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Characterization of Tropical Rural Homegardens and Their Households in a Premontane Forest of Costa Rica

Caracterización de huertos familiares rurales tropicales y sus hogares en un Bosque Premontano de Costa Rica

Jessica Arias Ramírez[1] y Marcela Dumani Echandi[2]

Abstract: Introduction: Homegardens are mixed cropping systems near homes that contribute Food and Nutritional Security (FNS), agrobiodiversity conservation, and household resilience. Yet, scientific studies in Central America, and particularly in Costa Rica, are still limited, and traditional knowledge about these systems is gradually disappearing. This study characterizes homegardens and their households in San Luis, Monteverde, a community undergoing socio-economic changes due to tourism and gentrification. **Methodology:** Following a descriptive and exploratory research approach, 23 homegardens (15 in Alto San Luis and 8 in Bajo San Luis) were selected using purposive sampling strategy with criterion-based selection. Data collection involved structured questionnaires, interviews, and direct observations. Descriptive statistics and correlation tests explored links between species richness and household variables. **Results:** A total of 182 species (169 plants, 13 animals) from 65 taxonomic families were recorded. Bajo San Luis, farther from markets and closer to forests, showed greater species diversity. Homegarden owners were mostly women (87%), with an average age of 54 years, and most had only completed primary education. Household size was small (3 members), and older age correlated with higher species richness ($r = .67$, $p < .001$). Most gardens were maintained for self-consumption. **Conclusions:** Homegardens in San Luis support agrobiodiversity, food security, and community health. Their maintenance is deeply linked to women's roles and traditional knowledge of older adults. However, threats such as youth migration, urbanization, and generational gaps challenge their sustainability. Policies should promote knowledge transfer, recognize health and dietary contributions, and support these spaces as vital components of local food systems.

Keywords: Homegarden, Agrobiodiversity, Food and Nutritional Security, Monteverde.

Resumen: Introducción: Los huertos familiares son sistemas de cultivo mixto cerca de hogares que contribuyen a la Seguridad Alimentaria y Nutricional (SAN), conservación de agrobiodiversidad y a resiliencia de hogares. Sin embargo, los estudios científicos en América Central, y particularmente en Costa Rica, son limitados, y el conocimiento tradicional sobre estos sistemas está desapareciendo gradualmente. Este estudio caracteriza los huertos y sus hogares en San Luis, Monteverde, comunidad en transformación socioeconómica debido al turismo y gentrificación. **Metodología:** Siguiendo un enfoque de investigación descriptivo y exploratorio, se seleccionaron 23 huertos familiares (15 en Alto San Luis y 8 en Bajo San Luis) mediante una estrategia de muestreo intencional con selección basada en criterios. La recolección de datos incluyó cuestionarios estructurados, entrevistas y observaciones directas. Se utilizaron estadísticas descriptivas, y pruebas de correlación para explorar relaciones entre la riqueza de especies y variables del hogar. **Resultados:** Se registraron 182 especies (169 plantas, 13 animales) pertenecientes a 65 familias taxonómicas. Bajo San Luis, más alejado del centro y cercano al bosque, mostró mayor diversidad. Las personas responsables de los huertos son principalmente mujeres (87%), con edad promedio de 54 años y educación primaria. Los hogares son pequeños (3 personas), y se encontró una correlación positiva entre mayor edad y riqueza de especies ($r = .67$, $p < .001$). El autoconsumo fue el principal motivo para mantener los huertos. **Conclusiones:** Los huertos en San Luis aportan a la agrobiodiversidad, SAN y salud comunitaria. Su sostenibilidad depende del conocimiento tradicional de mujeres y personas mayores, por lo que se requieren políticas que promuevan su transmisión, reconozcan sus beneficios e integren a estrategias alimentarias locales.

Palabras clave: Huerto, Agrobiodiversidad, Seguridad Alimentaria y Nutricional, Monteverde.

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1. Introduction

Over the past three decades, Monteverde, the site of this study a rural, somewhat isolated and mountainous area, in the northwest of Costa Rica has rapidly transitioned from a purely agricultural economy to a blend of tourism and agriculture (Ruiz et al., 2015). More recently, the phenomenon of gentrification has emerged in the area. According to Zarza and Cruz (2024), this process occurs in rural areas as a result of tourism as an alternative development strategy, and leads to lifestyle and cultural changes for locals, inflation, rising housing costs and land conversion that reduces the agricultural land, impacting local food production.

San Luis, the community in Monteverde where this research was conducted, has around 400 inhabitants (Asociación de Desarrollo Integral de San Luis, 2025, November 6th). It is situated on the Pacific slope of the continental divide, 7 km southeast of Monteverde's center (Cowherd, 2012; Ruiz et al., 2015) within the Very Humid Premontane Forest (bmh-P) life zone; ranging from 800 to 1,500 masl (Holdridge, 1987).

