maintain or restore soil fertility and agrobiodiversity, ensuring production, especially food, throughout the year (De Schutter, 2010).

The objective of the present study is to analyze the contribution of the home gardens to the family income using data collected through the Agro-ecological Booklet; specifically the objective is to make visible the importance of the home garden and of the women work to the family farmer´s economy.

2. MATERIAL AND METHODS

2.1. Study area

This study was conducted in 30 properties of family farmers located in the Zona da Mata, southeastern region of the state of Minas Gerais, Brazil. The Zona da Mata is located in the biome of Atlantic Forest, classified as subtropical evergreen or sub-evergreen forest (Golfari, 1975), one of the five hotspot of biodiversity (Myers et al., 2000). Nowadays only 8% of the Atlantic Forest remains, due to human impacts. The forest was replaced by pastures, croplands, mainly coffee, maize, beans, cassava, and sugarcane, among others (Cardoso, Guijt, Franco, Carvalho, & Ferreira Neto, 2001; Cardoso & Ferrari, 2006). The average temperature of

Zona da Mata is 18°C, with mean annual precipitations between 1200 and 1800 mm and a seasonal dry period ranging from two to four months (Golfari, 1975). The soils type are Oxisols, deep and well drained, but acidic and poor in nutrients (BDMG, 1989).

The region is characterized by the presence of various groups and organizations of family farmers that, since the end of the 1980s, have been working with agroecological principles, in partnership with the CTA-ZM (a Non-governmental Organization) and the Federal University of Viçosa (Cardoso & Ferrari, 2006).

The properties of family farmers considered in the study are located in municipalities of Acaiaca, Araponga, Divino, Ervália, Espera Feliz, Orizânia, Paula Cândido, Santana do Manhuaçu, Simonésia, Viçosa and Diogo de Vasconcelos. All municipalities, except Diogo de Vasconcelos, belong to the mesoregion of Zona da Mata. Diogo de Vasconcelos belongs to the Metropolitan Mesoregion of Belo Horizonte, bordering with the Zona da Mata (Figure 8).

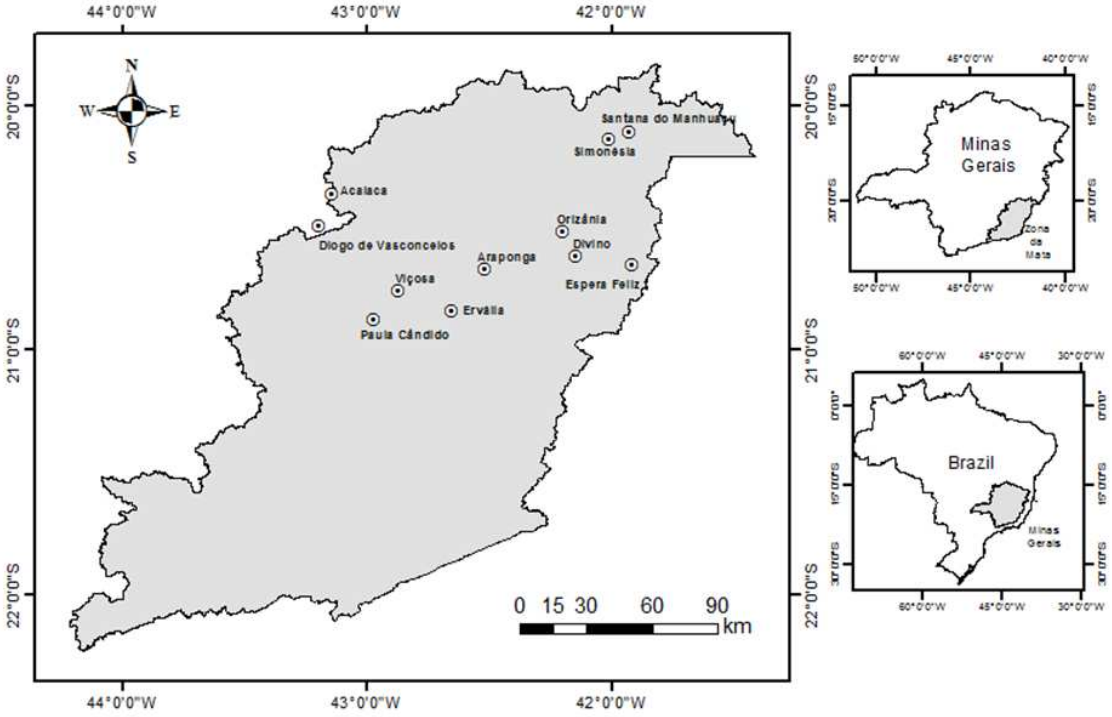

Figure 11. Map of Zona da Mata, Minas Gerais, Brazil, with the eleven municipalities where the home gardens were studied.

The present research was part of the project called "Women and Agroecology in network" headed by the CTA-ZM and financed by the European Union, that aimed to make

visible the female work in rural communities, favoring their empowerment and autonomy and strengthened the agro-ecological practices.

2.2. Data collect

Secondary information was used to analyze the socioeconomic importance of the rural home gardens of the Zona da Mata. The data were obtained by technicians of the CTA-ZM within the program "Women and Agroecology", who between 2013 and 2015 interviewed 64 farmers and trained them to fill the Agro-ecological Booklet, that is a kind of chart, developed by CTA-ZM that is fulfilled by the women with the information of the daily production of the home garden that specifies the destination of the product. In the booklet there are four columns to be filled with the amount (kg or unity) of the products that are used for consume, sold and donated or exchanged.

