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Taneyan Lanjang Shared Home Gardens and Sustainable Rural Livelihoods of Ethnic Madurese in Madura Island, Indonesia

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Abstract: The ethnic Madurese are among the top five most populous ethnic groups in Indonesia. Their traditional settlements have a special design called Taneyan Lanjang (TL). TL settlements consist of several elements, which are arranged in a specific pattern that is affected by local and Islamic culture. The gardening space of a TL settlement—here referred to as the shared home garden (SHG)—is shared by several family households. The ethnic Madurese apply traditional knowledge to manage their home gardens. This study investigated the features of TLs and SHGs, mostly in relation to cultural matters, the utilization of plants, management based on local knowledge, and their contribution to rural livelihoods. The study area consisted of the four regencies of Madura Island, Indonesia. A total of 200 TL settlements were observed, and 4 key informants and 400 respondents who were engaged in TL were questioned through in-depth interviews. The plant species cultivated in the SHGs were recorded and identified according to the database of The Plant List. In total, 108 plant species within 40 plant families were recorded. Fabaceae had the highest number of species, with 10 species (9.26%), most of which are used as food (65.7%). We identified and characterized the most important services and functions provided by SHGs to rural livelihoods that directly benefit rural communities.

Keywords: agrobiodiversity; ecosystem service; food system; home garden; conservation; rural livelihoods; sustainable management; traditional knowledge

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1. Introduction

Home gardens (HGs) are defined as small areas of cultivated land immediately surrounding the home or homestead [1]. HGs can also be more narrowly defined in multiple ways by highlighting various aspects according to the context, emphasis, and objectives of the research or their promotion through development programs to improve standards of living [2,3]. HGs are commonly found in tropical and temperate zones characterized by high plant diversity. They are considered a sustainable production system that contributes to biodiversity conservation [4–6]. HG farming is a time-tested local strategy, widely adopted and practiced in various circumstances by local communities with limited resources and institutional support. Globally, HGs have been documented as an important supplemental source contributing to food and nutritional security and livelihoods [2]. HGs can also potentially contribute to climate change mitigation and adaptation [7,8].

HGs in both rural and urban areas are predominantly small-scale subsistence agricultural systems. Home gardening has been hypothesized to be the oldest form of agriculture in Southeast Asia [9]. HGs are diversified agroecosystems that contribute to the conservation of useful plant species [10]. The sustainability of HGs is increased by soil fertility properties, agricultural heterogeneity, linking practices with other home gardens, family

participation, non-participation in government subsidies, and local agriculture knowledge [11].

Previous studies on HGs have been conducted in different countries, such as Malaysia [12], Vietnam [13], Myanmar [14], Bangladesh [1,15,16], Sri Langka [17], Colombia [18], Italia [19], Ethiopia [20,21], Ecuador [22], India [23], Benin [24], and Hungary [25]. All of these studies showed the importance of HGs, playing a major role in food production, crop improvement, agricultural development, and maintenance of green space, while providing job opportunities [26]. They offer a wide range of ecological and cultural benefits, with the most important ecosystem services being different from those offered by other agroecosystems [27].

In Indonesia, HGs are usually called *pekarangan*, which are defined as traditional agroforestry systems due to their interaction with rural livelihoods and the environment [28]. They are also referred to as 'kitchen garden', 'backyard', or 'backyard garden', and are commonly found in many parts of Indonesia [29]. Traditional HGs have many desirable characteristics, although gross yields per hectare are relatively low. They tend to function largely outside the market economy, cheaply satisfying a wide variety of domestic needs. The structure, composition, intensity of cultivation, and biodiversity of a home garden can be affected by the socioeconomic status of the households [9]. The produce, which is widely shared by the community, provides an important supplement to diet and income, particularly during the critical time between rice harvests [29]. HGs provide complete ecosystem services, including provisioning, regulating, and cultural services [30].

The ancient Madurese worked as gatherers, farmers, fishermen, breeders, shamans, and artisan workers. Today, agriculture and fishing are the two main livelihoods of the ethnic Madurese [31]. Currently, the Madurese people are spread out over various islands in Indonesia. However, most of them stay on Madura Island, maintaining their own traditions, culture, and customs. They uphold the concept of *bappa-babbu-guru-rato*, which implies a social hierarchy that must be respected and obeyed. First the father (*bappa*), then the mother (*babbu*), then the teacher (*guru*), and lastly the queen (*rato*) (government) [32–34]. The majority of Madurese are Muslim, which influences their behavior and cultural life, especially in rural areas. They celebrate holidays, weddings, births, house completion, and other activities according to Islamic customs [35]. The strongly recommended Islamic principle of establishing and protecting family relationships is strictly adhered to.

Some Madurese people live in traditional settlements called Taneyan Lanjang (TL), as discussed by Huub de Jonge, cited in Umam & Pratama [36]. Different alternative spellings occur in publications on this topic, such as *Tanean Lanjheng* [37], *Taneyan Lanjheng* [34], *Tanèyan Lanjháng* [38,39], *Taneyan Lanjhang* [33,40,41], *Tanean Lanjang* [42–44], and *Tanean Lanjhang* [32]. The name *Tanean Lanjang* is composed of two Madurese words; namely *tanèyan* (*tanean*, *taneyan*), which means 'yard', and *lanjhâng* (*lanjhang*, *lanjang*), which means 'long' [45]. A TL is constituted by a combination of social, religious, and kinship factors [32]. Physically, it is a settlement with several buildings belonging to the same household, located along a shared long yard. The arrangement of the houses is based on the hierarchy within the family. The yard is used jointly for daily and other activities such as children's play, drying clothes, and gardening. The gardening area in the TL is here referred to as the 'shared home garden' (SHG). Home gardening by a family is not the same as backyard gardening by a single household; rather, it is shared gardening managed collaboratively by different households who have a family relationship and live together in a TL.

Studies on HGs on several separate islands in Indonesia have been conducted, e.g., Sulawesi [46,47] Kalimantan [48–50], Bali [51,52], Sumatra [5,53], Lombok [54], Sumbawa [55], and Java Island [28,56–59]. All these studies concerned individual HGs, which are very different from SHGs. Administratively, Madura is part of East Java Province, but Madura has unique characteristics compared to other regions in East Java, specifically related to ethnicity. Several studies on TL settlements have been conducted, but they were limited to different aspects, such as the meanings of spaces in TL architecture [43]; a comparison of relationships in TLs and Madurese society [38]; ethno-ethics (business ethos construction in Madurese Muslim families) [37]; and anthropology [60]. More specific studies of TLs have

been conducted by researchers from Bogor Agriculture University, focusing on the landscape design and covering only a small part of Madura Island [32,33]. Based on previous studies, information about TLs and SHGs is limited, specifically related to agrobiodiversity, SHG management, culture, and their connection with rural livelihoods. To address this gap, the present study had the following objectives: to explore TL settlements in relation to culture and ethnicity; to analyze SHGs in TLs based on agrobiodiversity, local knowledge, and management practice; and to summarize the services and functions provided by TLs and SHGs for rural livelihoods. This study answers the following questions: What is the current condition of the TL settlements in Madura Island? How does Madurese culture effect TLs and SHGs? What are the most cultivated plants in the SHGs? How do the farmers manage their SHGs? How do TLs and SHGs contribute to rural livelihoods? We assumed that culture and traditional knowledge have a significant effect on the current condition of TLs and SHGs. Moreover, SHG provide some benefit for the rural livelihood. Through this research, we attempted to provide some scientific references on Madurese shared home gardens, ethnicity, local knowledge, sustainable management, and rural livelihoods. This study also expected to provide valuable insight to support the promotion of home garden utilization and agrobiodiversity conservation, not only in Indonesia but also in other countries.