San Luis, where this research was conducted, is a Monteverde community of ~400 inhabitants (Asociación de Desarrollo Integral de San Luis, 2025), located on the Pacific slope of the continental divide, 7 km southeast of Monteverde's center (Cowherd, 2012; Ruiz et al., 2015), within the Very Humid Premontane Forest (bmh-P) life zone at 800–1,500 m asl (Holdridge, 1987). Divided into Alto San Luis (6.5 km away from Monteverde center) and Bajo San Luis (10 km) sectors at different altitudes, the community traditionally relied on family farming (Himmelgreen et al., 2006) but has recently shifted toward rural tourism (Himmelgreen et al., 2013), leading to some degree of gentrification. Due to shifts in livelihoods and lifestyle, San Luis has faced high levels of food and nutritional insecurity in the past (Arias & Dumani, 2024; Himmelgreen et al., 2006; 2013; Ruiz et al., 2015,).

Although the exact number is unknown, homegardens in San Luis are widespread and represent valuable resourses for strengthening Food and Nutritional Security (FNS) (Arias & Dumani, 2024). As a result, this study aims to explore the conformation, composition, and characteristics of homegardens and their households in San Luis and to identify some of the factors influencing species diversity on these productive units. This information will serve as a valuable tool to comprehend how household and FNS can be enhanced by making more efficient use of an already existing resource in the community: homegardens.

2. Theoretical reference

Homegardens are mixed cropping systems that can provide a supplementary source of food and income to families (Galhena et al., 2013). The homegarden is the area near the house, which is used to produce food crops (tubers and roots, vegetables, fruits, medicinal plants, condiments, herbs, and others) as well as livestock; usually smaller animals (birds, rabbits, pigs and goats) intended for family feeding (Food and Agriculture Organization of the United Nations [FAO], 2000; Thamilini et al., 2019).

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As an agrobiodiversity system (Williams et al., 2018), the homegarden offers direct access to a variety of foods and nutrients (Issahaku et al., 2023) and contributes to the FNS, providing also a safety net for food shortages (Baliki et al., 2023; Oduor et al., 2019) like the ones during the COVID-19 pandemic due to movement restrictions (Cerda et al., 2022), which had a strong impact on areas with economies highly dependent on tourism, such as Monteverde.

Homegardens provide multiple environmental benefits by integrating trees, shrubs, and diverse crops, including nitrogen-fixing species, which enhance biodiversity and habitat complexity while improving soil fertility and reducing pest and disease incidence (Malézieux et al., 2009; Rivas & Ruiz, 2023). Agroecological practices such as crop rotation, intercropping, and soil and water management further maintain soil health, increase microbial diversity, and promote water conservation (Rivas & Ruiz, 2023). In addition, homegardens offer feeding and refuge areas for wildlife that contribute to key ecological processes such as seed dispersal and pollination (Ordóñez, 2018). These multifunctional systems also contribute to climate change mitigation by storing carbon in soil, vegetation, and woody biomass, while improving local environmental conditions (Rajagopal et al., 2021).

A review of homegardens research over the past decade (Monroy & Martínez-Gómez, 2024) indicates that most studies have focused on regions such as India, a leader in publication output emphasizing governance and biodiversity, followed by Mexico, which highlights biodiversity, ecosystem services, and the social functions of homegardens. In Mexico, local knowledge, although highly valuable, is rapidly being lost, underscoring the urgent need for documentation (Chi Quej, 2009). Research from the United States and Germany emphasizes ethnobotany and cultural practices, while studies from Sweden, Sri Lanka, Indonesia, and Kenya focus on contributions to food security. Investigations in China, Uganda, and Japan further explore agrobiodiversity and the influence of household characteristics on garden composition (Monroy & Martínez-Gómez, 2024). In contrast, Central America—and particularly Costa Rica— has received less attention. Despite their important roles in production, ecosystem protection, and food security, homegardens receive limited scientific attention (Ruiz, 2013).

In Costa Rica, research on homegardens has primarily focused on indigenous populations (Alfaro, 2014; García-Serrano & Del Monte, 2004; Harvey et al., 2006; Sylvester & Segura, 2016; Zaldivar et al., 2002), leaving gaps in understanding their characteristics and functions in non-indigenous communities (Jiménez, 2014; Lok, 1998; Rivas, 2014; Rodríguez, 2017; Samper, 2019). Monteverde is no exception to this situation, underscoring the need for further research in this region.

Integrated management of homegardens can ensure year-round access to nutritious food, serve as sites for experimentation with crops, and generate economic benefits through self-consumption and local sales (Korpelainen, 2023). Given the food insecurity previously reported in San Luis, assessing homegardens can highlight their role in enhancing FNS during socioeconomic transitions.

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3. Methodology

3.1 Approach

This study primarily employs a quantitative data analysis and an exploratory approach to characterize homegardens and to understand the households that manage them. The scope of this research is both exploratory and descriptive. It explores the diversity and abundance of species in homegardens, correlations between species richness and household characteristics and describes the differences between the upper (Alto San Luis) and lower (Bajo San Luis) areas of the community, considering their distance from the Center (Santa Elena).