Information of size of the family, agricultural practices and destination of the production was collected by the technicians of the CTA-ZM through field visits and semi-structures interviews with the women. Also, the booklets were filled from March 2013 and November 2015. The values of the production of the home gardens of food production were recorded daily in the Agro-ecological Booklet by the women (Figure 9). At the end of each month, they transformed the information of the yield (kg or units, depending of the product) to monetary values, with the referential prices in the market of each product that was harvested. Then, all the information of the Agro-ecological booklet was digitalized and stored on an on-line database developed by the CTA-ZM.

Information of Agro-ecological booklet with data of more than three months was considered for the present research. From the 64 Agro-ecological booklets delivered we used data from 30 (each one from one family), belonging to the 11 municipalities. Values on Reais, of both, the production of the home gardens and the minimum wage in Brazil, were converted into US dollar values using the official reports issued by the Central Bank of Brazil. Later, using Microsoft Excel (2010) the monetary values were processed and analyzed. All the products of the Agro-ecological booklet were grouped by municipality and separated in four classes

(Animals and animal origin, plant origin, processed foods and handicrafts) and quantified. The values of the incomes were categorized by farmer, month, year and destination. This procedure was repeated each month.

Agro-ecological Booklet Production control											
Qty.	**Consumed**	$	Qty.	**Donated**	$	Qty.	**Exchanged**	$	Qty.	**Sold**	$
1 kg	carrots	2,00	2 kg	pork	17,00	12	eggs	4,00	5 kg	lemon	10,00
2un	pumpkin	4,50				2 un	lettuce	2,00	1	cake	5,00
2 lt.	milk	4,00							1kg	cheese	15,00

Figure 12. An adaptation of the Agro-ecological Booklet used by women to take note of their home garden production, Zona da Mata of Minas Gerais, Brazil

Although relevant, not all the information is accurate. This is a difficulty in data processing, since not all the monthly information corresponded to data of all the home gardens surveyed, nor that all the farmers presented data of consecutive months. Because of that, the geometric mean was calculated for each destination and the total value, for each year, since of its lower sensitivity than the arithmetic mean to extreme values or outliers. Then, the coefficient of variation was calculated for the values of the total value. With this value, the percentage of the same was calculated in relation to the minimum wage equivalent to each year.

3. RESULTS

3.1. Family farmers

None of the families used agrochemicals or synthetic fertilizers on the home garden. Among the common practices used to manage the soil in their home gardens are bio-fertilization with manure, humus, green manure, mulch, poultry litter. They also use products from the property, such ash, eggshell, corn and banana to feed the animals.All women have an active participation in social movements, such as unions of rural workers, women's groups, NGO's and religious entities. Their social network allowed them to sale the surplus of the production of their home gardens to local markets and through federal programs such as PAA and PNAE.

To fill the agro-ecological booklets was considered easy by the women. They did not indicate greater difficulty in recording their production in the booklets, however, many of them mentioned to forget to write down all the products obtained, especially products that were exchanged and donated.

3.2. Diversity

A total number of 140 products were filled in the booklets, being of 107 plant-origin products distributed in 97 species and 38 botanical families (

Table 11. , 11 animal-origin products (Table 12) and 21 processed-food products (Table 13). Processed food refers to all those products that are transformed prior consumption, such as crushed, cooked, baked, and dehydrated, among others.

The municipality with the most diversity of products was Santana do Manhuaçu, with 73 items, followed by Espera Feliz, and Simonésia with 71 products each. Araponga, recorded less products, 24 items. *Brassica oleracea* var. *acephala*, *Manihot esculenta*, *Sechium edule*, *Allium schoenoprasum*, *Lactuca sativa*, *Petroselinum crispum* and *Solanum gilo* were recorded in all the municipalities, and all of them were destined to all the activities.

Table 11. . Species and botanical families, municipality and destination of production from home gardens, Zona da Mata, Minas Gerais, Brazil

No.	Botanical family	Scientific name	Vernacular name	Municipality[8]	Destination[9]
1	Amaranthaceae	*Beta vulgaris* L.	Beterraba	AC, DV, DI, ER, EF, PC, SM, SM, VI	C, D, S
2		*Beta vulgaris* L. var. *cicla*	Acelga	PC	C, D
3		*Spinacia oleracea* L.	Espinafre	AC, DV, DI, ER, EF, OR, PC, SM, SM, VI	C, D, E, S
4	Amaryllidaceae	*Allium ampeloprasum* L. var. *porrum*	Alho-poró	SM	C
5		*Allium cepa L.*	Cebola de cabeça	AC, AR, DV, DI, ER, EF, SM, SM, VI	C, D, E, S
6		*Allium sativum* L.	Alho	AC, AR, DV, ER, EF, OR, SM, SM	C, D
7		*Allium schoenoprasum* L.	Cebolinha	AC, AR, DV, DI, ER, EF, OR, PC, SM, SM, VI	C, D, E, S
8	Annonaceae	*Annona squamosa* L.	Fruto do Conde	SM	E
9	Apiaceae	*Apium graveolens*	Salsão	SM, SM	C, D
10		*Coriandrum sativum* L.	Coentro	VI	S
11		*Daucus carota* L.	Cenoura	AC, AR, DV, DI, ER, EF, OR, PC, SM, SM	C, D, E, S
12		*Foeniculum vulgare*	Funcho	OR, SM	C
13		*Petroselinum crispum* (Mill.) Nym.	Salsa (*Sin*. Salsinha)	AC, AR, DV, DI, ER, EF, OR, PC, SM, SM, VI	C, D, E, S
14	Araceae	*Colocasia esculenta* (L.) Schott	Cará	DV, DI, ER, EF, OR, PC, VI	C, D, S
15		*Dioscorea alata* L.	Inhame	AC, DI, ER, EF, OR, PC, SM, SM	C, D, E, S
16		*Xanthosoma sagittifolium* L. (Schott)	Taioba	AC, AR, DI, ER, EF, OR, PC, SM, SM, VI	C, D, E, S
17	Arecaceae	*Cocos nucifera*	Coco	SM	C, E
18		*Euterpe edulis*	Palmito	SM	C

