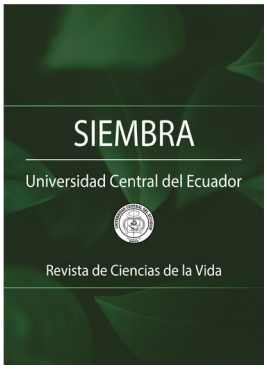
Traditional knowledge and socioecological interactions in the use of biodiversity in Jama, Manabí



Conocimientos tradicionales e interacciones socioecológicas en el uso de la biodiversidad en Jama, Manabí

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Abstract

We conducted an ethnobiological study in the La Mocora, Colorado, Calade, and Cañaveral communities in Jama, Manabí, Ecuador, to analyze socio-ecological interactions and document the transmission of traditional knowledge about biodiversity use. Semi-structured interviews were conducted with 190 people, considering variables such as age, gender, and educational level, and indicators of use value and frequency. Most participants were between 46 and 55 years old. There was a male predominance of 75% in Colorado, while Calade has a more balanced gender ratio. Over 50% of Colorado and Cañaveral residents lack formal education, while primary education predominates in La Mocora. We identified 23 plant species used for food, medicine, and cultural purposes. *Citrus reticulata* was the most frequently mentioned species (13.33%), followed by *Eucalyptus globulus* and *Passiflora edulis*. Fourteen animal species were reported, including *Gallus gallus*, *Oryctolagus cuniculus*, *Anas platyrhynchos*, and *Ortalis erythroptera.* There were variations within communities: duck was preferred in Colorado, rabbit in Calade, and chicken in La Mocora and Cañaveral . Seventy-five percent of respondents collected resources within 500 meters from their homes. These results demonstrate an extensive knowledge of the natural environment and the close relationship between biodiversity and cultural practices, highlighting the importance of strengthening intergenerational knowledge transfer and integrating conservation strategies with the preservation of the biocultural heritage of local communities.

Keywords: ecosystems, ethnobotany, conservation, rurality, sustainability.

Resumen

En las comunidades de La Mocora, Colorado, Calade y Cañaveral, del cantón Jama (Manabí, Ecuador), se realizó un estudio etnobiológico para analizar las interacciones socioecológicas y documentar la transmisión de conocimientos tradicionales sobre el uso de la biodiversidad. Se aplicaron entrevistas semiestructuradas a 190 personas, considerando variables como edad, género y nivel educativo, así como indicadores de valor de uso y frecuencia. La mayoría de los participantes tenían entre 46 y

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55 años, con predominio masculino del 75 % en Colorado y mayor equilibrio de género en Calade. Más del 50 % de los habitantes de Colorado y Cañaveral carecen de educación formal, predominando la educación primaria en La Mocora. Se identificaron 23 especies vegetales utilizadas con fines alimenticios, medicinales y culturales, siendo *Citrus reticulata* la más mencionada (13,33 %), seguida de *Eucalyptus globulus* y *Passiflora edulis*. Además, se registró el uso de 14 especies animales, entre ellas *Gallus gallus*, *Oryctolagus cuniculus*, *Anas platyrhynchos* y *Ortalis erythroptera*, con variaciones entre comunidades: en Colorado se prefirió el pato, en Calade el conejo y en La Mocora y Cañaveral la gallina. El 75 % de los encuestados recolectó recursos a menos de 500 metros de sus viviendas. Los resultados evidencian un conocimiento integral del entorno natural y una estrecha relación entre biodiversidad y prácticas culturales, destacando la importancia de fortalecer la transmisión intergeneracional de saberes e integrar estrategias de conservación con la preservación del patrimonio biocultural de las comunidades locales.

Palabras clave: ecosistemas, etnobotánica, conservación, ruralidad, sostenibilidad.

1. Introduction

Ecuador is considered a megadiverse country, as it hosts a wide variety of ecosystems that sustain significant biological richness, including high levels of endemism (Ministerio del Ambiente del Ecuador [MAE], 2015). This biodiversity provides essential benefits to rural and peri-urban communities, not only in terms of natural resources but also as part of their cultural identity and traditional knowledge (Jiménez-González et al., 2022). However, despite its importance, the relationship between communities and the biological resources they use faces increasing challenges due to processes of modernization, loss of traditional knowledge, and environmental degradation (Berkes et al., 2000; Toledo & Barrera-Bassols, 2009; Zent, 2009).

In Jama (Manabí province), communities maintain a close relationship with their natural environment through the traditional use of plant and animal species for food, medicinal, and cultural purposes. The intergenerational transmission of this knowledge has been key to biocultural conservation; however, it is increasingly threatened by the loss of access to resources, externally driven development models, and the lack of integrated conservation strategies (Carranza Patiño et al., 2021).

According to the Organización Mundial de la Salud (OMS, 2019), traditional medicine plays a fundamental role in many communities worldwide by providing therapeutic alternatives based on local knowledge. In Jama, the use of medicinal plants and other natural resources remains part of cultural identity, despite the growing influence of modern medicine (Lima López et al., 2019). Integrating these practices into conservation and development strategies may represent a viable solution for preserving traditional knowledge and biodiversity.

In this context, the present study aims to analyze socioecological interactions and the use of biodiversity in the canton of Jama, Manabí, by identifying the plant and animal species used by local communities, their patterns of use, and their importance for conservation and sustainable development.

2. Materials and Methods

2.1. Location of the area of study

The canton Jama is located at the West central part of the Manabi province, Ecuador, and it limits to the North with Pedernales, to the South with San Vicente, to the East with Sucre and Chone, and to the West with the Pacific Ocean (Peñarrieta Carranza, 2013). The total area is approximately 575 km² with an altitudinal range from 0 to 900 m a.s.l. This study was carried out in the communities of La Mocora, Colorado, Calade and Cañaveral, selected by their access to natural ecosystems, rich biology and traditional knowledge about the use of biodiversity (Figure 1).