3.2 Study population

According to projections from the Instituto Nacional de Estadística y Censos (INEC, 2025), the canton of Monteverde has an estimated population of 5,070 inhabitants in 2025. The gender distribution is nearly balanced, with 2,558 males and 2,512 females. The age structure reflects a youthful and productive demographic: 22.1% of the population are children aged 0–14 years, 14.9% are youth between 15–24 years, and 53.8% fall within the working-age range of 25–64 years. Meanwhile, 9.2% are aged 65 years or older, indicating a moderate but growing demand for senior services. The largest age group (25–34 years) suggests a predominantly economically active community. These demographic characteristics provide a general overview of the regional context where the study was conducted.

In the small rural community of San Luis, Monteverde (≈400 inhabitants), 23 households with homegardens were sampled: 15 from Alto San Luis and 8 from Bajo San Luis. The study also aimed to compare species richness and abundance between the two areas. Given that Bajo San Luis is more remote from the main center and markets and more embedded in forested areas, it was hypothesized to exhibit higher species diversity. Previous research suggests that greater distance from markets and proximity to forests are associated with increased homegarden diversity (Baudron et al., 2017), which in turn has been linked to more diverse diets and improved nutrient intake (Issahaku et al., 2023).

A purposive, criterion-based sampling strategy was used to recruit households with homegardens meeting study objectives (Memon et al., 2025). Eligible gardens were adjacent to the house, with productive areas between 100–1,000 m^2, as defined by FAO criteria, and used for crops and/or small animals for household consumption. Selection also considered participants' knowledge and willingness to collaborate. Participation was voluntary and anonymous, with informed consent obtained from adults managing the gardens.

3.3 Collection techniques

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Primary data were collected from August 2021 to July 2022 through structured questionnaires, direct observations, and semi-structured interviews. A structured questionnaire to gather demographic information from the household and characteristics of the homegarden was applied (Table 1).

Table 1

Variables and attributes of the structured interview

Characteristic	Type	Unit
Sociodemographic variables and attributes		
Number of household members	Variable	Numerical quantity
Number of children in the household	Variable	Numerical quantity
Number of adults in the household	Variable	Numerical quantity
Educational level of the adults of the household, mainly the owner of the homegarden	Variable	0=None 1=Primary (complete o incomplete) 2=Secundary 3=Secundary incomplete 4=University
Age of the owner of the homegarden	Variable	Years
Years of residing in the area	Variable	Years
Origin of the person in charge of the homegarden (geographical site)	Attribute	NA- Categorical variable-
Occupation of the owner of the homegarden	Attribute	NA- Categorical variable-
Age and gender of household members participating in the homegarden, as well as their contribution	Variable	Number (age). Categorical (Feminine –Masculine- other). attribute
Variables and general attributes associated with the homegarden		
Homegarden area	Variable	Square meter
Distance from the homegarden to the nearest forest	Variable	Meters/ Kilometers Meters/ Kilometers
Reasons for having the homegarden	Attribute	NA
Years of the homegarden	Variable	Years
Local name for the homegarden	Attribute	NA
Areas that make up the garden	Attribute	NA
Household members with decision-making power over the homegarden	Attribute	NA
People who tend the homegarden	Attribute	Numerical quantity
Weekly hours of work in the homegarden	Variable	Numerical quantity(hours)
Products for sale and barter	Attribute	NA
Homegarden contribution in difficult times	Variable	Yes-No
Source of knowledge people have of the homegarden	Attribute	NA
Person (if applicable) who transmitted knowledge	Attribute	NA

Source: Created by the author, based on and adapted from Cahuich (2012), Panyadee et al. (2016), Sander & Vandebroek (2016), Barbhuiya et al. (2016).

During semi-structured interviews, participants identified all useful species, (excluding ornamental). Plant uses were categorized as staple food, medicinal, fruit, spices, timber, or ecological/practical

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functions (e.g., living fences, windbreaks), while animal uses included staple food, sale, honey, medicinal, protection, and pets.

For each species, the number of individuals, uses, local names, growth form, photos, management practices, and purposes (sale, self-consumption, barter) were recorded. Identification relied on field guides and local botanical experts. Specimens were not collected given the high number and familiarity with most species.