[8] AC: Acaiaca; AR: Araponga; DV: Diogo de Vasconcellos; DI: Divino; ER: Ervalia; EF: Espera Feliz; OR: Orizania; PC: Paula Candido; SM: Santana do Manhuaçu; SM: Simonesia; VI: Viçosa.

[9] C: Consume; D: Donated; E: Exchanged; S: Sold.

19		*Euterpe oleracea*	Açaí	SM	C, D
20	Asteraceae	*Arnica montana*	Arnica	DV	D
21		*Cichorium endivia* L.	Chicória (Sin. Escarola)	AC, DV, EF, PC, SM	C, D, E, S
22		*Cichorium intybus* L.	Almeirão	AC, DV, DI, ER, EF, OR, PC, SM, VI	C, D, E, S
23		*Erechtites valerianaefolia* DC.*	Capiçova	DI, SM, VI	C, S
24		*Lactuca canadensis* L.	Almeirão roxo	EF	S
25		*Lactuca sativa* L.	Alface	AC, AR, DV, DI, ER, EF, OR, PC, SM, SM, VI	C, D, E, S
26		*Mikania glomerata*	Guaco	OR	C
27		*Smallanthus sonchifolius*	Batata yacon	EF, SM	C, D
28		*Sonchus oleraceous* L.	Serralha	DV, DI, EF, OR, PC, SM, VI	C, D, E, S
29	Boraginaceae	*Symphytum officinale*	Confrei	SM	D
30	Brassicaceae	*Brassica juncea* (L.) Coss	Mostarda	AC, DV, DI, ER, EF, OR, PC, SM, VI	C, D, E, S
31		*Brassica oleracea* L. var. *acephala* D.C.	Couve	AC, AR, DV, DI, ER, EF, OR, PC, SM, SM, VI	C, D, E, S
32		*Brassica oleracea* L. var. *capitata*	Repolho	AC, DV, DI, EF, PC, SM, SM	C, D, E, V
33		*Brassica oleracea* L. var. *italica* Plenck	Brócolis	EF, OR, VI	C, D, S
34		*Brassica oleracea* var. *botrytis*	Couve flor	EF, SM, SM	C
35		*Brassica rapa chinensis*	Couve chinesa	AC	C, D, S
36		*Eruca sativa* L.	Rúcula	DV, EF, PC, VI	C, D, E, S
37		*Nasturtium officinale*	Agrião	DV, DI, EF, PC, SM	C, D, S
38		*Brassica oleracea L.* var. *capitata f. rubra*	Repolho roxo	DV, EF, VI	C, S
39	Bromeliaceae	*Ananas comosus*	Abacaxi	DI, EF, SM, SM	C
40	Cactaceae	*Pereskia aculeate*	Ora-pro-nobis	AC, AR, DV, EF, OR, PC, SM, SM, VI	C, D, E, S
41	Caricaceae	*Carica papaya* L.	Mamão	AC, DI, EF, OR, PC, SM, SM	C, D
42	Celastraceae	*Maytenus ilicifolia*	Espinheira-santa	SM	D
43	Convolvulaceae	*Ipomea batatas* L.	Batata doce	DI, ER, EF, OR, PC, SM, SM	C, D, E, S