2. Methodology

2.1. Study Area

Indonesia is an archipelago with more than 17,000 islands, about 300 ethnic groups, and 30,000 plant species [61]. The top-five most populous ethnic groups are the Javanese (40.1%), the Sundanese (15.5%), the Malay (3.7%), the Batak (3.6), and the Madurese (3%). The Madurese have a strong character and a unique culture reflected in their daily lives [33,62]. They hail from Madura, a dry, inhospitable island off the northeast coast of Java, Indonesia, and traditionally make their living off the island. Their main language is Madurese, an Austronesian language that is also spoken in parts of eastern Java and on many of the 66 outlying islands. They have a forceful philosophy of life and cultural values such as hard work, self-awareness, kindness, courage, avoiding corruption and usury, being cautious about harassment, and helpfulness to others [63].

This study was conducted in Madura Island (Figure 1) based on two considerations: firstly, ethnic Madurese people have a unique away of managing their home gardens to support their livelihood needs; secondly, the TL is a traditional type of settlement exclusively developed by the inhabitants of Madura. Madura Island covers an area of 5025.3 km^2 [64]. There are four regencies (Bangkalan, Sampang, Pamekasan and Sumenep) on the island, which administratively belong to East Java Province. Bangkalan Regency is located in the west between 6°51′ and 7°11′ south latitude and between 112°40′ and 113°8′ east longitude, covering 1260.14 km^2 [65]. Sampang Regency is located between 113°8′ and 113°39′ east longitude and between 6°05′ and 7°13′ south latitude and is bounded by the Java Sea in the north, Bangkalan Regency in the west, Pamekasan Regency in the east, and the Madura Strait in the south [66]. Pamekasan Regency is located between 113°19′ and 113°58′ east longitude and between 6°51′ and 31°7′ south latitude and is the smallest district, with a total area of 86.04 km^2 [67]. Sumenep Regency is located at the eastern end of Madura between 113°32′54″and 116°16′48″ east longitude, and between 4°55′ and 7°24′ south longitude; it is the largest regency in Madura (2093.47 km^2), covering part of the mainland as well as 126 small islands [68]. Our study focused only on the mainland of Madura Island, thus excluding the small islands of Sumenep.

Madura Island has an undulating surface, rising up to 700 feet (210 m) in the west and more than 1400 feet (430 m) in the east. The highest average temperature is 32 °C in October, and the lowest is 29 °C in January. The average annual temperature is 30 °C, and the rainfall is about 1017 mm per year. The socio-economic conditions of the four regencies in Madura Island are worse than in other districts of East Java Province, especially in terms of poverty, sanitation, and the human development index [64]. According to the

population census of 2020, Madura Island has a population of about 3.99 million: 1.06 million in Bangkalan [65], 0.96 million in Sampang, [66], 0.85 million in Pamekasan [67], and 1.12 million in Sumenep [68].

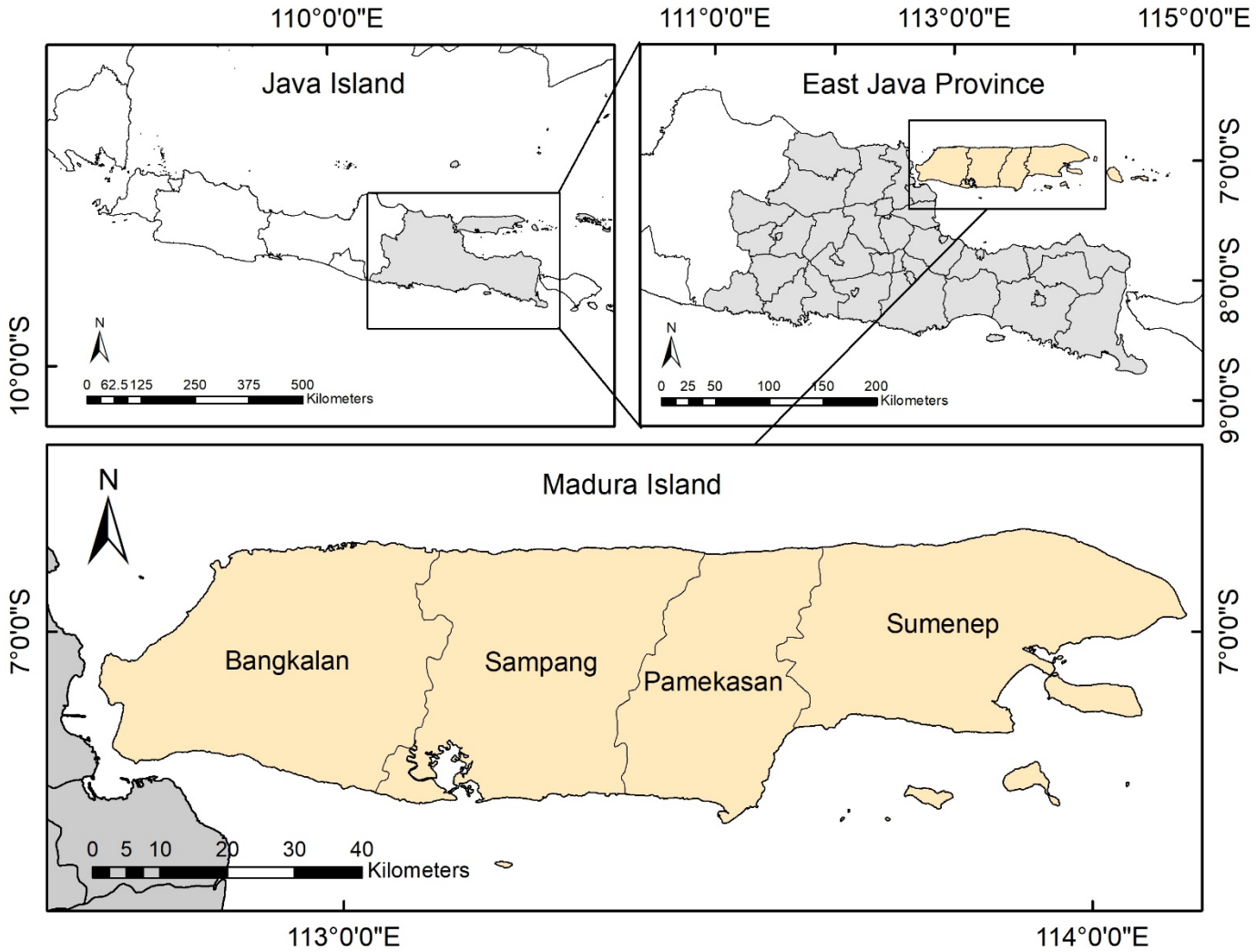

Figure 1. Map of study area. Source: GeoSIS. Indonesian SHP Data. Available online: https://geosis.id/blog/data-shp-seluruh-indonesia/ (accessed on 3 September 2021).

2.2. Data Collection and Analysis

The present status of the ethnic Madurese was reviewed from several published sources and reports. No population data of the TLs in Madura Island are available. We interviewed four staff members of the University of Trunojoyo Madura (UTM) as key informants. They were experts in rural sociology, economics, and agriculture, with a thorough awareness of Madurese ethnicity, which allowed them to provide general information on Madurese ethnicity as well as on the TL specifically. Based on suggestions from the key informants, the second author and a local field assistant identified TLs in different locations. We expanded the population sample by using the 'snowball technique' [69–71]. We interviewed the head of the household, his wife, and other household members as respondents. In total, we interviewed 400 respondents based on the field condition that each TL houses more than one household.