3.4 Analysis processing

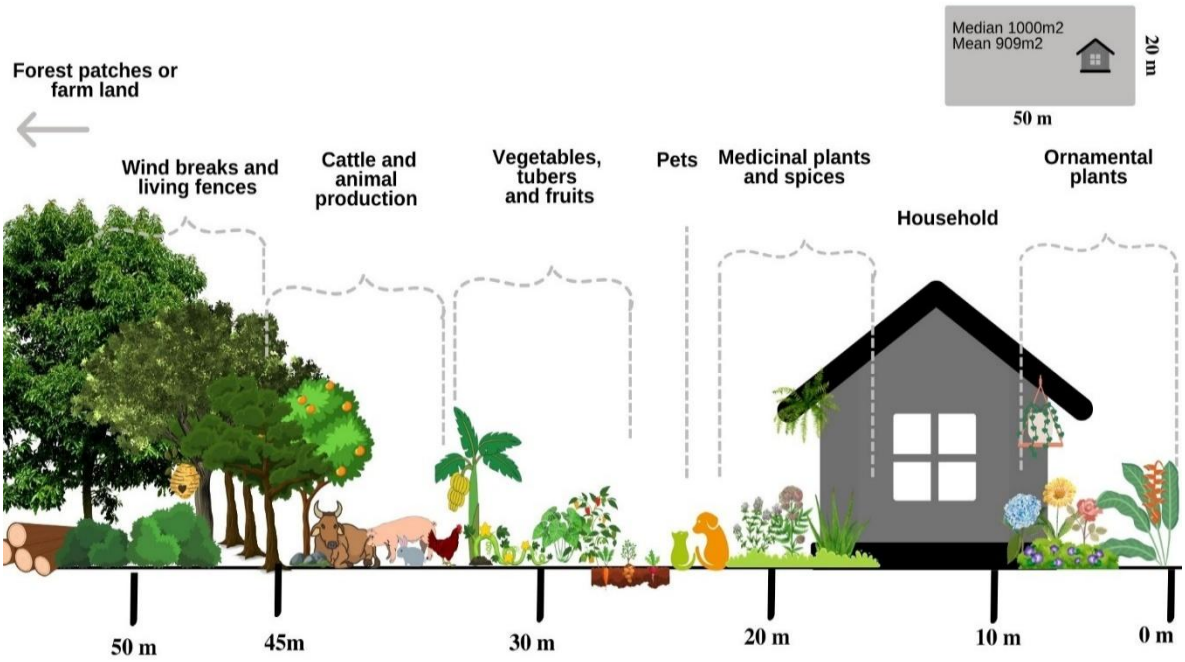
Data were analyzed using R 4.2.0 and Microsoft Excel 2013. Descriptive statistics were applied to characterize homegardens and household demographics (Traversa & Alejano, 2013). Differences between Alto and Bajo San Luis were examined, and Pearson's correlations were used to assess relationships between species richness and household demographic variables.

4. Results

The average size of the homegardens is 909 ± 480 square meters (Mean ± SD). These areas are divided into productive zones for various purposes: a) decorative areas with ornamental plants, b) medicinal plants and spices, c) cultivation of vegetables, tubers, and fruits, and d) windbreaks and living fences (see Figure 1).

Figure 1

Typical land use patterns of homegardens in San Luis, Monteverde.



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Some of the descriptive statistics on household and homegarden characteristics are summarized in Table 2.

Table 2

Selected household characteristics in San Luis, Monteverde (N=23)

	Variable type	Median	Mean	SD	Min	Max
Demographic	Owner age	54.00	53.91	15.20	26.00	90.00
	Total number of household members	3.00	3.26	1.32	1.00	6.00
	Children in the household	0.00	0.52	0.73	0.00	2.00
Agroecological	Homegarden size	1000	909	480.27	200	2000
	Total of species including ornamentals	83.00	92.22	41.72	32.00	193.00
	Total of species with uses	34.00	35.48	1.32	12.00	78.00
	Taxonomic families	22.00	22.48	7.27	7.00	44.00
	Animal taxonomic families	2.00	2.65	1.15	1.00	4.00
	Plant taxonomic families	20.00	19.83	6.64	5.00	40.00
	Distance of homegarden from the nearest forest	50.0	127.6	172.23	10.0	600.0
	Homegarden's years	20.00	20.57	16.10	1.00	70.00
	Work hours per week in the homegarden	7.00	9.65	8.64	0.00	28.00

Source: Author's data and survey (Arias, 2024)

Of the 23 homegarden owners, all but one were native to San Luis; the exception had lived in the community for 19 years. Homegarden tenure ranged from 1 to 70 years (mean = 20), with most participants descending from Monteverde's founding families who migrated from the Central Valley.

Homegarden maintenance and decision-making are typically managed by a single household member, most often women (86.96%), who also carry out domestic responsibilities; men represent 13.04% of owners. Occupations are diverse, including housewives (47.82%), farmers (13.03%), entrepreneurs (8.70%), teachers (8.70%), administrators (4.35%), biologists (4.35%), interpreters (4.35%), housemaids (4.35%), and receptionists (4.35%). Educational level is generally low: 4.35% had no formal education, 56.52% completed primary school, 8.70% incomplete secondary, 8.70% secondary, and 21.73% university studies. This demographic profile suggests that homegardens function as a key self-consumption strategy among low-income households with high domestic workloads. The prevalence of long-term owners also indicates that many belong to older generations with limited access to formal education.