44	Cucurbitaceae	*Citrullus lanatus* (Thunb.) Matsum. & Nakai	Melancia	SM	C
45		*Cucumis sativus* L.	Pepino	AC, AR, EF, SM, SM	C, D
46		*Cucurbita pepo* L.	Abobrinha	AC, DI, EF, OR, PC, SM, SM, VI	C, D, E, S
47		*Curcubita maxima Duch.*	Moranga	AC, SM, SM	C, D
48		*Curcubita moschata* Duch.	Abóbora	AC, DV, DI, ER, OR, PC, SM, SM	C, D, E, S
49		*Luffa aegyptiaca*	Bucha Vegetal	SM, SM	C, D
50		*Sechium edule* Sw.	Chuchu	AC, AR, DV, DI, ER, EF, OR, PC, SM, SM, VI	C, D, E, S
51	Ebanaceae	*Diospyros kaki*	Caqui	SM	C
52	Equisetaceae	*Equisetum arvense*	Cavalinha	SM	D
53	Euphorbiaceae	*Manihot esculenta* Crantz*	Mandioca	AC, AR, DV, DI, ER, EF, OR, PC, SM, SM, VI	C, D, E, S
54	Fabaceae	*Arachis hypogaea*	Amendoim	ER, OR, PC, SM	C, S
55		*Phaseolus vulgaris* L.	Feijão	AC, AR, DI, EF, OR, PC, SM, SM, VI	C, D, E, S
56		*Phaseolus vulgaris* L.	Vagem	DI, ER, EF, OR, SM	C, D, S
57		*Phaseolus vulgaris* L. var. carioquinha	Feijão carioquinha	AC	C
58		*Phaseolus vulgaris* var. vermelho	Feijão vermelho	AC	D, S
59	Lamiaceae	*Melissa officinalis*	Melissa	OR	C
60		*Mentha spicata* L.	Hortelã	AC, OR, SM, SM, VI	C, D, S
61		*Mentha* x *piperita*	Hortelã pimenta	AC	C
62		*Ocimum basilicum* L.	Manjericão	AC, SM, VI	C, S
63		*Rosmarinus officinalis* L.	Alecrim	AC, SM, VI	C, S
64		*Stachys lanata*	Peixinho de horta	EF	C
65	Lauraceae	*Persea americana* Mill.	Abacate	PC, SM, SM	C, D, S
66	Malpighiaceae	*Malpighia emarginata*	Acerola	AR, DV, DI, ER, EF, PC, SM, VI	C, D, E, S
67	Malvaceae	*Abelmoschus esculentus* L. (Moench)	Quiabo	AC, AR, DV, DI, ER, EF, OR, PC, SM, SM	C, D, E, S
68	Mirtaceae	*Eugenia stipitata*	Araçá boi	SM	E

69		*Myrciaria cauliflora*	Jabuticaba	DI, PC, SM, VI	C, D, E, S
70		*Psidium guajava*	Goiaba	AR, DI, ER, EF	C, D, E
71	Moraceae	*Artocarpus heterophyllus*	Jaca	DI	E
72		*Ficus carica* L.	Figo	DI, SM, SM	C, D, E, S
73		*Morus nigra*	Amora	DI	C
74	Musaceae	*Musa acuminata* x *Musa balbisiana Colla* grupo AAA	Banana prata	DI, EF, VI	C, S
75		*Musa acuminata* x *Musa balbisiana* Colla grupo AAB	Banana nanica	EF, SM	C, S
76		*Musa* spp.	Banana	AC, AR, DI, ER, EF, OR, PC, SM, SM, VI	C, D, E, S
77	Oxalidaceae	*Averrhoa carambola*	Carambola	DI, OR, PC	C, D
78		*Oxalis acetosella* L.	Azedinha	AC, VI	C, S
79	Passifloraceae	*Passiflora edulis*	Maracujá	AC, DI, ER, EF, SM,SM	C, D, E, S
80	Poaceae	*Cymbopogon citratus*	Capim limão	SM	C
81		*Saccharum officinarum* L.	Cana-de-açúcar	EF	D
82		*Zea mays* L.	Milho	AC, DI, ER, EF, PC, SM, SM	C, D, E, S
83		*Zea mays* L.	Milho verde	AC, EF, SM, SM	C, D
84	Rosaceae	*Eriobotrya japonica* (Thunb.) Lindl.	Ameixa do Japão	AR	C
85		*Fragaria* spp.	Morango	DV, ER	C, D
86		*Prunus persica* L.	Pêssego	EF, OR, SM	C
87	Rubiaceae	*Coffea arabica* L.	Café	DI, ER, EF, OR, SM, SM, VI	C, D, S
88	Rutaceae	*Citrus* x *sinensis* (L.) Osbeck	Laranja	AC, DV, DI, OR, PC, SM, SM, VI	C, D, E, S
89		*Citrus limettioides* Tanaka	Lima	ER, PC	C, D
90		*Citrus* x *latifolia*	Limão	AC, DV, DI, ER, EF, OR, PC, SM, SM, VI	C, D, E, S
91		*Citrus limetta*	Limão doce	PC, SM	C, D
92		*Citrus reticulata* Blanco	Mexerica	AC, DV, DI, ER, EF, OR, PC, SM, SM, VI	C, D, E, S
93		*Citrus tangerine*	Tangerina	DI, ER, EF, SM, SM	C, D

94	Sapindaceae	*Litchi chinensis* Sonn.	Lichia	DI	C
95	Solanaceae	*Capsicum annum* L.	Pimentão	DV, DI, EF, OR, PC, SM, VI	C, D, E, S
96		*Capsicum bacatum*	Pimenta dedo de moça	EF	S
97		*Capsicum chinense* L.	Pimenta biquinho	VI	S
98		*Capsicum* spp.	Pimenta	AC, DV, EF, PC, SM, SM	C, D, E, S
99		*Solanum gilo* Raddi	Jiló	AC, AR, DV, DI, ER, EF, OR, PC, SM, SM, VI	C, D, E, S
100		*Solanum lycopersicum* Mill.	Tomate	AC, DV, DI, ER, EF, OR, PC, SM	C, D, E, S
101		*Lycopersicon pimpinellifolium* L.	Tomatinho	AC, DI, EF, PC, SM, SM	C, D, S
102		*Solanum lycopersicum* Mill. var. *cercasiforme*	Tomate cereja	OR, PC, SM	C, D
103		*Solanum melongena* L.	Berinjela	DV, VI	C, D, E, S
104		*Solanum tuberosum* L.	Batata	DI, ER, OR, PC	C, D, S
105	Theaceae	*Camellia sinensis* (L.) Kuntze	Chá	AC, OR	C
106	Vitaceae	*Vitis vinifera* L.	Uva	PC	C
107	Zingiberaceae	*Zingiber officinale* Roscoe	Gengibre	SM, SM, VI	C, D, S

The botanical family with most diversity of products was Solanaceae, with 10 different products (9,26%) corresponding to nine species, followed by the Asteraceae family, with nine products (8,33%) in equal number of species, Brassicaceae with eight products (7,40%) in five species.