We observed the hardscape elements in the TLs, discussed them with the key informants and examined their description, function, and philosophy. Using an ethnobotanical approach, we observed the plant species cultivated in 200 different SHGs. Their local and scientific names were identified based on the knowledge of the research team, the key

informants, and respondents in the TLs. The names of the observed species were recorded based on the respondents' answers in their own language (i.e., Indonesian and Madurese). Photographs were taken for additional information and to support the description of the plants' characteristics and their identification. The identified scientific names of the plants were verified based on The Plant List (http://www.theplantlist.org, accessed on 15 March 2022) [72]. We calculated the relative frequency (RF) of plant species to determine the dominant plant species in the SHGs [73–75].

The survey took place from November 2020 to August 2021, covering both the rainy and the dry seasons. The questionnaire survey was combined with in-depth interviews to provide the best interpretation. Prior to the interviews, we gave the respondents a brief description of the study and asked whether they were willing to participate. The interview would continue if they agreed. The questions we asked included: What are the plants you grow? How are the plants used? What are the management practices in your SHG? What are the primary functions of the TL and SHG in your opinion? During the interviews, we also offered information about home gardening, so the respondents could benefit from participating in this study. The respondents' statements were analyzed and integrated with the quantitative data.

3. Results and Discussion

3.1. Description of Participants, TLs, and SHGs

The majority of the respondents were between the ages of 30 and 60, with approximately 63% being male (Table 1). Furthermore, approximately 78.8% of the respondents were married, with 69% of the respondents having completed elementary school as their highest formal education. All of the respondents in this study were farmers. They also cultivated farmland other than the SHG. Their farmland was commonly planted with rice, maize, cassava, sweet potatoes, peanuts, tobacco, and chili. They also had alternative off-farm income, for example from trade, transportation, and construction work. On average, the majority of their earned income was about 100 to 145 USD per month, which is lower than the average regional minimum wage (148 USD) in Madura Island [64]. The average TL size was 764.59 m^2, while the average SHG size was around 609.85 m^2.

Table 1. Description of respondents (n = 400).

Description		Percentage
Age (years old)	<30	10.0
	30–60	74.5
	>60	15.5
Sex	Male	63.4
	Female	36.6
Status	Single	10.0
	Married	78.5
	Widow/widower	11.5
Education level	No education	12.5
	Elementary school	69.0
	Junior high school	9.5
	Senior high school	7.8
	University	1.3
Occupation	Farmer	100.0
Religion	Islam/Muslim	100.0
Family members	1–4	80.5
	>4	19.5
Monthly income (USD)	<100	34.2
	100–145	65.8
	>145	34.2

Each TL consists of nine elements: the *roma* (house), the *kobung/langgar* (mosque), the *dapor* (kitchen), the *kandang* (cage), the *taneyan* (yard), natural fences, a warehouse, a water reservoir, and an outdoor bathroom. Based on our field observations, we found that the TLs are arranged in a specific pattern (shape and design). They are used for daily and other activities, and are affected by Islamic culture. These findings are in accordance with previous studies [32,33,43]. Descriptions, the functions, and the philosophy of the nine TL elements are presented in Table 2.

Table 2. Description, function, and philosophy of TL elements.

No.	Element	Description, Function and Philosophy
1	 *Roma* (house)	■ Used by family household, divided into main house (*tongghu*) and girls' house ■ Male guests are prohibited from entering the *roma* ■ Each household occupies a different house ■ Rows of houses built sequentially from west to east—from the parents, the eldest daughter to the youngest daughter ■ This sequence is in accordance with the qibla [1], where a more western location and seniority are seen as superior
2	 *Kobung/langgar* (mosque)	■ Sacred place, used for religious and family activities ■ Secondary function as a room for sons with bachelor status (who have the responsibility to protect the family) ■ Room for males and guests (not from the extended family) ■ Always located at the end of the yard and facing the qibla direction to make it easier to monitor the guests
3	 *Dapor* (kitchen)	■ Used for preparing and cooking food for the family household ■ Located opposite the *roma*, and next to the *kobung* ■ Rural households use firewood and a traditional cooking stove in the kitchen ■ Some of the firewood consists of leftovers from animal feed

Table 2. *Cont.*

No.	Element	Description, Function and Philosophy
4	 *Kandang* (cage)	■ Used as a shelter for livestock, such as cattle, goats, sheep, ducks, birds, chickens, and swans ■ The number of cages is usually equal to the number of households (each household has its own livestock and cage) ■ Usually, it is located next to the kitchen, far away from the *roma* ■ Bamboo is used for most of the parts
5	 *Taneyan* (yard)	■ Used as a place for daily, religious and agricultural activities (drying, processing) ■ A courtyard surrounded by buildings and an empty expanse of land ■ The size indicates the social status of the owners: the wider the *taneyan*, the higher their social status
6	 Natural/organic fence	■ Used as a barrier from the field, protecting against animals or intruders from outside; made from a row of trees or shrubs that grow densely ■ Plant species used are for example: *Bambusa glaucescens* (Willd.) Merr., *Lannea coromandelica* (Houtt.) Merr. *Hibiscus tiliaceus var. abutiloides* (Willd.) Hochr., *Hibiscus rosa-sinensis* L., *Sauropus androgynous* Merr, *and Moringa oleifera* Lam.
7	 Warehouse	■ Used as storage room for firewood, animal fodder, agricultural input, products, and equipment ■ Located next to the cage and the kitchen

Table 2. *Cont.*

No.	Element	Description, Function and Philosophy
8	 Well and water reservoir	▪ Used as water source for the daily needs of the household, irrigation, and rain water storage ▪ Water drum made from clay (traditional), metal, or plastic
9	 Outdoor bathroom	▪ Used for bathing and washing, the waste water is used for plant irrigation. ▪ Located outdoors to prevent guests from entering the main house based on Islamic customs related to receiving guests (protecting women in the *roma*) ▪ The bathroom and toilet are always separate based on the Islamic principle that the bathroom is a place for cleaning and ablution before praying, while the toilet is a dirty place

[1] The qibla is directed towards the Kaaba in the Sacred Mosque in Mecca, which is used by Muslims in various religious contexts, particularly as the direction the prayer of the *salah*).

3.2. SHG Plant Species' Major Use Categories

SHGs as sustainable agroecosystems are good repositories of genetic resources. Our field survey and observation records yielded 40 families and 108 species (Table A1). Some previous studies found similar results [20,76,77]. *Fabaceae* had the highest portion with 10 species (9.26%), followed by seven species of *Zingiberaceae* (6.48%), while *Cucurbitaceae* and *Rutaceae* each had five species (4.63%) (Figure 2). The identified species were placed into eight use categories: 74 (68.5%) food; 18 (16.7%) ornamental; 17 (15.4%) medicinal; 16 (14.8%) providing shade; 11 (10.2%) commercial; 9 (8.3%) building material; 8 (7.4%) firewood; and 7 (6.5%) fodder (see Figure 3). As in the previous study [10], we found that plant species with more than one use value were found in each use category. The most widely used plant part is the fruit (51 species, or 47%). In Table 3, we list the ten plant species with the highest relative frequency (RF) values.

Table 3. Top ten of plant species according to RF value.