Households typically consist of 3±1 members, with a surprising 60.87% having no children; 26.09% have one child, and 13.04% have two children. The average age of the homegarden owner is 54 ± 15 years, ranging from 26 to 90 years. There is a strong positive correlation between the owner's age and the total number of species (including ornamentals) in the homegarden ($r = .67$, $p < .001$). However, the correlation between the owner's age and the number of useful species (excluding ornamentals) is weaker ($r = .13$, $p > .05$), likely due to the differing maintenance requirements. Additionally, there is a positive correlation between the number of species and the weekly hours of

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work dedicated to the homegarden (r = .47, p < .05). A slight positive correlation exists between homegarden's age and total number of species (r = .35, p > .05), with older homegardens having more species.

Homegardens in San Luis exhibits significant diversity in species with reported uses, with a total species richness of 182 (see Table 3). The highest species richness (78 useful species) was recorded in a homegarden in Bajo San Luis, owned by a 55-year-old female Farmer.

Table 3

Species richness and composition of useful species in homegardens of San Luis, Costa Rica.

Location	No. of homegardens (N)	Total species	Native species	Exotic species	Plant species	Animal species
Bajo San Luis	8	125	55	70	114	11
Alto San Luis	15	124	42	82	118	6
Total (San Luis)	23	182	74	108	160	13

Source: Author's survey data.

A total of 65 taxonomic families were recorded in the community, comprising 10 animal and 55 plant families. Among animals, Canidae, Phasianidae, and Felidae were the most abundant, while bees and rabbits were less common (see Table 4)

Table 4

Animal families recorded in homegardens and their abundance.

Family (common name)	No. of homegardens	No. of individuals / hives*
Canidae (dogs)	18	29
Phasianidae (chickens)	16	248
Felidae (cats)	15	28
Suidae (pigs)	3	10
Apidae ("Mariolas" bees)	2	2 hives
Leporidae (rabbits)	2	19
Bovidae (goats)	1	1
Apidae ("Ocuta" bees)	1	1 hive
Numididae (guineafowl)	1	2
Phasianidae (quails)	1	3
Bovidae (cows)	1	4
Psittaculidae (parrots)	1	6
Anatidae (ducks)	1	16

**Individual counts include both animals and bee hives. Data is based on 23 sampled homegardens.*

Source: Author's survey data.

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Among the plant families, 35 were represented by more than one species, while 20 families had only one species each. Bajo San Luis exhibited greater plant diversity than Alto San Luis, along with a higher richness of native species and greater animal diversity. Fabaceae (15 species), Rutaceae (10), Solanaceae (10), Lamiaceae (9), and Myrtaceae (9) were representing the plant families with the greatest number of useful species. The most frequently cultivated plant species across households included *Aloe vera*, *Citrus aurantifolia*, *Eryngium foetidum*, and *Persea americana*, each grown by more than half of the households (see Table 5).

Table 5

Most frequently grown plant species in homegardens.

Species (scientific name)	% of households cultivating*
Aloe (*Aloe vera*)	91.30%
Lemon (*Citrus aurantifolia*)	86.96%
Wild cilantro (*Eryngium foetidum*)	78.26%
Avocado (*Persea americana*)	69.57%
Mango (*Mangifera indica*)	69.57%
Orange (*Citrus sinensis*)	69.57%
Banana (*Musa sp.*)	65.22%
Sweet pepper (*Capsicum sp.*)	65.22%
Oregano (*Lippia graveolens*)	65.22%
Rosemary (*Salvia rosmarinus*)	65.22%
Guava (*Psidium guajava*)	60.87%
"Juanilama" (*Lippia alba*)	60.87%
Squash (*Sechium edule*)	56.52%
Coffee (*Coffea arabica*)	56.52%
"Cas" (*Psidium friedrichsthalianum*)	56.52%
Chayote (*Sechium edule*)	56.52%
Plantains (*Musa sp.)*	52.17%
Papaya (*Carica papaya*)	52.17%
Basil (*Ocimum basilicum*)	52.17%

*****Percentages indicate the proportion of households cultivating each species. Data from 23 homegardens.*

Bajo San Luis, with eight sampled homegardens and located farther from the center and markets, exhibited greater plant species diversity—particularly trees—than Alto San Luis, where 15 homegardens were sampled (Table 3). These findings highlight the high agrobiodiversity of San Luis homegardens and the variation in species composition between the two localities.

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Table 6

Distribution of plant species by growth form in homegardens of San Luis*

Type of growth	Overall San Luis (N/% of the overall study)	Bajo San Luis (N/% of the section)	Alto San Luis (N/%of the section)
Tree species	56 (33.14)	41(32.80)	34 (27.42)
Shrubs	31(18.34)	20(16.00)	22 (17.74)
Gigantic shrubs	4(2.37)	3(2.40)	4 (3.23)
Herbs	63(37.28)	50(40.00)	52(41.94)
Creeping plant	3(1.78)	2(1.60)	3(2.42)
Climbing plant	12(7.10)	9(7.20)	9(7.97)
Total of plant species	169(100)	125(100)	124(100)

** Sample size: N = 23 (Bajo San Luis, n = 8; Alto San Luis, n = 15)*

Source: Author´s survey data.