2.2. Methodology

2.2.1. Tools for data recollection

Data was collected through a semi structured interview designed based on Jiménez-González et al. (2021)'s

adapted by the author according to the local context. The questionnaire included questions about plant and animal species used by local people, and included information about their common names, life forms (tree, bush, weed), beneficial parts (leaves, fruits, roots, etc.) forms of use (raw, cooked, infusion, fabric), recollection methods (total, partial, seeds), habitats, and utilization purposes (medicine, food, cultural, among others). Likewise, data about abundance perception, time, and frequency of recollection, and management or traditional practices loss were registered. Sociodemographic data from the interviewers was also collected (age, gender, level of education) allowing the contextualization of the recorded knowledge.

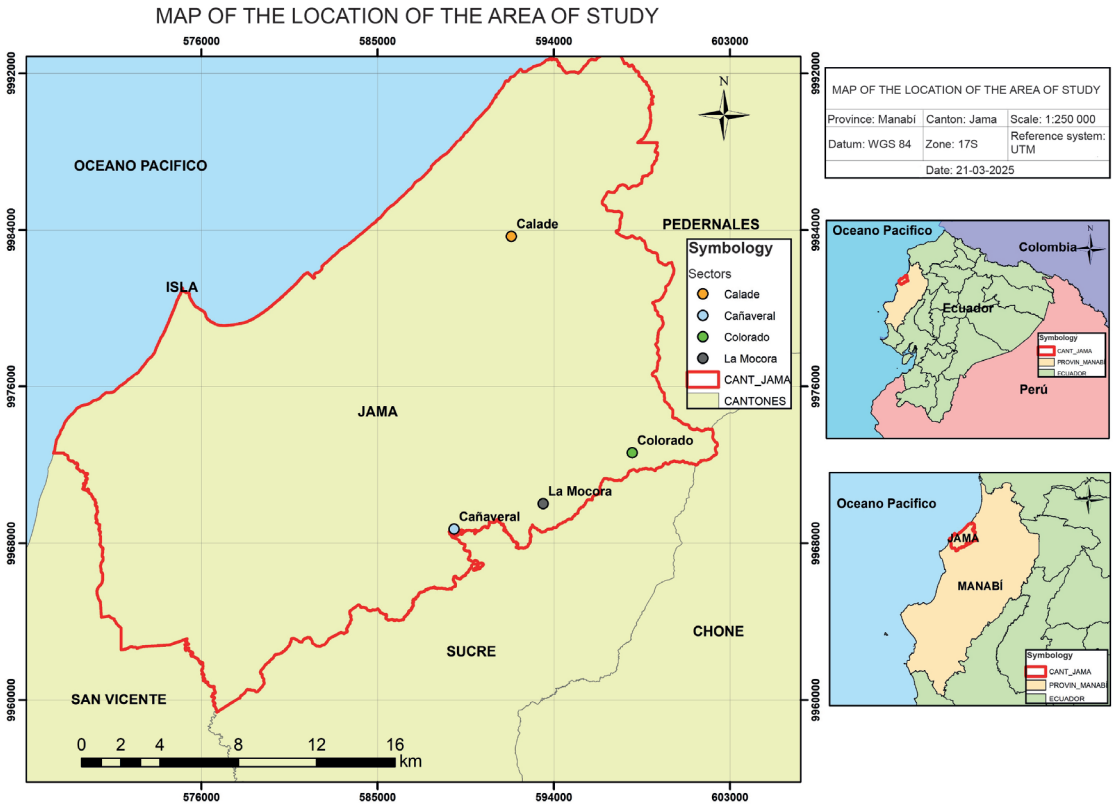

Figure 1. Location of the study areas in the La Mocora, Colorado, Calade, and Cañaveral communities of Jama, in Manabí, Ecuador.

To complement the data, field observations and photography records were taken. The sample size was determined through equation [1] for finite populations according to Torres et al. (2006), considering a confidence level of 95% and error margin of 10%. The calculations showed the need to interview 48 people in La Mocora and Colorado, 47 in Calade and Cañaveral, giving a total of 190 interviews.

$$n = \frac{N*Z^2*p*q}{d^2\,(N-1)+ Z_a^2*p*q} \quad [1]$$

Where: N = population size; Z = confidence level of 95%, p = success rate or expected proportion (0.5), q = probability of failure (0.5), and d = precision (maximum admissible error in terms of proportion – 10%). To solve the previous equation, the number of inhabitants from each sector are considered, which results in the total of interviews applied. Table 1 presents the data on the number of inhabitants from each sector of the study in the Jama canton.

Table 1. Number of inhabitants in the communities studied in Jama.

Communities	N.º of inhabitants
Mocora	330
Colorado	300
Calade	290
Cañaveral	280

2.2.2. Calculation of the species use value index and the Tramil significant use (TSU)

The TRAMIL significant use (TSU) was used to analyze the cultural importance and the percentage of the use of plant and animal species in the areas of study. This index reflects the frequency of the usage of one species with at least one purpose recognized by the community. According to Pérez et al. (2011), a frequency of usage similar or superior to the 20% between the informants is considered significant in terms of cultural recognition. This allows to identify the most common and relevant purposes. The percentage of use of each species was calculated based on Jiménez-González et al. (2021)'s equation [2].

$$\%\ species\ usage = \frac{fn}{N} * 100 \quad [2]$$

Where: f_n = number of people who mentioned a determined species, and N = total number of interviewed people.

The TRAMIL significant use (TSU) or simplified use value index was calculated using equation [3].

$$IVUs = \frac{\sum i\ UVis}{n_s} \quad [3]$$

Where: UV_{is} = number of mentioned purposes by each informant i for the species s, and n_s = total number of interviewed informants for that particular species.