Species	Occurrence No.	Relative Frequency/RF (%)
Musa spp.	196	98.0
Mangifera indica L.	175	87.5
Zea mays L.	155	77.5
Manihot esculenta Crantz	152	76.0
Bambusa glaucescens (Willd.) Merr.	150	75.0
Moringa oleifera Lam.	145	72.5
Capsicum frutescens L.	138	69.0
Piper retrofractum Vahl	129	64.5
Curcuma longa L.	125	62.5
Arachis hypogaea L.	123	61.5

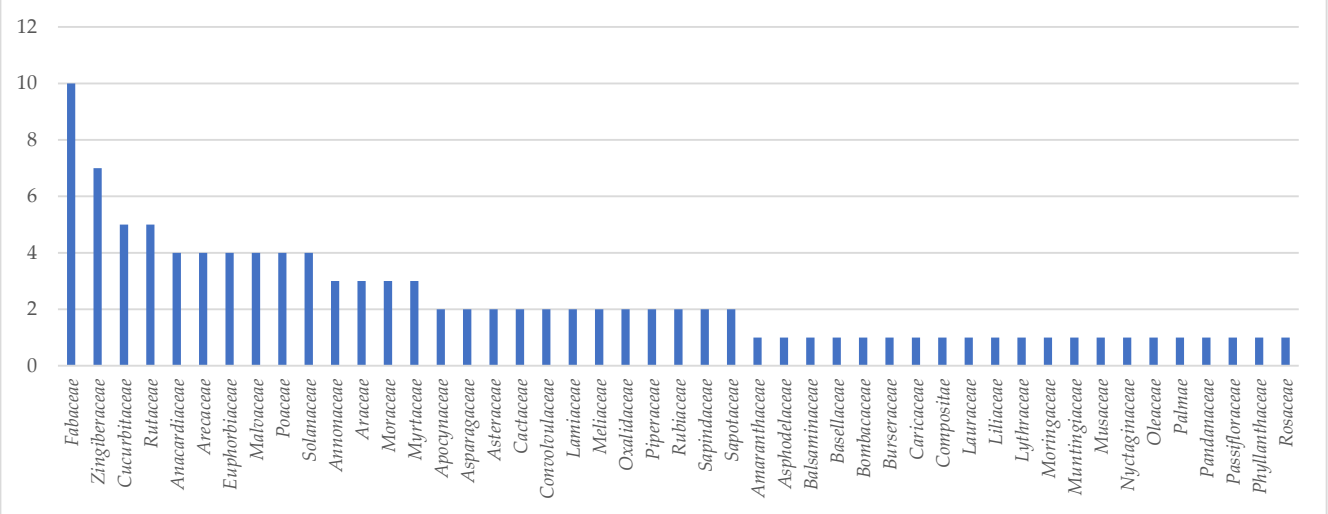

Figure 2. Families of species and their numbers recorded in the SHGs.

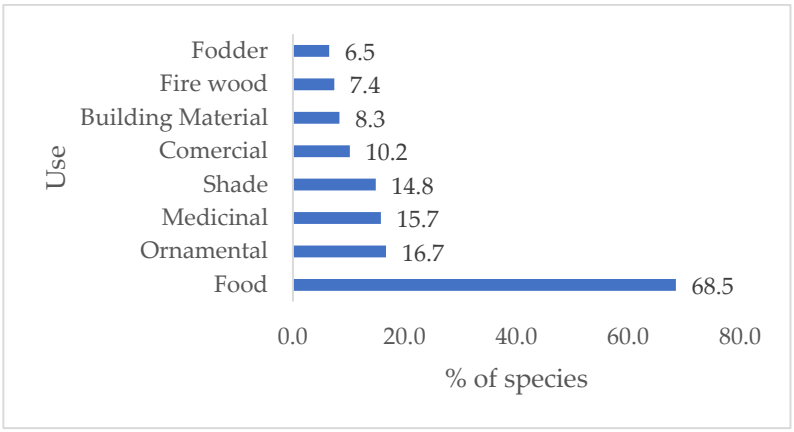

Figure 3. Families of species and their numbers recorded in the SHGs.

Musa spp. (banana) is the most common and dominant species (RF = 98%). However, it is poorly managed and grows haphazardly. In Madura Island, banana plants are widely distributed and cultivated mostly by small-scale farmers in backyards and drylands, intercropped with annual and/or perennial crops [78]. The cropping pattern has no spacing adjustment (replacement of unproductive mats). Poor management can cause banana mats to decline in productivity [79]. Banana fruit is consumed, shared, and sold in traditional markets by rural households. It is often consumed as fruit in religious rituals, and the tree's leaves are often used to wrap traditional foods.

Mangifera indica L. (mango) was the second most common fruit species (RF = 87.5%). The mango tree is a fruit source as well as a source of shade and firewood. There are two types of sales systems: a small amount is sold in traditional markets and a large amount is sold to brokers.

Prior studies indicated that *Musa* spp. and *Mangifera indica* L. are commonly planted in home gardens throughout Indonesia, for example in Central Sulawesi [46], Lombok Island [54], Sumbawa Island [55], West Aceh [80], and Yogyakarta [81].

> *"The banana tree is a plant that is simple to cultivate, produces fruit all year that tastes delicious. Usually, we consume bananas from our family garden." (Male, 50).*

> *"The mango tree is a plant that grows well in dry, low-fertility areas like Madura. You will find mango trees in some home gardens in Madura Island." (Male, 45).*

> *"Because of the hot weather in Madura, we use mango trees not only to harvest their fruit but also to provide shade to make our home cooler." (Male, 55).*

Among the staple foods, *Zea mays* L.(maize) had the highest occurrence with RF = 77.5%, followed by *Manihot esculenta* Crantz (cassava) with RF = 76.0%, and *Arachis hypogaea* L. (peanut) with RF = 61.5%. Rural ethnic Madurese rarely consume pure rice; they usually mix it with coarsely ground maize. *Manihot esculenta* is dried and stored as reserve food. During the dry season, when there is not enough rice and maize, dried cassava is used as a food source [82]. *Arachis hypogaea* L. is planted for commercial or economic purposes. It is sold in traditional markets by housewives in three forms: dry pealed, fresh unpeeled, and steamed unpeeled.

> *"We are used to consuming a mixture of rice and corn as a staple food, so we decided to plant corn in our garden." (Female, 50).*

> *"Apart from rice, we eat maize, cassava, and sweet potatoes as staple foods. Cassava is dried, stored and used as reserve food, especially when our rice or corn reserves are running low." (Female, 36).*

> *"In our garden, we grow peanuts, but we only eat a small fraction of them. We usually sell them in the neighborhood market, and the stems and leaves are used as fodder." (Female, 54).*

Moringa oleifera Lam (moringa) is usually planted for use as an organic fence and as a vegetable (RF = 87.5%). Its leaves can be used as a substitute or alternative for dark-green leafy vegetables, and are a main source of nutrition to fight food insecurity [83–85]. In prior studies [86–88], *Moringa oleifera* Lam has been shown to have several health advantages, such as fighting fever, convulsions, coughs, stomach aches, lack of stamina, sprue, headaches, cholesterol, gout pain, and typhus. *Capsicum frutescens* L. (chili pepper) is a strategic vegetable commodity in Indonesia [89]. Widely used as a spice, its high RF value (69.0%) indicates that is a preferred food plant species. Rural households combine moringa with other vegetables and spices such as *Capsicum annum* L. (cayenne pepper), *Solanum lycopersicum* L. (tomato), *Allium cepa* L. (onion) and *Allium sativum* L. (garlic) in a traditional recipe called *sambal*.