The difference between the numbers of species in each family refers to the different varieties within some species. Some species have more than one variety and were declared as different products by women, for example, *B. vulgaris* (two varieties), *B. oleracea (*four varieties*), P. vulgaris (*two varieties*), S. lycopersicum (*two varieties*),* Musaceae (two varieties). In other cases, for instance, *Z. mays* ("milho" and "milho verde") and *P. vulgaris* ("feijão" e "vagem"), different products corresponded to different phenological stages of the plant.

In animal-origin there are differences in how the animals are raised. Eggs and range-free eggs and barn chickens and range-free chickens refer to the production system where, in a barn system the animals generally are confined in cages, in a range-free system the animals are allowed to constant access to the outdoors.

With the data in monetary values, the most representative products that were consumed by the families are eggs (10,37%) and chicken (8,5%), both classified as animal origin products. For products of plant origin, the most consumed products are *P. vulgaris* (7%) and *Musa* spp. (5,67%) stand out above the others, and it is necessary to emphasize that in this study, followed by *C. limettioides* (5,6%) also obtained representative results. Other important products are *B. oleracea* var. *acephala*, (5,21%) pork (4,21%) and *M. esculenta* (4,12%). These all 8 products represent over the 50% of all the products consumed. For the processed food, the most significant processed product consumed by the families was corn meal. A total of 128 products are included in this category (91,4%).

Table 12. Animal-origin product, municipality and destination of production from home gardens, Zona da Mata, Minas Gerais, Brazil

Product	Common name	Municipality[10]	Destination[11]
Range-free chicken	Frango caipira	AC, DI, ER, EF, OR, PC, SM, SI, VI	C, D, E, S
Barn chicken	Frango de granja	AR, OR, SI	C, D, S
Hen	Galinha	DI, ER, EF, OR, PC, SI, VI	C, S
Rooster	Galo	AC, DI, EF, PC	C, D, S
Milk	Leite	AC, DI, EF, OR, PC, SM, VI	C, D, E, S
Eggs	Ovos	AC, AR, DI, ER, EF, OR, PC, SM, SI, VI	C, D, E, S
Range-free eggs	Ovo caipira	EF, SI	C
Quail egg	Ovo de cordna	AR	C
Duck	Pato	ER, EF, PC	C, D, S
Fish	Peixe	AC, ER, EF, SM, SI	C, D, E, S

Table 13. Processed food products, municipality and destination of production from home gardens, Zona da Mata, Minas Gerais, Brazil

Product	Common name	Municipality[12]	Destination[13]
Cake	Bolo	AC, DI, OR, PC	C, D, S
Broa de fubá	Broa de fubá	DV, DI, OR, PC, VI	C, D, E, S
Caçarola	Caçarola	DI	C, D, S
Dessert of banana	Doce de banana	AR, SI	E, S
Dessert of papaya	Doce de mamão	AR, SI	C, D, S
Desserts	Doce	DI, ER, EF, PC, SI, VI	C, D, E, S
Cassava flour	Farinha de mandioca	SI	C, D, E, S
Fubá	Fubá	AC, DV, DI, ER, OR PC, SM, SI	C, D, E, S
Pig fat	Gordura	SM	C
Butter	Manteiga	AC, PC	C, S
Melado	Melado	EF	D
Cream	Nata de leite	AC, PC	C, D, S
Bread	Pão	DI, PC, SI	C, D, E, S
Cassava starch	Polvilho	DI, OR, PC, SI	C, D, E, S
Cheese	Queijo	AC, DI, EF, PC, SM	C, D, E, S
Panela	Panela	DI, EF	C, D, S
Requeijão	Requeijão	AC, PC, SM, SI	C, D, S
Ricotta	Ricotta	PC	C
Donuts	Rosquinha	AC, DI, OR	C, D, E, S
Dried tomatoes	Tomate seco	AC	C, D

[10] AC: Acaiaca; AR: Araponga; DV: Diogo de Vasconcellos; DI: Divino; ER: Ervália; EF: Espera Feliz; OR: Orizânia; PC: Paula Candido; SM: Santana do Manhuaçu; SM: Simonésia; VI: Viçosa.
[11] C: Consume; D: Donated; E: Exchanged; S: Sold.
[12] AC: Acaiaca; AR: Araponga; DV: Diogo de Vasconcellos; DI: Divino; ER: Ervália; EF: Espera Feliz; OR: Orizânia; PC: Paula Candido; SM: Santana do Manhuaçu; SM: Simonésia; VI: Viçosa.
[13] C: Consume; D: Donated; E: Exchanged; S: Sold.

In the case of the sold products, cheese is clearly the most important product in this group, and its sales represented almost the 12% of the total. Other important products are milk (7,6%), barn chicken (6,7%), *L. sativa* (6,19%), eggs (5,68%), broa de fubá (5,57%) and *M. esculenta* (5,39%). Together they approach 50% of the total sales of all the products of this group. 83% of the products correspond to the other half of the items in this group.