In ethnobiological studies and studies about the purposes of biodiversity, a citation is referred to the number of times a species has been mentioned by the informants in relation to its specific use/purpose, being medicinal, nutritional, ritual or another type. This value allows to estimate the cultural or functional importance of each species within a community, and it facilitates the quantitative analysis of the collected ethnobiological information (Bermúdez del Sol et al., 2022).

The taxonomic identification and nomenclature of the species were based on Tropicos.org (2025) and the Catalogue of Life (Bánki et al., 2024; Hernández-Robles et al., 2023), and common names were provided by local field guides (Jiménez-González et al., 2021). The scientific nomenclature of mammals and birds was updated in accordance with the official checklist of mammals of Ecuador (Brito et al., 2023; Freile & Poveda, 2019; Tirira & Solórzano, 2025).

2.2.3 Data analysis

For data analysis, statistical and visualization tools were employed using the R software (R Core Team, 2023) and Python with the Matplotlib, Seaborn, and NetworkX libraries (Hagberg et al., 2008; Hunter, 2007). Data processing included frequency analyses, measures of central tendency and dispersion, as well as the construction of interaction networks among species and communities using graph-based models (Hashemi et al., 2024).

Data visualization was carried out using bar charts, network diagrams, and heat maps, which facilitated the interpretation of patterns in the use of plant and animal species within the analyzed communities. For the analysis of species use categories, cluster analysis was applied following the recommendations of Martínez-López et al. (2021), allowing the identification of similarities and differences in resource use among communities.

Compliance with ethical considerations in data collection was ensured by obtaining informed consent from participants and guaranteeing the confidentiality of the collected information, in accordance with the OMS (2019) guidelines for ethnobiological studies.

3. Results

Figure 2 presents the results of the analysis of age groups, gender distribution, and educational level in the studied communities. Most respondents are between 46 and 55 years old, with greater representation in Cañaveral and Colorado. In contrast, the group of individuals over 66 years of age is the least represented. Regarding gender, in Colorado more than 75% of respondents are men, indicating a pronounced male predominance. In Calade, the distribution is more balanced, although with a slight male majority, while in Cañaveral and La Mocora the proportion is approximately 60% men and 40% women. With respect to educational level, more

than 50% of respondents in Colorado and Cañaveral lack formal education. Primary education is the most commonly attained level, particularly in La Mocora, where only 4% accessed higher education.

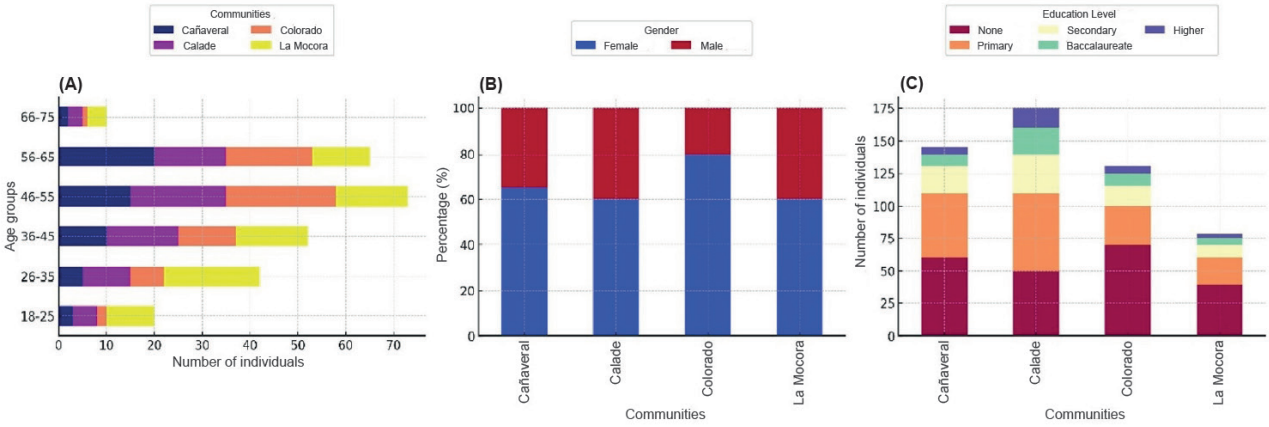

Figure 2. Sociodemographic characteristics of participants in the Jama communities. (A) Distribution by age group (number of individuals). (B) Gender distribution (percentage by community). (C) Educational level (number of by educational level and community).

According to the results in Figure 2, the distribution by gender, the age groups, and levels of education in the communities indicated that more than the 50% of the interviewers in Colorado and Cañaveral do not have any formal academic instruction. Moreover, it is observed that most of the participants in La Mocora had only primary education, while only a small percentage (4%) accessed higher education.

Figure 3 presents the results of the ethnobiological study about the origin of the resources used by the Jama communities. This analysis, based on the information collected by all of the interviewers, shows that plant resources constitute most of the proportion of the reported uses, while animal resources have a smaller representation. This difference could not reflect an explicit preference for vegetables, but it could be related to a higher biodiversity and availability of plant species used in comparison to animals.

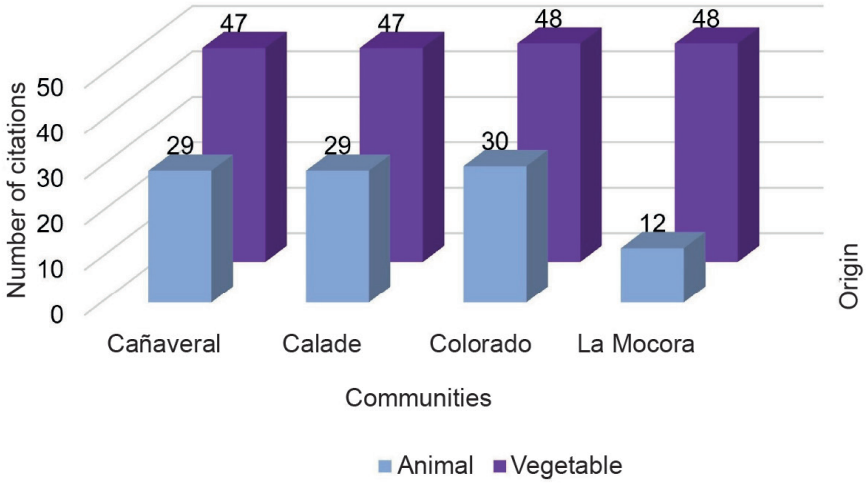

Figure 3. Distribution of citations according to the origin of the non-timber forest products used by interviewees in the five Jama communities studied.