> *"Moringa is a very common vegetable in our daily food consumption. This plant is easy to grow and we believe it is good for our health." (Female, 54).*

Ornamental plant species are mostly used for decoration, using their leaves, flowers, or the whole plant. Most ornamental plants are prized for their colorful flowers: *Adenium obesum* (Forssk.) Roem. & Schult (desert rose), *Bougainvillea* spp. (paper flower), *Cananga odorata* (Lam.) Hook. f. & Thomson (perfume tree), *Catharanthus roseus* (L.) G. Don. (periwinkle), *Euphorbia milii* Des Moul. (crown of thorns), *Hibiscus rosa-sinensis* L. (Chinese hibiscus, shoeblack plant), *Hibiscus sabdariffa* L. (roselle), *Impatiens balsamina* L. (rose balsam), *Ixora coccinea* L. (jungle geranium), *Jasminum sambac* (L.) Aiton (jasmine), and Rosa spp. (rose). Four species are appreciated for their colorful leaves: *Caladium bicolor* (Aiton) Vent. (caladium), *Codiaeum variegatum* (L.) Rumph. ex A. Juss. (croton), *Dypsis lutescens* (H. Wendl.) Beentje & J. Dransf. (butterfly palm), and *Sansevieria trifasciata* Prain (snake plant). *Opuntia* spp. (prickly pear) is appreciated for all of its parts. *Hibiscus rosa-sinensis* L. was the most common ornamental species (RF = 47%) in the SHGs. It is mostly planted to serve as an organic fence, but it is also used to feed goats and sheep in rural areas as well as for decoration. This indicates that rural households have a great understanding of how to make full use of the plants they grow. *Hibiscus rosa-sinensis* L. leaf extract can be used as a forage concentrate and has a good effect on goat growth [28]. The Madurese and other ethnic groups in Indonesia use *Rosa* spp. and *Jasminum sambac* (L.) in wedding ceremonies [52].

> *"Sometimes we use shoeblack plants to feed our goats. I remember one time when I was sick and could not find any forage. My wife trimmed those plants and fed them to our goats." (Male, 38).*

Javanese long pepper (*Piper retrofractum* Vahl) had the highest occurrence among the medicinal plant species (RF = 64.5%). Javanese long pepper grows in the wild in Madurese SHGs. This plant is commonly found in Southeast Asia [90] and is grown on drylands in Java and Sumatra [91]. It is used to treat various diseases [90,92]. The families in TLs use it as traditional medicine called *jamu* (traditional herbal medicine) to treat fever, flatulence, heartburn, impotence, vomiting, toothaches, wounds, seizures, to overcome digestive disorders, to stimulate the appetite, and as mouthwash. The community in Sumenep uses this medicinal plant to increase stamina and treat rheumatic pain [93]. Javanese long peppers are sold to brokers or middlemen to provide an additional source of income.

> *"We cultivate Javanese long pepper for a traditional medicine called 'jamu'. It is a commercial commodity, quite expensive, and we usually sell it to middlemen." (Male, 42).*

Zingiberaceae is a family with a high number (6) of medicinal species: *Curcuma longa* L. (turmeric), *Curcuma rotunda* L. (fingerroot), *Curcuma xanthorrhiza* Roxb (Javanese turmeric), *Curcuma zedoaria* (Christm.), Roscoe (zedoary), *Kaempferia galanga* L. (aromatic ginger), and *Zingiber officinale* Roscoe (ginger). The dominance of this family has been reported in HG studies in other places in Indonesia [94,95]. *Curcuma* is the genus of *Zingiberaceae* that is the most important ingredient of a *jamu* that is used by the ethnic Madurese to maintain stamina [95]. *Curcuma longa* L. was the second highest occurring medicinal species (62.5%) and is mostly used as a traditional medicine in the household, for example, for treating gastrointestinal disorders, pain, inflammatory conditions, and wounds, and as an anti-aging remedy. Essential oils from *Curcuma* spp., particularly *Curcuma longa* L., have demonstrated various health-related biological activities [96].

> *"We cultivate curcuma, galanga, and ginger near the outdoor bathroom, utilizing the wastewater for irrigation. We use those plants as a source of traditional medicine for our family." (Male, 42).*

Bambusa glaucescens (Willd.) Merr. (bamboo) had the highest occurrence among the species used as building material (RF = 75%). The most commonly used building material in the TLs is bamboo, used, for example, for the *khobung* (mosque), the *kandang* (cage), the *dapor* (kitchen), the warehouse, and fences. Some traditional kitchen utensils used by rural households are also made from bamboo. Bamboo tree gardens are among the most common traditional dryland agroecosystems. They have an ecological and an economic function, supporting the sustainable development of rural livelihoods [97]. Bamboo shoots are consumed as vegetables.

> *"The most used construction material in our settlement is bamboo from our garden." (Male, 55).*

> *"Bamboo shoots are cooked as a vegetable with spices (onion, garlic, and chili) and coconut milk. It is tasty." (Female, 37).*

3.3. Local Knowledge and Management Practice of SHG

The communities in the study area managed their SHGs either traditionally or by using indigenous knowledge that was passed on from generation to generation. Gardening is done primarily on low-fertility soil. Intercropping, also known as mixed cropping or polyculture, is an agricultural practice known around the world. Intercropping increases the average content of nitrogen, phosphorus, and potassium in the soil [98]. It is a traditional farming practice of diversified crop cultivation using comparatively low inputs to improve the quality of the agroecosystem [99]. Intercropping is not only applied in Javanese HGs [99,100], but also by ethnic Madurese in SHGs (Figure 4). *Zea mays* L., *Solanum lycopersicum* L. *Arachis hypogaea* L. *Capsicum frutescens* L., and *Vigna sinensis* L. (long bean) are common plant species used in intercropping systems.

(**a**) (**b**)

Figure 4. Intercropping in SHGs. (**a**) *Zea mays* L., *Arachis hypogaea* L. and *Capsicum frutescens* L. (**b**) *Solanum lycopersicum* L., *Arachis hypogaea* L., and *Vigna sinensis* L.

Land preparation is carried out by tilling the soil using a traditional hoe. Irrigation relies on rainfall and manual watering using water from a well or the water reservoir. Some plants planted near the bathroom get their water from the wastewater from bathing and washing. Digging and watering are natural activities that initiate the growth of SHG species [77]. Weeding is carried out by hand to remove weeds that compete for light, water, and nutrients with planted crops. Pruning is carried out to remove branches from tall trees that block the sunlight, some of which are used as animal feed or firewood.

Due to budget limitations, chemical fertilizers are rarely applied. The majority of the respondents (95%) used manure or compost, and only 5% (mostly richer farmer) used chemical fertilizers. This is higher than in a previous study in rural Czechia [101] and three mountain regions of the Iberian Peninsula [102]. In contrast, the application of compost, manure, and crop rotation to improve soil fertility and reduce rapid soil degradation is common. In line with the home garden management of rural households in the central Catalan Pyrenees, the application of livestock and hen dung, ashes, and other natural fertilizers is also done in Madurese SHGs. [4]. Organic fertilizer is also known as biological or biodynamic fertilizer. It helps to improve soil biology, enhances the soil's natural fertility, and promotes plant biodiversity and species productivity [77]. Organic fertilizer is produced in the TLs, both for use in the farm fields and the SHGs. Budget and knowledge limitations are problems in SHG management that affect productivity.