These results underscore the heterogeneity and complexity of homegardens, indicating that no single management approach applies uniformly across these productive units. This heterogeneity is also reflected in local terminology, with residents referring to their homegardens as jardín (47.83%), cerco (17.39%), huerta (13.04%), patio (13.04%), solar (4.35%), and lote (4.35%). Homegardens in San Luis were primarily used for self-consumption (100%), while barter (25%) and sales (17%) were less common purposes. Of the 182 species with reported uses, 151 were recorded with the purpose of self-consumption, including staple foods, medicinal plants, fruit trees, spices, and honey-producing species; 10 were animal species, and the remainder were plants. The remaining 31 species had other uses, including timber, ecological/practical functions, or pets.

5. Discussion

The mean size of homegardens in the study area is 909 m^2, like other homegardens worldwide, typically less than a hectare (Barbhuiya et al., 2016; Thamilini et al., 2019; Traversa & Alejano, 2013). While size may limit production quantity, it offers opportunities for better control and management due to household proximity. However, gentrification threatens homegarden structure, as rising land values and urban development in Monteverde displace local residents and convert productive areas into commercial or residential sites. This transformation could undermine ecological resilience, local biodiversity, food security, and traditional knowledge.

Homegardens in San Luis, like in other regions (Castañeda-Navarrete, 2021; Williams et al., 2018), are not the sole source of food but contribute to food access and household dietary needs. Families in San Luis and other regions often engage in other jobs, making homegardens a complementary food source. Moreover, the diversity found in these homegardens contributes to more balanced household diets by supplying fresh fruits, vegetables, herbs, and animal protein, thus forming a

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strategy to achieve household FNS. This is especially important in areas like San Luis, where rising food costs possible in part due to gentrification limit market access. Several studies have shown that higher on-farm agrobiodiversity—such as that observed in San Luis, with multiple tree and plant strata, and diverse food sources—is associated with improved dietary diversity and nutritional outcomes (Issahaku et al., 2023; Korpelainen, 2023; Oduor et al., 2019; Thamilini et al., 2019).

The widespread use of medicinal plants in San Luis underscores the role of homegardens in supporting traditional health practices and overall wellbeing. Moreover, homegardens activities have been linked to health benefits, including relaxation and a sense of security from having access to self-produced food (Zapata et al., 2024), findings that were also observed in a parallel study conducted in the same homegardens in San Luis by the lead author (Arias, 2024).

The average age of homegarden owners in San Luis is 54 years, slightly older than reported in other studies (Oduor et al., 2019; Sander & Vandebroek, 2016). This indicates that homegardens in the study area are mainly managed by older generations, serving as reservoirs of traditional ecological knowledge. However, limited participation of younger people —often due to migration for education or employment—poses a challenge in San Luis for intergenerational knowledge transfer, as the involvement of sons and daughters in farm activities is a key factor for agricultural succession (Rodríguez-Lizano et al., 2020). Moreover, homegardens are predominantly managed by women, reflecting their proximity to household spaces and the integration of food production with domestic responsibilities (Castañeda-Navarrete, 2021; Dietrich, 2011; Traversa & Alejano, 2013).

Household factors significantly influence homegarden diversity. Consistent with previous studies (Barbhuiya et al., 2016; Panyadee et al., 2016; Williams et al., 2018), species richness increased with owner age, although the correlation weakened when ornamental species were excluded. This suggests that maintaining crops and animals demands greater physical effort, which may limit older individuals compared to the care required for ornamental plants (Castañeda-Navarrete, 2021).

These household characteristics directly shape the structure, use, and functions of homegardens. The predominance of women as homegardens owners—often housewives—highlights their role as gendered spaces linked to caregiving and household food provision. Small household size and low educational levels further shape homegardens toward self-consumption and health-oriented systems rather than market production. Overall, these demographics emphasize the multifunctional nature of homegardens as sources of food, biodiversity, and resilience for rural families facing socio-economic vulnerability.

This research reinforces the high species diversity in homegardens, with 182 species (13 animals and 169 plants) and 65 taxonomic families identified in San Luis. The 169 plant species recorded in San Luis homegardens reflect a high level of agrobiodiversity within a relatively small area. This richness aligns with Monteverde's exceptional floristic diversity, where approximately 3,021 vascular plant species—including 755 tree species—have been documented, representing nearly one-third of Costa Rica's flora (Haber, 2000). The composition of homegarden species may, therefore, mirror the regional floristic wealth, as homegardens often incorporate germplasm and wild species from

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surrounding forests (Barbhuiya et al., 2016; Poot-Pool et al., 2015). Indeed, several studies suggest that homegarden flora can be representative of native forest species (Barbhuiya et al., 2016), highlighting their role as reservoirs of local biodiversity and as bridges between cultivated and natural ecosystems.