From the results shown in Figure 3, it is observed that 100% (190 respondents) reported the use of at least one plant-derived resource, confirming their relevance in the daily practices and traditions of the studied communities. On the other hand, 52% of participants also reported the use of animal-derived resources, although to a lesser extent. This trend suggests that plant resources are not only more accessible but also fundamental to subsistence and daily use, while animal-derived resources play a complementary role in community dynamics.

Respondents cited 23 plant species used for medicinal and food purposes, distributed among six tree species, nine shrub species, and eight herb species; additionally, they reported one forest species, five fruit species, and 17 medicinal species.

Table 2 presents the relationship between the plant species recorded in the communities of Jama, their growth habits, and their traditional uses. Analysis of this relationship shows that herbaceous species constitute the majority (47.8%), followed by trees (30.4%) and shrubs (21.7%). This distribution may be influenced by ecological and practical factors such as accessibility, regeneration time, and local management practices. In terms of use, herbs are primarily associated with medicinal applications, suggesting a functional relationship between their ease of collection, immediate availability, and simple preparation as infusions, ointments, or other home remedies.

Table 2. Relationship between plant species, growth habits, and traditional uses in the sampled communities of Jama.

N°	Scientific Name	Common Name	Habits			Uses
			Tree	Bush	Weed	
1	*Plantago major* L.	Broadleaf plantain			x	Medicinal
2	*Citrus x sinensis* Osbeck	Orange	x			Food
3	*Mangifera indica* L.	Mango	x			Alimento
4	*Ruta graveolens* L.	Rue		x		Medicinal
5	*Citrus reticulata* Blanco	Mandarin	x			Food
6	*Origanum vulgare* L.	Oregano		x		Medicinal/Food
7	*Thunbergia alata* Bojer ex. Sims	Black-eyed Susan vine		x		Medicinal
8	*Passiflora edulis* Sims	Passion fruit		x		Medicinal/Food
9	*Aloe vera (L.) Burm.f.*	Aloe vera		x		Medicinal/ Food
10	*Cymbopogon citratus* (DC.) Stapf	Lemongrass		x		Medicinal/Drinks
11	*Carica papaya* L.	Papaya	x			Medicinal/ Food
12	*Pimpinella anisum* L.	Anise			x	Medicinal/ Food
13	*Passiflora quadrangulari*s L.	Giant granadilla		x		Food
14	*Coriandum sativum* L.	Coriander			x	Medicinal/ Food
15	*Matricaria chamomilla* L.	Chamomile			x	Medicinal
16	*Salvia rosmarinus* Spenn	Rosemery			x	Medicinal
17	*Valeriana officinalis* L.	Valerian			x	Medicinal
18	*Rosmarinus officinalis* L.	Thyme		x		Medicinal/ Food
19	*Saccharum officinarum* L.	Sugar cane			x	Food
20	*Taraxacum officinale* (L.) Weber ex F.H.Wigg., Prim. Fl. Holsat.	Dandelion		x		Medicinal/ Food
21	*Citrus reticulata* Blanco	Mandarin	x			Food
22	*Mentha rotundifolia* L.	Mint			x	Medicinal/ Food
23	*Eucalyptus globulus* Labill.	Eucaliptus	x			Medicinal/Incense

According to the results from Table 2, trees and bushes, despite being less in number, are mostly associated with nutritional uses, especially fruit species, which reflects their importance in the local diet and more structured agricultural practices. This association between lifestyle and type of usage does not imply an exclusive relationship, but it proves cultural and ecological patterns in the use of local flora. Moreover, some species like *Aloe vera* and *Origanum vulgare* present multifunctional uses, which shows their flexibility and the adaptive knowledge of communities. Overall, these relationships reveal how traditional knowledge structure the use of plants by not only their taxonomical identity but also according to their morphology and functionality for the daily live.

Figure 4 shows the percentual distribution of the uses of the plants in four communities of the Jama canton: Cañaveral, Calade, Colorado y La Mocora. The categories include food and drinks, incense, veterinarian medi-

cine and medicinal uses. It is important to point out that the values surpass 100% because the same species can be classified in multiple usage categories. Therefore, the percentages reflect the proportion of the species that are used in each purpose in relation to the total of recorded species in each community, and not an exclusive distribution.