> *"Industrial fertilizers are expensive and sometimes difficult to obtain. We use them for the main crops in the fields. On the other hand, we prefer to use compost for the plants in our garden." (Male, 42).*

Fencing is a TL management activity that is done to protect the TL and the SHG against humans, domesticated animals, and wild animals that could damage crops during the growing stage [77]. Species often used in organic fences are: *Bambusa glaucescens* (Willd.) Merr., *Lannea coromandelica* (Houtt.) Merr. (Indian ash tree), *Hibiscus tiliaceus* var. *abutiloides* (Willd.) Hochr. (sea hibiscus), *Hibiscus rosa-sinensis* L., *Sauropus androgynous* Merr (sweet leaf), and *Moringa oleifera* Lam. *Lannea coromandelica* (Houtt.) Merr. and *Hibiscus tiliaceus* var. abutiloides (Willd.) Hochr. are also used to provide shade and firewood, while *Sauropus androgynous* Merr. is used as a food supplement for breastfeeding women. Although several different plants can be used for the same purpose, preferences for selecting them depend on demographics, and social and cultural factors [77].

> *"Fencing is necessary not only as a barrier and protection, but also as a source of healthy food. For example, the sweet leaf plant is a nutritious food for breastfeeding mothers." (Female, 30).*

Based on the kinship principle in TLs, there are no specific shared resources—all households manage and utilize the available resources together. The TL and the SHG are managed by the parents. If the parents are no longer alive, then the eldest child will replace them. They worship together every day at the *khobung*, and discuss and make decisions about the family, including SHG management. A son who marries will leave the TL and live with his bride. If a daughter marries, her spouse will live in the TL and participate in family decision-making. Richer farmer has household assistant who work both in TLS and in the field.

Both men and women are involved in SHG management activities. Planting, weeding, and harvesting are tasks that are mostly done by women. The men are mostly responsible for land preparation and pruning. An interesting finding from our study concerns the marketing system. Selling SHG products in a traditional market is mostly done by the women. However, marketing decisions (to sell or not to sell) are the domain of men. This is related to Islamic culture, where the husband is the leader, has a higher position than the wife, and makes all decisions that concern the family. Madurese women are subservient and obedient to their men. The husband has dominant power over his wife. The concept of *bappa-babbu-guru-rato* also exemplifies the husband's power. The placement of *bappa* (father) at the beginning of the chain of obedience in this concept is structurally related to the position of the husband in relation to the other family members [34]. Current shifts in livelihoods can be related to changes in gender roles in home gardening [103].

> *"Our religion states that men are leaders (in charge of women) and must be responsible for their families and respect women. We handle heavy work, but we still cooperate with each other in various activities." (Male, 65).*
>
> *"The men tend to the primary crops in the fields, while the women tend to our garden. However, men will still perform some of the heavy activities, i.e., land preparation and the pruning of high-growing plants." (Female, 50).*
>
> *"In daily life, we attempt to be submissive to our spouses, even in the management and utilization of the garden." (Female, 43).*

The results of our field observations show that several TLs in Pamekasan were used for tourism purposes. Inside a TL managed as a homestay, tourists and visitors can enjoy the atmosphere of living in one. This project was initiated by the younger generation and supported by the village budget, but its management is still very simple. Assistance from the local government will be helpful for the further development of this project.

3.4. SHG Functions and Services to Rural Livelihoods

The ethnic Madurese have developed an SHG system that integrates aesthetics, agriculture, horticulture, and animal husbandry. In our field observations, we found that TLs and SHGs provide multiple services and functions that contribute directly to rural livelihoods.

1. Provision of daily food nutrition The primary function of the SHG is to produce food as a supplement to the daily nutrition in rural areas. The total production from the farm fields and the SHG can supply food for a whole year and provide rural households with cereals, tubers, vegetables, fruits, and spices. We noted that during the COVID-19 pandemic, the respondents felt no worry about their daily food because they had enough food in storage (both from their farm fields and the SHG). In accordance with previous studies [104–107], the COVID-19 pandemic had a negative impact on household income. Households reduced expenditure on food by utilizing their SHGs. This is in line with previous studies [108], which found that home gardens played an important role in advancing food and nutritional security during and after the COVD-19 pandemic. Madurese farmers grow rice and corn as the most important staple crops. Rice is harvested from paddy fields and kept as grain—it is never sold. When the rice supply gets low, they grind it. Dried corn with husks is hung in the kitchen or the storeroom. Food provisioning was the most frequently mentioned ecosystem service, especially in rural areas [109]. Most families depend on

their home garden for food. Thus, they grow plants that can meet their basic needs, thereby reducing their daily food expenses.

"Despite the fact that we are in a COVID-19 pandemic, we are not concerned about food shortages. We have rice and corn (from the fields), as well as other food crops in our SHG." (Male, 43).

"Our family prefers to eat eggs and poultry that we raise ourselves because they taste better and we also save money. We are pleased to be able to provide for the family's nutritional needs using garden produce, both plants and livestock." (Female, 43).

"We bought less veggies (carrots, potatoes, and cabbage) and replaced them with moringa, cassava leaf, and young jackfruit, which we can harvest from our SHG to save money during the pandemic." (Female, 32).

"We do not have to worry about becoming hungry because of COVID-19 at any moment. We can take cassava, taro, sweet potato, or corn from our garden if we are hungry, and then boil or fry them." (Male, 67).

2. Additional income and saving system The home garden represents an integrated production system for family income [110]. We found that ethnic Madurese women sell cereals, tubers, fruits, vegetables, and chili peppers grown in their SHG at the nearest traditional market to get additional income. The income from food sales was only a supplemental source of income for all rural households, not a major one. An SHG can contribute 10% to 15% of the monthly household income, which agrees with the findings of a previous study conducted in Jenggolo Village, Malang, East Java [30]. However, in the latter instance, the contribution to the household income from such sales was greater.

"We were short on cash at the time and our extended family needed immediate assistance, so we decided to sell the bamboo in the garden." (Male, 62).

"My child entered college last year and it was rather expensive. Fortunately, we had cows to sell. Yes, raising a cow is a great way to save money that may be put to good use at any moment." (Male, 62).

3. Agrobiodiversity reservoir SHGs can be considered agrobiodiversity reservoirs on a micro-regional scale and are important areas for in-situ and on-farm conservation [111]. Home gardens play an important role in biodiversity conservation, especially for local traditional crop varieties. Local crop varieties are grown in SHGs by Madurese farmers to conserve seeds and for other reasons as well (preferences). For example, we recorded local varieties of *Zea mays* L., *Allium cepa* L., and *Cucumis sativus* L. in the SHGs. Most farmers (75%) do not accept hybrid varieties. They believe that local varieties are tastier: the maize is sweeter, the onion has a stronger scent, and the cucumbers are crunchier. Rural communities have a tradition of exchanging seeds, which also contributes to the richness of genetic diversity (local variety conservation).

"We prefer to plant a local variety (of Madurese corn), both in the fields and in the garden. It tastes better, even though it is smaller than hybrid varieties, and we want to preserve it." (Male, 62)

"The strong scent of Sumenep shallots and the crispness of yellow cucumbers are my favorites. We are attempting to conserve both of these local types, which are becoming increasingly rare. I am out of seeds at the moment, so I have asked my brother to plant some in the garden." (Female, 50).