A total of 97 (87,86%) products was donated by the families. Among the donated products, 50% corresponded to *C. arabica* (15%), followed by *Musa* spp. (8,7%), barn chicken (5,18%), eggs (4,8%), *P. vulgaris* (4,8%), cheese (4,32%), *B. oleracea* var. *acephala* (4%) and *L. sativa* (3,75%). A total of 57 (40,7%) of the products was exchanged by the families. Among the exchanged products, 50% were pork meat (26%) followed by *Zea mays* (7,46%), *Allium cepa* (6,65%), broa de fubá (5,48%) and *Citrus x sinensis* (4,6%). They expressed that in the region is not common to exchange.

In six municipalities (Acaiaca, Araponga, Divino, Espera Feliz, Orizânia and Simonésia), an important amount of handicrafts, mainly made of vegetable fibers, were recorded in the booklet by the female farmers. The raw material used for these particular products are available in the properties. They also used recycled material for the handicrafts.

3.3. Hidden income

Throughout the year, the greatest production obtained of the home gardens occurs from February to June, with a notable reduction in the months of winter (from June to September), and from December to February (scholar vacations). On average, home gardens generated US$ 84,94, 29,79% of the minimum salary per month.

In 2013, on average, the home gardens generated US$105,44 per month. The highest income per month (US$ 265,53) occurred in May, corresponding to 83.47% of the minimum Brazilian wage. The lowest income (US$39,39) occurred in December, corresponding to 13.61% of the minimum Brazilian wage. (Table 14). The highest value generated was for consume (51%), followed by sold products (30%) and donation together with Exchange products (19%)

In 2014, the range of the percentage of the incomes generated by the home gardens varied between US$ 75,31 (24,27% of the minimum wage) in February to US$112,14 (39,64%) in November (Table 15. **Home gardens' monetary values (geometric means) from January to December. The total value per month was compared (percentage) with the minimum Brazilian wage, in 2014**Table 15). The highest value generated was for sale (45%), followed by self-consumed products (34%) and donation together with Exchange products (21%).

In 2015, the values ranged between US$ 8,68 (3,17%) in February to US$ 114,51 (46,61%) in March. The highest value generated was for sale (56%), followed by self-consumed products (35%) and donation together with Exchange products (9%) (Table 16).

The percentage of the sold production increased from 2013 to 2014 and 2015, whereas the production for self-consumed and exchanged plus donated production decreased.

Table 14. Home gardens' monetary values (geometric means) from March to December. The total value per month was compared (percentage) with the minimum Brazilian wage, in 2013.

Destination	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Consumed	$68,91	$134,58	$157,18	-	$24,28	$10,75	$30,99	$112,41	$34,12	$16,00
Donated	$37,87	$0,50	$68,45	-	$13,20	$9,80	$5,09	$16,32	$3,89	$5,07
Exchanged	$0,12	-	$48,79	-	$2,62	-	$0,90	$6,58	$4,88	-
Sold	$39,99	-	$28,15	$69,98	$16,52	$25,32	$17,29	$42,20	$47,49	$47,37
TOTAL	**$123,22**	**$134,85**	**$265,53**	**$69,98**	**$64,92**	**$58,01**	**$63,75**	**$143,29**	**$91,45**	**$39,39**
Coefficient of variation	30,01%	6,56%	4,41%	-	45,56%	25,41%	42,66%	71,80%	53,91%	116,94%
% of minimum wage	36,59%	39,78%	83,47%	22,86%	21,92%	20,29%	20,96%	46,54%	31,35%	13,61%
Dollar exchange rate	R$ 2,01	R$ 2,00	R$ 2,13	R$ 2,22	R$ 2,29	R$ 2,37	R$ 2,23	R$ 2,20	R$ 2,32	R$ 2,34
Minimum wage in Brazil in 2013 corresponded to R$ 678										

Table 15. Home gardens' monetary values (geometric means) from January to December. The total value per month was compared (percentage) with the minimum Brazilian wage, in 2014.

Destination	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Consumed	$39,76	$36,93	$39,93	$45,64	$27,89	$44,40	$32,92	$34,71	$40,75	$31,51	$33,42	$32,95
Donated	$13,42	$23,53	$18,08	$15,90	$7,65	$14,22	$6,76	$7,40	$11,42	$15,26	$17,49	$9,52
Exchanged	$3,42	$4,25	$2,10	$6,75	$13,17	$18,08	$4,23	$4,58	$4,82	$25,82	$13,11	$4,39
Sold	$34,08	$17,12	$41,24	$41,51	$56,91	$67,94	$50,01	$67,07	$54,83	$53,48	$46,96	$50,23
TOTAL	**$84,30**	**$75,31**	**$96,77**	**$107,62**	**$92,31**	**$116,80**	**$86,37**	**$85,71**	**$95,18**	**$95,14**	**$112,14**	**$88,49**
Coefficient of variation	95,12%	120,99%	147,39%	136,46%	120,59%	75,66%	99,48%	134,17%	88,91%	70,60%	53,26%	95,12%
% of minimum wage	28,24%	24,27%	30,24%	33,23%	28,54%	35,52%	27,04%	26,50%	32,21%	31,69%	39,64%	32,46%
Dollar exchange rate	R$ 2,43	R$ 2,33	R$ 2,26	R$ 2,24	R$ 2,24	R$ 2,20	R$ 2,27	R$ 2,24	R$ 2,45	R$ 2,41	R$ 2,56	R$ 2,66
Minimum wage in Brazil in 2014 corresponded to R$ 724												

Table 16. Home gardens' monetary values (geometric means) from January to November. The total value per month was compared (percentage) with the minimum Brazilian wage, in 2015.