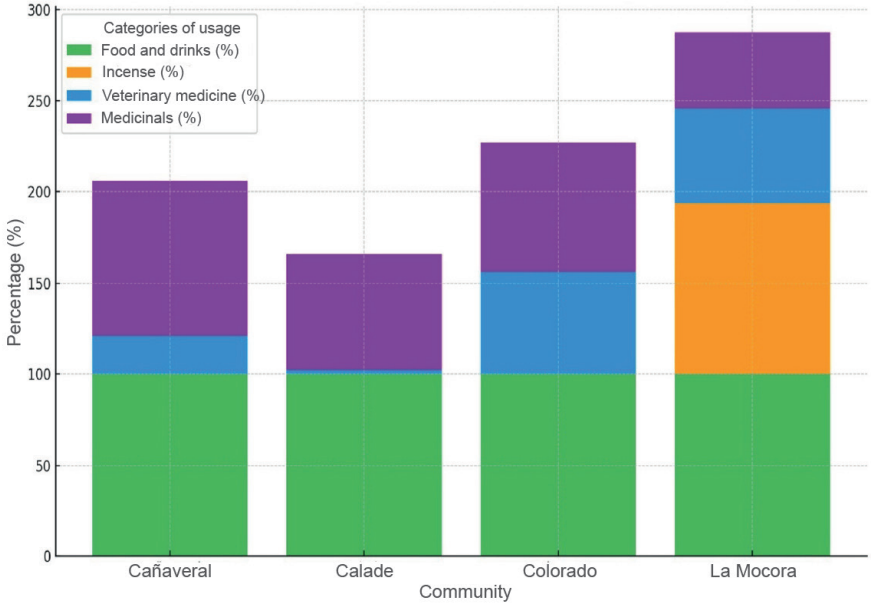

Figure 4. Uses of plants in the sampled communities of Jama.

As observed in Figure 4, the category of food and drinks is the most frequent purpose in all communities. The medicinal usage is also predominant, especially in Cañaveral and Colorado. At La Mocora, the incense is a distinctive practice, while veterinary medicine reaches significant values in Colorado and La Mocora. The reference to values like "100% of relevance" shows that all the reported species in a community have at least one registered purpose under this category. Likewise, when it is said that veterinary medicine "surpass 50%", it means the percentage of these species within the community that are used with this purpose.

In the four analyzed communities, the leaves and fruits were the most used parts from the plants with a prominent frequency in La Mocora (13 and 12 mentions, respectively) and Colorado (15 y 13 mentions). Flowers and seeds showed a moderated use, while the stem was the least mentioned part in all communities with just one or two mentions in Calade and Cañaveral. These results reflect a general preference for accessible and generative plant structures and suggest that the differences in the usage of the plant parts could be associated to local availability and shared cultural patterns.

Figure 5 presents a comparative analysis of the usage forms of plants in the communities of Cañaveral, Calade, Colorado y La Mocora. Three main modalities were identified: infusion, raw consumption and previously cooked. In all the communities, the infusion usage is the most frequent modality, followed by raw usage. The category of "previously cooked" presents lower values and it varies slightly between communities. These patterns reflect traditional practices centered in simple and direct methods of preparation that are transmitted generation to generation as part of the ancestral knowledge.

Figure 6 shows the frequency of the three strategies of recollection used by the inhabitants: total harvest, recollection of useful parts and seed collection. The total harvest is more common in Calade with a markedly superior value than in other communities. In contrast, in Colorado and La Mocora predominate the recollection of useful parts of the plant, which could reflect more selective and sustainable practices. On the other side, seed collection, despite being overall less frequent, it is relatively more common in Cañaveral and La Mocora. This suggests an approach focused on the conservation and species regeneration.

Taken together, both figures show that while patterns of use display a certain degree of uniformity across communities, collection strategies exhibit greater variability, likely influenced by ecological factors, species availability, and traditional knowledge specific to each locality. This variation suggests a dynamic link between modes of use and management practices, which contributes to the sustainability of local biodiversity use.

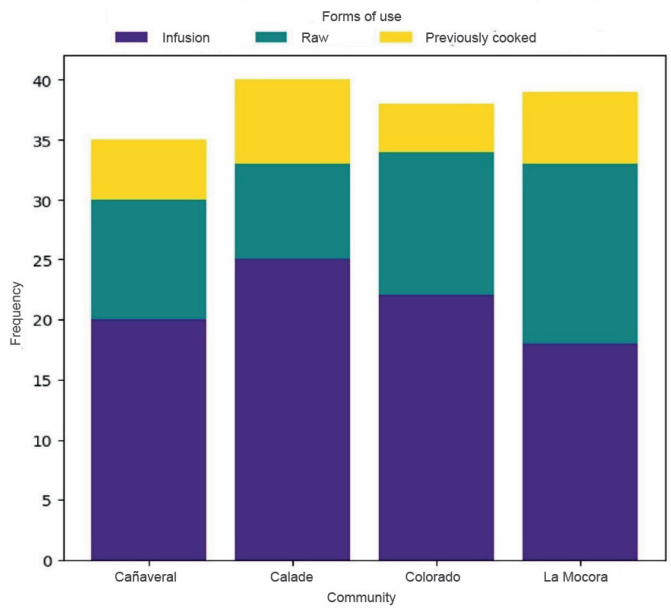

Figure 5. Frequency of plant species use in the sampled communities of Jama.

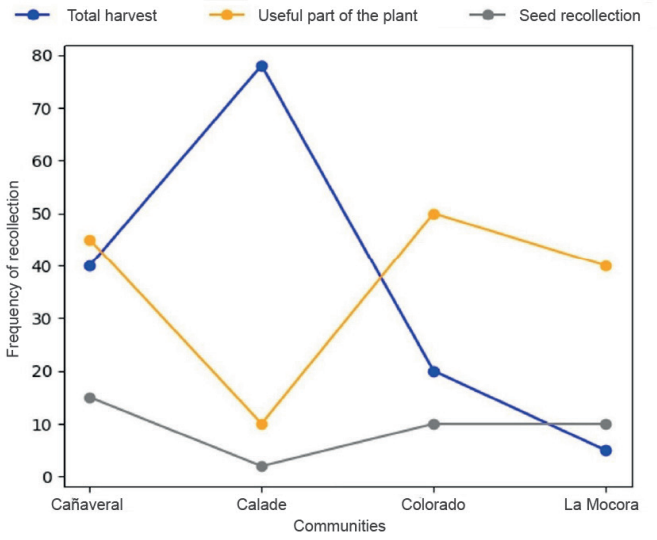

Figure 6. Frequency of plant species collection strategies in the sampled communities of Jama.