4. Fuel storage SHGs produce firewood that is commonly used for cooking in TLs. Rural households use subsidized liquid gas for cooking, but they prefer to use firewood in their daily lives; liquid gas is only used for simple cooking activities, such as boiling water for making coffee or tea. The ethnic Madurese strictly use firewood for cooking during religious activities and festival celebrations. Several cultural and religious activities are held in TLs [37]; the more activities, the more firewood is needed.

"I often cook using firewood, which reduces expenses for buying LPG (liquid petroleum gas)." (Female, 50).

"Several species of trees in the garden provide both fuel and animal fodder. We frequently cook using leftover animal feed." (Male, 40).

5. Livestock shelter Livestock is an essential part of ethnic Madurese culture, especially cattle. The SHG plays an important role in providing fodder for family-raised livestock in the TLs. *Pennisetum purpureum* Schumach. (elephant grass) is the plant most commonly used as fodder for cattle. Corn stalks, both dry and fresh, are also used as fodder. On the other hand, livestock manure that is kept also produces organic fertilizer. Cattle are the most important livestock raised by households in TLs. Every household has a minimum of two cattle. This finding is in line with the previous research by Nugroho [112]. The motives for keeping cattle are saving, manure production, income, social status, and cultural values [113]. Usually, parents give cattle to their daughters when they get married as capital for setting up their new life. Small ruminants, such as goats and sheep, are also kept by the ethnic Madurese. They will sell cattle, goats, or sheep if they have a large expenditure, for example, school fees, a wedding ceremony, tobacco planting capital, the Feast of Sacrifice, etc. Chickens, ducks, and swans are also kept in the TLs and mainly consumed for self-sufficiency. A small number of eggs are sold in a traditional market for additional income. Additionally, some birds are raised as a hobby (pigeons, love birds).

   "For the Madura tribe, cows are a specific type of cattle. My in-laws' family gave me a cow when I got married." (Female, 50).

6. Social and cultural services TLs and SHGs are used for daily activities, spatial arrangement, health, enjoyment, personal satisfaction, and social satisfaction [30]. Drying agriculture products, washing and drying clothes, raising livestock, playing, doing carpentry, and other activities are conducted daily in the TLs. Products from the TL and SHG play an important role in traditional festival celebrations and religious activities. Madurese people's marriages, funerals, festivals, and religious ceremonies must be carried out in their TL. SHG products are used for various ceremonies, especially fruit, chickens, and eggs. We note that families conserve and maintain their TL because they need a large space for reunions with their extended family and use products from their SHG during those events. SHG products are also shared with others, such as neighbors and guests who visit the TL. As a result, the SHG also contributes to the community's social network [114]. All of our respondents stated that they feel happiness when they share with others.

   "In Islam, we are encouraged to give charity. The fruit I harvest from my garden is shared with my neighbors and relatives outside the village. This is a banana harvest from the garden. Please eat it and take it home. It feels very good when we can share and believe that God will give us more." (Male, 63).

7. Regulating services Studies on ecosystem services and environmental benefits of SHGs highlight various regulating services they offer [30,114,115]. Some plant species that are found in most SHGs are used for providing shade: *Cananga odorata* (Lam.) Hook. f. & Thomson, *Artocarpus heterophyllus* Lam (jackfruit), *Dalbergia latifolia* Roxb. (rosewood), *Dimocarpus longan* Lour. (longan), *Hibiscus tiliaceus* var. abutiloides (Willd.) Hochr., *Lannea coromandelica* (Houtt.) Merr., *Mangifera indica* L., *Muntingia calabura* L. (cotton candy berry), *Nephelium lappaceum* L. (hairy lychee), *Persea americana* Mill. (avocado), *Pterocarpus indicus* Willd. (Burmese rosewood), *Samanea saman* (Jacq.) Merr. (rain tree), *Swietenia macrophylla* King. (big leaved mahogany), *Syzygium aqueum* (Burm. f.) Alston (water apple), *Syzygium cumini* (L.) *Skeels* (black plum), and *Tamarindus indica* L. (tamarind). These plants are easy to grow and resistant to strong gusts of wind, as their branches and twigs do not break easily. Multipurpose species

often form the core of the SHG and create microclimates and soil conditions favorable for the cultivation of many other species [115].

"Plants that have grown up have lush leaves that are very comfortable to shelter under and feel the fresh wind. It is better when you can enjoy the fruit and eat it with your family under a tree." (Male, 63).

4. Conclusions

This study treated the home garden as a broad notion, including the interconnections throughout the family household and culture, rather than just as an area for plant production. This paper revealed the landscape element of the Taneyan Lanjang of the ethnic Madurese and the agrobiodiversity of their shared home gardens. The diversity of the cropping patterns in SHGs is influenced by factors related to regional characteristics such as customs and religion. The most cultivated plant species in the SHGs are used as food. The ethnic Madurese use traditional wisdom to manage their SHG, with both males and females contributing. Food for daily consumption, supplemental income, livestock shelter, fuel storage, agrobiodiversity conservation, cultural services, and regulatory services are all provided by the TL and SHG agroecosystem. Based on this study, we propose the following policy recommendations:

1. It is necessary to improve education, especially for the youth, to explain how important SHGs are. The younger generations can promote and develop tourism in TLs and SHGs to provide economic benefits;
2. Given the traditional nature of SHG management, the low productivity of SHGs, and the opportunity tourism development provides, the local government and the university in Madura Island can help to protect the TLs and SHGs and improve the productivity of plant species, specifically those with high economic value, by providing trainings, extension activities, and establishing an SHG related institution.

Conservation is necessary to safeguard the sustainability-producing contribution of TLs and SHGs to rural livelihoods. Hopefully, rural communities will become more interested in making their TLs more attractive and profitable so that SHGs and traditions related to the TL can be better preserved, supported by tourism development. This study offers valuable insight to support the promotion of home garden utilization and agrobiodiversity conservation, not only in Indonesia, but also in other countries, since home gardens are also common in other developing nations. One of the drawbacks of this study is that it covered only a relatively short time period. More research, particularly on changes in biodiversity, needs to be conducted over a longer period of time.

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Appendix A

Table A1. Major use categories of Madurese ethnic SHG plant species in Madura Island, Indonesia.