Comparable studies have documented high plant diversity in homegardens across different regions, with reported species richness ranging from 87 in Jamaica (Sander & Vandebroek, 2016) to over 300 in Mexico and Nicaragua (Poot-Pool et al., 2015; Méndez et al., 2001). In Costa Rica, Kappelle et al. (2000) recorded 189 species in the Los Santos region, while Barbhuiya et al. (2016) and Panyadee et al. (2016) reported similar diversity patterns in the Himalayas and Thailand, respectively.

The study also explored species richness differences between homegardens in Alto San Luis (closer to the market) and Bajo San Luis (more forested and farther from market). Homegardens in Bajo San Luis contained more native plant species, more tree species, and supported greater animal diversity. This diversity could be due to factors such as proximity to forests and market access (Baudron et al., 2017; Das & Das, 2015; Ickowitz et al., 2014; Kabir & Webb, 2009), since geographical and social isolation can play a role in determining homegarden's diversity (Baudron et al., 2017).

Common taxa identified in this study, including *Citrus*, *Mangifera*, *Carica*, *Psidium*, and *Capsicum*, are consistently reported across tropical homegardens (Barbhuiya et al., 2016; Das & Das, 2015; Kabir & Webb, 2009; Kumar & Nair, 2004; Sander & Vandebroek, 2016). The predominance of Fabaceae (15 species), Rutaceae (10), and Solanaceae (10) aligns with floristic compositions documented in homegardens in other regions. Notably, Fabaceae species play a dual ecological and nutritional role: their capacity for biological nitrogen fixation enhances soil fertility, while their nutrient-dense seeds represent a key source of dietary protein, carbohydrates, and energy (Shavanov, 2021). This dual contribution of Fabaceae species enhances soil fertility and supports FNS in San Luis.

Self-consumption is the primary reason for maintaining homegardens in San Luis. However, the significance of self-consumption has often been overlooked in studies and public policies, overshadowing the productive and social processes involved (Grisa et al., 2010). Rodríguez and Coelho-de-Souza (2014) highlight that self-consumption enhances family structure and food security by reducing the need for monetary income to buy food, thus increasing economic liquidity for other needs.

Self-consumption emerged as the primary motivation for maintaining homegardens in San Luis. Yet, its importance is often underestimated in research and policy, which tend to overlook the productive and social processes it sustains (Grisa et al., 2010). As noted by Rodríguez and Coelho-de-Souza (2014), self-consumption strengthens household FSN and resilience by reducing dependency on cash income for food purchases, increasing economic flexibility. Furthermore, homegardens may contribute to overall wellbeing and mental health by fostering a sense of autonomy and connection to food sources, while also functioning as a recreational activity that promotes relaxation and wellbeing. Producing food locally not only ensures knowledge of its origin and production process but can also improve nutritional quality compared to market alternatives. Although this study did

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not explore these aspects, future research could examine the comparative nutritional value and environmental footprint of homegardens-produced versus market-sourced foods.

Homegardens exhibit substantial variation in composition and structure driven by physiographic, climatic, and household factors (Kabir & Webb, 2009), a pattern clearly reflected in this study, where two sectors of the community just a few kilometers apart exhibited distinct characteristics—one being more diverse, forest-embedded, and distant from markets. While such complexity poses challenges for incorporating homegardens into development programs (Landon-Lane, 2004), it simultaneously offers an opportunity to integrate accumulated local knowledge with agroecological principles to enhance sustainable management. Despite their ecological and cultural significance, homegardens face pressures that may compromise their persistence, highlighting the urgency of integrating them into research and conservation agendas.

This study has limitations. Future research could examine in depth the reasons behind specific the presence/absence of species in homegardens, the motivations and decision-making, and knowledge transfer across generations. More detailed assessments of actual contribution of homegarden produce to dietary intake, family nutrition, and the effects of homegardening on mental health and wellbeing are also needed to fully understand the multifunctional value of these systems.

6. Conclusions

In San Luis, women, primarily housewives, are responsible for decision-making and maintenance of homegardens. This pattern is common worldwide, suggesting that support (training, inputs, advice, extension) should focus on these women to improve homegarden productivity and diversity. Additionally, homegardens diversity is influenced by geographic and ecological context, with higher species richness in areas closer to forests and farther from market.

Homegardens in San Luis harbor a high diversity of native and exotic species, functioning as in situ reservoirs of agrobiodiversity and supporting household FNS. In this study, 151 species were recorded for self-consumption, including staple foods, fruit trees, vegetables, medicinal plants, spices, and honey-producing species. These diverse plant and animal resources contribute directly to balanced and resilient diets, supporting multiple dimensions of health beyond the use of medicinal plants (34 species reported). Key species central to local diets include beans, bananas, citrus, root crops, culinary herbs, and medicinal plants, underscoring the role of homegardens in sustaining dietary diversity and nutrition.