Table 3 presents the frequency of animal species citations used in the communities of Cañaveral, Calade, Colorado and La Mocora, in Jama canton. Domestic and wild species are included reflecting their importance within local utilization systems. The information is based on the answers of the interviewers, who identified the species of higher relevance in their socio-cultural and ecological context.

As shown in Table 3, there are differences in the distribution and use of animal species among communities. In Cañaveral, *Gallus gallus* (chicken) is the most frequently cited species, whereas in Calade, *Oryctolagus cuniculus* (rabbit) predominates in the mentions. In the case of Colorado, a high frequency of citations of *Anas platyrhynchos* (duck) stands out, reflecting a preference for aquatic species in this community. In La Mocora, *Gallus gallus* and *Ortalis erythroptera* (guacharaca) lead the citations, suggesting a combination of domestic and wild birds in local use practices.

The use of animals in the communities of Cañaveral, Calade, Colorado, and La Mocora shows variations in frequency and importance. Although the use of animals for food is common across all communities, the degree of dependence varies. In communities such as Cañaveral and Colorado, the frequency of citations of animal species is higher compared to La Mocora, where a lower proportion of citations is observed. This pattern suggests that in La Mocora, food sources may be more diversified or that there are constraints on the availability of faunal resources.

Table 3. Frequency of citations of animal species used in the sampled communities of Jama.

Communities	Common Name	Scientific Name	Citations	Total
Cañaveral	Cow	*Bos taurus* Linnaeus	15	47
	Pig	*Sus domesticus* Erxleben, 1777	6	
	Goat	*Capra hircus* Linnaeus, 1758	3	
	Hen	*Gallus gallus* Linneo	23	
Calade	Rabbit	*Oryctolagus cuniculus* Linneo	26	47
	Guacharaca	*Ortalis erythroptera* Gray, 1867	14	
	Armadillo	*Dasypus novemcinctus* Linnaeus	3	
	Squirrel	*Simosciurus stramineus* (Eydoux & Souleyet, 1841)	4	
Colorado	Paca	*Cuniculus paca* Linnaeus	6	48
	Agouti	*Dasyprocta punctata* Gray	11	
	Duck	*Cairina moschata domestica* Donkin, 1989	31	
La Mocora	Guacharaca	*Ortalis erythroptera* Gray, 1867	7	48
	Armadillo	*Dasypus novemcinctus* Linnaeus	3	
	Squirrel	*Sciurus vulgaris* Linnaeus	6	
	Paca	*Cuniculus paca* Linnaeus	4	
	Hen	*Gallus gallus* Linneo	28	

The results show that the use of plant and animal species occurs almost equally during both climatic seasons in the Jama canton. A total of 48.9% of respondents indicated that they collect resources mainly during the dry season, while 51.1% do so during the rainy season. This distribution suggests the absence of marked seasonality in biodiversity use, which may be due to the continuous availability of certain species, particularly those that are domesticated or semi-cultivated. Nevertheless, some participants mentioned that certain medicinal species, such as *Aloe vera* and *Cymbopogon citratus*, are more effective or more frequently harvested during the dry season due to reduced post-harvest deterioration. In contrast, fruit species such as *Mangifera indica* and *Passiflora edulis* were more frequently mentioned during the rainy season, reflecting phenological availability patterns. This analysis shows that, although resource use is constant, there are ecological and cultural nuances related to seasonality that should be considered in management and conservation plans.

Analysis of the continuity or abandonment of traditional practices in the use of plant and animal resources in the Jama canton reveals differentiated trends among communities and population groups. In Colorado, 100% of respondents stated that they continue to use these resources for medicinal or food purposes, indicating a strong persistence of traditional knowledge within the community.

In contrast, in Cañaveral, Calade, and La Mocora, although a considerable proportion of the population continues to use these resources, partial abandonment was observed in certain groups. Specifically, the data suggest that the loss of these practices is more pronounced among young people under 35 years of age, who have reduced their engagement with this knowledge compared to older adults. In addition, disuse appears to be more marked among the female population, which may be related to changes in social and economic roles within the communities.

Analysis of the timing of plant and animal collection shows that the communities of Colorado and La Mocora have an even distribution, with 50% of collection occurring during the rainy season and 50% during the dry season. In contrast, in Cañaveral and Calade, the distribution is slightly skewed toward the dry season, with percentages of 48.94% and 51.06% for the rainy and dry seasons, respectively. This indicates a slight preference in these communities for harvesting during drier periods.

The distances traveled for resource collection vary significantly among communities. In Cañaveral, Colorado, and La Mocora, 100% of respondents reported an average distance of 20 m, reflecting close access to resources. However, in Calade, this distance increases dramatically to 1,000 m (1 km), indicating possible limitations in access to vegetation or the need to travel to specific collection areas.

The primary destination of the collected plants and animals, or their parts, is household consumption, with percentages ranging from 58% to 68% depending on the community. Sale–consumption is also a common practice, with values ranging between 32% and 42%. This balance highlights both the importance of these resources for food security and their contribution to household economies in some communities, particularly in Colorado, where sale–consumption reaches 42%.

Analysis of the availability and use of natural resources in the communities of the Jama canton reveals homogeneous perceptions regarding their abundance, habitat, and frequency of use. One hundred percent of respondents consider the available resources to exhibit medium abundance, suggesting a relatively stable level of availability. Regarding habitat, all communities identified open areas—such as pastures, field margins, or scrubland—as environments frequently used for animal husbandry and the collection of easily accessible plant species. Although these are disturbed or secondary vegetation areas, they fulfill relevant ecological functions by sustaining interactions between species and their abiotic environment and can therefore be considered functional ecosystems within the local context.

Regarding frequency of use, 90% of respondents reported collecting resources with high regularity, visiting forest areas approximately every three days, while 10% do so less frequently, about every seven days. This indicates that, in addition to open areas, forests are also key habitats for obtaining certain resources, possibly those of higher cultural or medicinal value. This pattern suggests constant interaction with diverse local ecosystems, highlighting the importance of both disturbed areas and forests in daily life and in the sustainability of traditional practices.