Destination	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
Consumed	$43,02	$7,00	$43,70	$29,61	$14,49	$17,04	$11,87	$21,44	$31,97	$8,63	$7,94
Donated	$16,40	-	$6,86	$6,85	$6,62	$4,19	$5,77	$6,05	$1,72	-	$2,86
Exchanged	$18,08	-	-	-	-	-	-	-	-	-	-
Sold	$75,56	$37,84	$42,59	$42,20	$29,75	$18,92	$99,61	-	$39,34	-	-
TOTAL	**$119,07**	**$8,68**	**$114,51**	**$90,06**	**$58,39**	**$40,45**	**$41,55**	**$54,76**	**$66,24**	**$8,63**	**$10,79**
Coefficient of variation	88,22%	98,73%	38,93%	47,17%	67,40%	88,41%	80,19%	55,70%	53,97%	-	-
% of minimum wage	40,22%	3,17%	46,61%	34,21%	23,55%	15,92%	17,89%	25,34%	33,39%	4,23%	5,27%
Dollar exchange rate	R$ 2,66	R$ 2,88	R$ 3,21	R$ 2,99	R$ 3,18	R$ 3,10	R$ 3,39	R$ 3,65	R$ 3,97	R$ 3,86	R$ 3,85
Minimum wage in Brazil in 2015 corresponded to R$ 788											

4. DISCUSSION

Despite the reduction of biodiversity with the specialization of the agriculture in Brazil, mainly in the 1980s, home gardens are still productive areas that allow family farmers to have access to a great variety of products, such as vegetables, fruits, condiments, medicinal plants, among others (Vieira & Lee, 2014). The large number of products included in the annotations in the Agro-ecological booklets helps to know the importance of home gardens not only by making visible the generation of significant economic income for the families, but also when it allows to know the agrobiodiversity present in the home gardens and to analyze socio-cultural aspects of rural communities in the Zona da Mata in Minas Gerais.

There are indications that the economic importance of the home gardens is increasing, that is why the increase of the share of the product sold in the total production of the property. On the other hand, secondary destinations like donations and exchange kept lower numbers, as it was indicated by the women, that they are activities non common in the region.

Besides contributing to a great variety of products destined, among other uses, to a varied feeding of the family, the home gardens are very important spaces in the contribution to the income of the rural families. Most studies show that the production of home gardens is focused on the family's own consumption, with minor percentages in selling, donation or exchange. Oliveira (2015), reported that in three productive home gardens, from different municipalities in the Zona da Mata, the incomes ranged average values between R$ 189,70 to R$ 906,98 per month along October 2013 to September 2014. Although having used the Agro-ecological booklets, those farmers did not record any information concerning about exchanged product, because in general, they donate products that in some situations are returned with other product, so they do not consider as an exchanged product. Vieira & Lee (2014) registered, from a total of 40 family farmers assessed in the municipality of Itapuranga, Goias, in the Central Western of Brazil, a mean value of incomes of R$ 420,70 per month. In spite of any product was declared as donated or exchanged, 33 farmers declared to sell surplus that averaged R$183,30, equals to 43% of the total of the production in the home gardens.

The production in the home gardens, as well as the number of products could be underestimated in the present research, because the women did not recorded all the products from their home garden. In the rural area it is not common to register the production of the home gardens, but after starting with the project of the Agro-ecological booklet women began to notice the importance of their spaces in the family economy. It is necessary to highlight that one of the possible causes of the reduction of production between the months of May to July is due to the fact that it is the coffee harvest season, in which practically all the family labor is engaged in this activity, being the management of the secondary home garden even for the women of the house.

Also, it demonstrates that high biodiversity is a common pattern in home gardens. The total number of products (140 in total, 108 plant-origin, 11 animal-origin and 21 processed food) is similar with the biodiversity found by other authors in the region. In six home gardens, in the municipalities of Acaiaca, Divino and Espera Feliz, Oliveira (2015) identified 160 vegetal species; In five home gardens, of Visconde do Rio Branco, also in Zona da Mata of Minas Gerais, Tonini, (2013) identified 155 species, of 65 botanical families.

Besides contributing to the maintenance of biodiversity, the home gardens are important for the food security and sovereignty. Boone & Taylor (2016) suggest that home gardens contribute positively to food security and sovereignty since the production of these units allows a high diversity of food, where peasants themselves have the ability to define by their own dietary needs what plant species plants and what species animals to breed, and that can satisfy their nutritional needs with foods with a high cultural significance, according to the premises of the Declaration of Tlxcala of the “Via Campesina” in 1996.