Key factors such as the owner's age, time dedicated to the homegarden, and the garden's age positively influence this diversity. The older the owner, the more time dedicated to this productive system, and the older the homegarden itself, the greater the species richness. However, this brings us to the issue of generational change, as the most diverse homegardens are managed by elders, with limited involvement from younger generations, which could pose a significant future challenge. The demographic characteristics of homegarden households in San Luis—such as the low presence

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of children (in contrast to the broader Monteverde region, where 20% of the population is under 14), small household sizes, and low educational levels—underscore the critical role of homegardens as sites of food autonomy and resilience. Understanding this context is key to developing policies and interventions to strengthen these spaces.

In Monteverde, where gentrification has raised the cost of living, homegardens helps reduce food insecurity. Producing food for self-consumption, allows the household to rely less on markets and ensure access to fresh and diverse food. These small agricultural spaces also support the surrounding environment by providing habitats for wildlife and contributing to multiple ecosystem services. Furthermore, ecological context influences homegardens composition and diversity, highlighting the interaction between landscape characteristics and agrobiodiversity.

Some implications for research and practice that comes out from this study include the relevance of exploring culturally appropriate and locally adapted strategies to enhance the multifunctional nature of homegardens, increase their productivity, and make them more appealing to younger generations. Additionally, it is essential to provide households with training and technical support specifically aimed at improving soil quality and production practices, in order to ensure high nutritional quality in self-produced foods. Building on their previous work in the study region and drawing on successful experiences in Mexico; the authors already proposed interventions in Monteverde homegardens focused on agroecological management, including the creation of a community-wide network of educational homegardens and the integration of agroecotourism as a value-added activity (Arias & Dumani, 2023). These approaches aim to strengthen the sustainability, multifunctionality, and social impact of homegardens while fostering knowledge exchange and community engagement.

Implementation of these strategies requires coordinated action across political, governmental, academic, and social spheres, including targeted extension services and programs that respond to local needs. Additionally, municipal regulatory frameworks that guide land use and mitigate the effects of gentrification are crucial to protecting homegardens. Such efforts are essential for balancing development with the conservation of local traditions, biodiversity, and the ecological and social functions of these productive spaces.

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Editorial colaboración especial

Escuela de Nutrición: 45 años de aportar al desarrollo de la nutrición en Costa Rica

La Escuela de Nutrición de la Universidad de Costa Rica celebra 45 años de existencia, periodo en el que se registran importantes contribuciones al desarrollo de la nutrición en el país. Su aporte en la formación de profesionales, investigación y acción social se enriquece con la interrelación de saberes, la innovación y la proyección universitaria.

La carrera abre sus puertas en 1980, y se adscribe a la Facultad de Medicina. La investigación ha sido diversa por parte del personal académico y estudiantes, constituyéndose en un eje transversal en el currículum.

Entre 1980 y 1990 el estudio se enfocó en el abordaje de la nutrición materno infantil, políticas y programas nacionales en alimentación y nutrición e intervenciones nutricionales en comunidad, educación alimentaria y nutricional, análisis de la composición nutricional de alimentos, metodologías para la evaluación del consumo de alimentos, entre otros temas relevantes.

A partir de 1990, el trabajo se amplía en el abordaje de otras etapas de vida, enfermedades crónicas no transmisibles, seguridad alimentaria y nutricional, entre otras temáticas, en respuesta a nuevas realidades y necesidades sociales e institucionales.

En el año 2023 se actualizaron las líneas de investigación y acción social, en congruencia con la agenda nacional y universitaria, con el objetivo de priorizar el trabajo y facilitar la integración de grupos académicos, así como la participación en comisiones universitarias, nacionales y redes académicas para el intercambio académico, la difusión científica y la divulgación.

Desde el 2016, se cuenta con la acreditación por el Sistema Nacional de Acreditación, SINAES, y al 2025 ratifica su compromiso con la gestión de la calidad, con el fin de continuar brindando el apoyo a las transformaciones que la sociedad requiere en pro del bien común y el desarrollo humano, donde la nutrición es un pilar fundamental, y en congruencia con los propósitos de la UCR como universidad pública.

Para celebrar el 45 aniversario, se presenta esta edición especial de la revista que reúne varios trabajos académicos que son muestra de la generación de nuevo conocimiento en la comprensión de temas de nutrición de especial relevancia en el ámbito nacional e internacional. Los artículos incluidos en este número pasaron por el proceso normal de evaluación: una revisión preliminar a cargo del comité editorial de la revista, seguida por la verificación, por parte del comité conformado para esta sección, de que los documentos cumplieran rigurosamente con las normas editoriales; finalmente, cada contribución fue sometida a la selección y dictamen de pares externos en el marco del proceso de revisión por pares a doble ciego.

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