One hundred percent of respondents rated the quantity of natural resources collected as "medium." This perception was consistent across all communities evaluated, with no variation by age group, gender, or type of resource used. The "medium" category was used to describe an availability that allows basic needs to be met without generating significant surpluses.

Table 4 presents the values obtained for the Use Value Index (UV) for 22 plant species with medicinal, food, and cultural applications. Species with higher use values stand out for their importance in local traditional medicine, while others are particularly recognized for their effectiveness in treating respiratory ailments.

Table 4. Use Value of Species (%) in the sampled communities of Jama.

N°	Scientific Name	Citations	UV (%)
1	*Citrus reticulata* Blanco	10	13,33
2	*Eucalyptus globulus* Labill.	5	6,67
3	*Citrus × sinensis* (L.) Osbeck	4	5,33
4	*Cymbopogon citratus* (DC.) Stapf	4	5,33
5	*Mangifera indica* L.	4	5,33
6	*Matricaria chamomilla* L.	4	5,33
7	*Mentha rotundifolia* L.	4	5,33
8	*Taraxacum officinale* (L.) Weber ex F.H.Wigg., Prim. Fl. Holsat.	4	5,33
9	*Salvia rosmarinus* Spenn	4	5,33
10	*Plantago major* L.	4	5,33
11	*Valeriana officinalis* L.	3	4,00
12	*Ruta graveolens* L.	3	4,00
13	*Carica papaya* L.	3	4,00
14	*Passiflora quadrangularis* L.	3	4,00
15	*Saccharum officinarum* L.	3	4,00
16	*Thunbergia alata* Bojer ex. Sims	2	2,67
17	*Aloe vera* (L.) Burm.f.	2	2,67
18	*Pimpinella anisum* L.	2	2,67

N°	Scientific Name	Citations	UV (%)
19	*Origanum vulgare* L.	2	2,67
20	*Coriandum sativum* L.	2	2,67
21	*Passiflora edulis* Sims	2	2,67
22	*Rosmarinus officinalis* L.	1	1,33
	Total	**75**	**100**

According to the results shown in Table 4, the species with the highest UV coincide with those that are widely recognized in traditional medicine and human consumption. The prevalence of *Citrus reticulata* Blanco and *Eucalyptus globulus* Labill highlights the importance of species with well-documented therapeutic properties. Likewise, the presence of plants with lower UV values, such as *Rosmarinus officinalis* L. (1.33%), suggests more localized knowledge or less widespread use within the community. These findings underscore the need to strengthen the conservation of key species and to document the traditional knowledge associated with their management and application.

Table 5 presents the results of the TRAMIL significant use level (TSU) for 22 species used in the communities of the Jama canton.

Table 5. Significant TRAMIL use of species in the sampled communities of Jama.

N°	Species	Citations	TSU (%)
1	*Citrus reticulata* Blanco	190	100,00
2	*Passiflora edulis* Sims	167	87,89
3	*Aloe vera* (L.) Burm.f.	156	82,11
4	*Eucalyptus globulus* Labill.	120	63,16
5	*Plantago major* L.	111	58,42
6	*Cymbopogon citratus* (DC.) Stapf	99	52,11
7	*Thunbergia alata* Bojer ex. Sims	99	52,11
8	*Mangifera indica* L.	98	51,58
9	*Mentha rotundifolia* L.	98	51,58
10	*Carica papaya* L.	98	51,58
11	*Citrus × sinensis* (L.) Osbeck	97	51,05
12	*Pimpinella anisum* L.	97	51,05
13	*Origanum vulgare* L.	97	51,05
14	*Passiflora quadrangularis* L.	96	50,53
15	*Valeriana officinalis* L.	95	50,00
16	*Ruta graveolens* L.	90	47,37
17	*Matricaria chamomilla* L.	90	47,37
18	*Salvia rosmarinus* Spenn	87	45,79
19	*Coriandum sativum* L.	78	41,05
20	*Saccharum officinarum* L.	76	40,00
21	*Taraxacum officinale* (L.) Weber ex F.H.Wigg., Prim. Fl. Holsat.	76	40,00
22	*Rosmarinus officinalis* L.	67	35,26
	Total of citations	**2282**	
	Total of responders	**190**	

The analysis of the TRAMIL significant use level (TSU) showed that the 22 identified species surpass the threshold of 20% evidencing their cultural and functional importance in the studied communities at the Jama canton. Among these, *Citrus reticulata* White stood out as the most representative species with a significant use level of 100%, followed by *Passiflora edulis* Sims (87.89%), *Aloe vera* (L.) Burm.f. (82.11%) and *Eucalyptus globulus* Labill. (63.16%). These species have a key role in traditional medicine and other local uses. On the other hand, *Rosmarinus officinalis* L. showed the lowest level of representativeness (35.26%).

4. Discussion

The analysis of traditional knowledge and forms of biodiversity use in communities of the canton of Jama reveals a complex network of socioecological relationships that link knowledge, seasonal availability, local perception, and social organization. The predominance of older adults as knowledge holders is consistent with what has been documented in other rural Latin American communities, where traditional ecological knowledge is preserved and transmitted across generations in relation to the natural environment and social structure (Millán-Rojas et al., 2016). This contrasts with observations from regions of Mexico and Colombia, where younger adults also participate in the use and management of natural resources (Manzano-García et al., 2023). Knowledge is transmitted across generations, and its distribution is influenced by gender. In Jama, men predominate in the collection of raw materials, while women specialize in food-related and medicinal uses—a division of roles that has also been described in other Latin American countries (Olvera Cuessy, 2022).