It is also important to highlight that the importance of the home gardens of Minas Gerais dates back to the 18th century, when thousands of people began to populate the territories of the current state of Minas Gerais, attracted by the discovery of deposits of various minerals. Due to the migration of people from several points in Brazil, as well as the influence of indigenous populations of the region and the arrival of Europeans (mainly from Portugal) and

African slaves, several products started to be part of the traditional culinary of Minas Gerais and due to the difficulty of mobilization between the different settlements, the home gardens were the ideal places for the planting of vegetable species and the raising of small animals. The need to produce easy-to-grow food and small animals and low maintenance costs in small spaces has determined that species such as cassava, yam, cabbage, corn, beans, bananas, guava, jabuticaba among others, and animals such as chickens and pigs are fundamental ingredients in the cuisine of Minas Gerais (Bazote, 2013). In this case, in the colonial Minas Gerais of the pig meat and grease was very much desired, a tradition that has been maintained until modern times, where pork is considered a precious product, so much so that meat donation is common of pork to the neighbors as a sign of affection and way to strengthen the bonds of friendship in the community (Meneses, 2014).

One aspect for why the house is an important component in home gardens is its function in the processing of certain products such as seasonal fruits (e.g. jabuticaba or guava) and milk to avoid their rapid decomposition and to be able to conserve them for a longer period of time with the production of fruit pastes and fermented beverages with the fruit (Meneses, 2014) and several kinds of cheese with the milk, as well as fubá or cassava flour.

5. CONCLUSIONS

The high diversity present in home gardens supplies a significant number of products for the family consumption, many of which are almost exclusively produced in them and not found in markets or in conventional stores. These are products of high quality, as the home gardens are managed without external inputs, such as pesticide. In addition, the high diversity is of utmost importance in the conservation of native varieties and in non-conventional food plants.

Despite having as main objective the consumption of food for the family, high productivity allows obtaining surpluses that are important sources of additional income that benefit the economy of rural families, but the contribution of the home gardens go far beyond the economic aspects. The high diversity is of utmost importance in the conservation of native varieties and in non-conventional food plants and also motivates the recycling of organic material as well as the

coverage of the soil, the non-use of synthetic substances such as fertilizers and pesticides favor the conservation of soil and improve its fertility, contributing with environmental factors. Likewise, the high diversity of products that can be obtained from the home gardens allows the conservation of the culinary traditions of the people of Minas Gerais, resisting the aggressive external intervention in the eating habits of the communities.

Finally, the Agro-ecological booklet, despite presenting problems in the accuracy of the information, turned out to be a very important tool that allows visualizing the environmental, economic and socio-cultural importance of the home gardens in the rural communities of the Zona da Mata of Minas Gerais.

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CHAPTER IV

GENERAL CONSIDERATIONS

Home gardens are productive systems that, although they are of small extension, fulfill important functions in favor of the rural families as well as the environment. The common pattern of the structure of the home gardens of the Zona Da Mata in Minas Gerais is constituted by a house, which functions as a central axis where around it areas such as the *terreiro*, as a meeting place with the community and for the drying of grains (coffee, corn and beans mainly), a specific planting area for ornamental species, a yard for vegetables and condiments, an orchard for shrubs and fruit trees, a space for medicinal plants (which may be associated with yard and condiments) and finally the spaces destined to the breeding of small and easy to use animals such as chickens, ducks, pigs.

The field visits resulted in interesting values for agrobiodiversity, identifying 246 plant species (81 families) and six domestic animal species (six families), of which, 60% of the species found in the visited home gardens are of herbaceous growth, 15% are of shrub growth and 25% are of arboreal growth, noting that these home gardens were established a few years ago, with low and medium tree strata which were confirmed with the work done with the laser scanner.

Most of the identified species were classified as food, but also medicinal and ornamental species were included as important species for the families visited. Also it is important to note that 43 species are used for two uses. Farmers are aware of the importance of conservation of the biodiversity, as a source of additional income, ensuring a constant supply of food and other products, as well as ecological benefits such as keeping the soil covered for water retention and maintenance of the natural fertility of the soil, and in situ conservation of traditional species.

Finally, with laser scanner it was possible to estimate the height of randomly selected plants in the homegarden and thus try to visualize the different strata present in the home

garden. In this study it was observed the presence of individuals in the low and medium strata, and absence of plants in upper strata (above 15 meters).

Talking about the Agro-ecological Booklet, it is a very important tool that makes it possible to highlight the contribution of home gardens to the economy of family farmers, women's agricultural work, since women are the leaders of activities in these areas, as well as gives an idea of the diversity of products generated.

During the three years of research with the Agro-ecological Booklet, family farmers were benefited from the production of their home gardens with an average value of 30% of a basic salary in Brazil. Unlike monocultures of family farmers, the production of home gardens is permanent during the 12 months of the year and, and even though there are highs and lows in production, it is undoubtedly that home gardens contribute significantly to reduce poverty of rural communities despite being relatively small areas compared to the rest of the property.

In the booklets were registered 140 different products, of which 108 are of vegetable origin, 11 of animal origin and 21 are processed products. In addition, some women work in the manufacture of handicrafts, often made with recycled material from home gardens, and are destined for sale or donation, allowing strengthening interpersonal relationships with other people in the community.

The results of the two previous chapters confirm the importance of home gardens, basically work managed by a female hand, in collaboration to support the needs of the family. On the other hand, the food habits of the rural mining families are reflected in the similarities between the species declared in the booklets and by the women farmers. There are 87 vegetal species and four animal species common between the two parts of the research, and it is likely that the number of similar species is greater if the women in charge of recording the information in the booklets do not forget to do so, as they mentioned in the interviews with the CTA-ZM working group because most of the species detailed in the booklets are of the feeding type , having few use of medicines and other uses, so it is also recommended to try to recommend to

women farmers do not forget to note species of home garden intended for different uses when feeding.