In some communities, more than 50% of respondents lack formal education. This situation may favor the conservation of traditional knowledge, as several studies have shown that schooling—when it does not incorporate culturally grounded approaches—tends to create distance from ethnobotanical practices and ancestral knowledge (Barahona & Almeida-Leñero, 2005). This pattern has been observed in multiple studies documenting how formally educated youth move away from traditional uses, leading to a progressive loss of ancestral knowledge (Carranza Patiño et al., 2021; Zent, 2009).

From an ecological perspective, the use of plants predominates over the use of animal species, a pattern that is also observed in other regions of the country, such as the Amazon and the Andean highlands, where recent studies have documented a high dependence on local flora for medicinal, food, and cultural purposes (Sánchez-Capa et al., 2023; López-Tobar et al., 2023).

Herbaceous species are particularly valued due to their ease of access and preparation and are therefore preferred for medicinal uses. Infusion is the most widespread method of preparation, given its simplicity and effectiveness in treating common ailments (Guerra et al., 2016; López-Tobar et al., 2019). Species such as Aloe vera and Origanum vulgare stand out for their multifunctionality, encompassing both therapeutic and food-related uses. In this regard, several introduced plant species exhibit notable multifunctionality, as they are used for both medicinal and dietary purposes, as documented by ethnobotanical studies in different regions of Latin America (Manzano-García et al., 2023; Santes Hernández, 2018).

This multifaceted value is also reflected in indicators such as the use value index (UV) and the level of significant use (TSU), which confirm the local importance of species such as *Passiflora edulis* and *Eucalyptus globulus* (OMS, 2019; Pérez et al., 2011).

Collection practices reflect an adaptive relationship with the environment. In communities such as La Mocora and Colorado, partial harvesting (leaves, fruits) is favored, whereas in Calade a higher frequency of whole-plant harvesting is observed. This differentiation may be linked to local availability or to conservation strategies (Zeni & Bosio, 2011). The preferential use of leaves and fruits rather than stems or roots is consistent with findings from other studies in Latin America and is associated with lower ecological impact (Fernández-Cusimamani et al., 2019). Conversely, seed collection in communities such as Cañaveral suggests practices related to species regeneration and management. The inclusion of species such as *Thunbergia alata*, despite being considered invasive, illustrates empirically driven use based on perceived effectiveness. This species has been recognized for its antifungal and antibacterial properties (Vanegas Romero et al., 2023), although its use should be evaluated within a framework of responsible ecological management.

The seasonal pattern of species use shows notable continuity between the dry and rainy seasons, indicating a low level of seasonality in resource use. This has been linked to the presence of cultivated species or those with permanent accessibility (Jiménez et al., 2021). However, phenological and cultural variations do exist: *Aloe vera* and *Cymbopogon citratus* are used more frequently during the dry season, while fruit species

such as *Mangifera indica* and *Passiflora edulis* predominate during the rainy season (Carranza Patiño et al., 2021). This adaptation to ecological cycles is also related to collection distances. While some communities rely on species located near households, others—such as Calade—travel farther, possibly depending on resource availability or conservation practices. This pattern has also been documented in studies on the use of non-timber forest products in tropical dry forests (Jiménez González et al., 2017).

From an economic perspective, resource use serves a dual function: household consumption and commercialization. This duality is common in rural contexts, where natural species function both as subsistence resources and as sources of income (Toledo & Barrera Bassols, 2009; Toro Chacón et al., 2019). Perceptions of "moderate abundance" and high frequency of use indicate empirically based management grounded in experience, but they may also mask degradation that is not immediately perceived in the short term (Fernández-Cusimamani et al., 2019; Zeni & Bosio, 2011). In this regard, subjective assessments of the quantity collected and derived products function as indicators of the state of the resource-use system (Martínez-López et al., 2021).

Overall, the results allow us to conclude that communities in Jama manage their biodiversity through a deep and dynamic body of local ecological knowledge that integrates biological, cultural, economic, and spiritual components. This system of knowledge and practices is reflected in use decisions, conservation strategies, perceptions of abundance, and forms of intergenerational transmission. Recognizing this complexity is essential for designing public policies that respect biocultural diversity and strengthen food and medicinal sovereignty in rural contexts of Ecuador.

5. Conclusions

Communities in the canton of Jama report the use of 23 plant species with medicinal, food, and cultural applications, with *Citrus reticulata* Blanco, *Passiflora edulis* Sims, and *Aloe vera* (L.) Burm.f. being the most frequently cited. Plant resources constitute the foundation of traditional use, while animal species play a complementary role, particularly in food consumption. Among these, *Gallus gallus* and *Odocoileus virginianus* stand out for their cultural and utilitarian value. Traditional knowledge is concentrated primarily among older adults, whereas younger generations show lower levels of participation, suggesting an ongoing process of generational knowledge loss. Collection practices prioritize the use of non-lethal plant parts, which supports regeneration and sustainable use. Overall, these results demonstrate the continued relevance of local knowledge associated with biodiversity and highlight the need for strategies aimed at its preservation and transmission.

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Contributor roles

- Alfredo Jimenez González: conceptualization, formal analysis, methodology, visualization, writing – review & editing.

- Stephanie Nahomy Moreira Mero: investigation, software, writing – original draft.
- César Alberto Cabrera Verdesoto: validation, writing – original draft.
- Luis Fernando Lucio Villacreces: validation, writing – original draft.

Ethical Implications

The authors declare that the collection of information through surveys and interviews was conducted with the informed consent of the participants, ensuring data confidentiality and respecting their autonomy in accordance with the ethical principles established in the Code of Ethics for Scientific Research of the Universidad Estatal del Sur de Manabí [UNESUM]. The methodology employed adhered to the principles of transparency, respect, and responsibility in interactions with participants, in line with UNESUM guidelines for scientific research.

Conflicts of Interest

The authors declare that they have no affiliation with any organization with a direct or indirect financial interest that could have appeared to influence the work reported.

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