Plant Taxon (Species)	Family	English Name	Vernicular Name		Utilization *		RF **
			Indonesia	Madurese	Ctg	PU	(%)
Adenium obesum (Forssk.) Roem. & Schult.	*Apocynaceae*	Desert rose	Kamboja	Kamboja	Or	Fl	2
Allium cepa L.	*Liliaceae*	Onion	Bawang merah	Bhabang merah	Fd, Cm	Tu	5
Aloe vera (L.) Burm.f.	*Asphodelaceae*	Aloe vera	Lidah buaya	Jhilê bhâjê	Md, Or	Le	5
Alpinia galanga (L.) Willd.	*Zingiberaceae*	Siamese ginger	Lengkuas	Laos	Fd	Rz	20
Amaranthus sp.	*Amaranthaceae*	Amarant/spinach	Bayam	Tarnya'	Fd	Le	10
Amorphophallus oncophyllus Prain ex Hook.f.	*Araceae*	Konjac	Porang	Subeg Leres	Fd	Tu	38
Anacardium occidentale L.	*Anacardiaceae*	Cashew	Jambu Mente	Jâmbhu Monyet	Fd, Cm	Fr, Se	33
Annona muricata L.	*Annonaceae*	Soursop	Sirsak	Sarkajhê	Fd	Fr	10
Annona squamosa L.	*Annonaceae*	Sugar apple	Srikaya	Sorkajeh	Fd	Fr	8
Arachis hypogaea L.	*Fabaceae*	Peanut/groundnut	Kacang tanah	Kacang tana	Fd, Cm, Fo	Se	62
Artocarpus altilis (Parkinson ex F.A.Zorn) Fosberg	*Moraceae*	Breadfruit	Sukun	Sokon	Fd	Fr	10
Artocarpus heterophyllus Lam.	*Moraceae*	Jackfruit	Nangka	Nangkah	Fd, Sh	Fr	35
Averrhoa bilimbi L.	*Oxalidaceae*	Bilimbi	Belimbing wuluh	Blimbhing Buluh	Fd, Md	Fr	4
Averrhoa carambola L.	*Oxalidaceae*	Star fruit	Belimbing	Bhlimbhing	Fd	Fr	8
Bambusa glaucescens (Willd.) Merr.	*Poaceae*	Bamboo	Bambu	Pêrreng	Fd, BM, FW, Cm	Tb, St	75
Basella rubra L.	*Basellaceae*	Malabar spinach	Binahong	Kandula	Md	Le	5
Borassus flabellifer L.	*Palmae*	Palmira	Lontar, Siwalan	Ta'al	Fd	Fr	4
Bougainvillea spp.	*Nyctaginaceae*	Paper flower	Bugenvil	Bunga kertas	Or	Fl	6
Caladium bicolor (Aiton) Vent.	*Araceae*	Caladium	Keladi	Kembhâng tales	Or	Le	8
Cananga odorata (Lam.) Hook.f. & Thomson	*Annonaceae*	Perfume tree	Kenanga	Kenanga	Or, Sh	Fl	4
Canarium ovatum Engl.	*Burseraceae*	Walnut	Kenari	Kenari	Fd	Fr	3
Capsicum annum L.	*Solanaceae*	Cayenne pepper	Cabai besar	Cabbhi rajhê	Fd	Fr	13
Capsicum frutescens L.	*Solanaceae*	Chili pepper	Cabai Rawit	Cabbhi keni'	Fd, Cm	Fr	69
Carica papaya L.	*Caricaceae*	Papaya	Pepaya	Kates	Fd	Fr, Le, Fl	49
Catharanthus roseus (L.) G.Don	*Apocynaceae*	Periwinkle	Tapak dara	Tapak dara	Or	Fl	3
Ceiba pentandra (L.) Gaertn.	*Bombacaceae*	Kapok-tree	Kapuk Randu	Kapo	Cm, FW	Fr, Tb	2
Chrysophyllum cainito L.	*Sapotaceae*	Star apple/caimito	Kenitu	Menitu	Fd	Fr	2
Citrus amblycarpa (Hassk.) Ochse	*Rutaceae*	Java lime	Jeruk limau	Jhêrruk bujhel	Fd	Fr	13
Citrus aurantiifolia (Christm.) Swingle	*Rutaceae*	Key lime	Jeruk Nipis	Jhêrruk peccel	Fd	Fr	13
Citrus hystrix DC.	*Rutaceae*	Kaffir lime	Jeruk purut	Jhêrruk porot	Fd	Fr, Le	11
Citrus paradisi Macfad.	*Rutaceae*	Grapefruit/pomelo	Jeruk Bali	Jhêrruk Bali	Fd	Fr	7
Citrus sinensis (L.) Osbeck	*Rutaceae*	Sweet orange	Jeruk Manis	Jhêrruk Manes	Fd	Fr	12

Table A1. *Cont.*

Plant Taxon (Species)	Family	English Name	Vernicular Name		Utilization *		RF **
			Indonesia	Madurese	Ctg	PU	(%)
Cocos nucifera L.	*Arecaceae*	coconut	Kelapa	Nyior	*Fd, BM, FW*	Fr, Tb	41
Codiaeum variegatum (L.) Rumph. ex A.Juss.	*Euphorbiaceae*	Croton	Puring	Karoton	Or	Le	8
Colocasia esculenta (L.) Schott	*Araceae*	Taro	Talas	Talês	Fd	Tu, St	47
Cosmos caudatus Kunth	*Asteraceae*	Wild cosmos	Kenikir	Knikir	Fd	Le	28
Cucumis sativus L.	*Cucurbitaceae*	Cucumber	Mentimun	Temon	Fd, Cm	Fr	4
Cucurbita maxima Duchesne	*Cucurbitaceae*	Pumpkin	Labu kuning	Labuh	Fd	Fr	4
Curcuma longa L.	*Zingiberaceae*	Turmeric	Kunyit	Konyek	Fd, Md	Rz	63
Curcuma rotunda L.	*Zingiberaceae*	Fingerroot	Kunci	Konceh	Fd, Md	Rz	46
Curcuma xanthorrhiza Roxb	*Zingiberaceae*	Javanese turmeric	Temulawak	Temo labek	Md	Rz	51
Curcuma zedoaria (Christm.) Roscoe	*Zingiberaceae*	Zedoary	Kunyit Putih	Konyek pote	Md	Rz	45
Cymbopogon citratus (DC.) Stapf	*Poaceae*	Lemongrass	Serai	Sereh	Fd, Md	Le	45
Dalbergia latifolia Roxb.	*Fabaceae*	Rosewood	Kayu Sono	Kaju Sono	BM, Sh, FW	Tb	5
Dimocarpus longan Lour.	*Sapindaceae*	Longan	Kelengkeng	Klèngkèng/Khmer	Fd, Sh	Fr	13
Dracaena angustifolia (Medik.) Roxb.	*Asparagaceae*	Soap tree	Pandan suji	Pandhen Sojih	Fd	Le	13
Durio zibethinus L.	*Malvaceae*	Durian	Durian	Dhurian	Fd	Fr	13
Dypsis lutescens (H.Wendl.) Beentje & J.Dransf.	*Arecaceae*	Butterfly palm	Palem	Palem	Or	Le	7
Euphorbia milii Des Moul.	*Euphorbiaceae*	Crown of thorns	Bunga Euporbia	Seribu duri	Or	Fl	8
Hibiscus rosa-sinensis L.	*Malvaceae*	Chinese hibiscus, shoeblack plant	Bunga Sepatu	Kembhâng sepatu	Or, Fo	Fl	47
Hibiscus sabdariffa L.	*Malvaceae*	Roselle	Rosella	Rosella	Fd, Or	Fl	3
Hibiscus tiliaceus var. abutiloides (Willd.) Hochr.	*Malvaceae*	Sea hibiscus	Waru	Beruh	BM, Sh, FW	Tb	8
Hylocereus undatus (Haw.) Britton & Rose	*Cactaceae*	Dragon fruit	Buah Naga	Buah Naga	Fd	Fr	5
Impatiens balsamina L.	*Balsaminaceae*	Rose balsam	Bunga pacar air	Pacar kuku	Or	Fl	7
Ipomoea aquatica	*Convolvulaceae*	Water spinach	Kangkung	Kangkung	Fd	Le	13
Ipomoea batatas (L.) Lam.	*Convolvulaceae*	Sweet potato	Ubi jalar	Sabbrêng longghê	Fd	Tu	61
Ixora coccinea L.	*Rubiaceae*	Jungle geranium	Asoka	Kembhâng Soka	Or	Fl	3
Jasminum sambac (L.) Aiton	*Oleaceae*	Jasmine	Melati	Malate	Or	Fl	16
Jatropha multifida L.	*Euphorbiaceae*	Coral plant	Bunga betadine	Penisilin	Md	Le	1
Kaempferia galanga L.	*Zingiberaceae*	Aromatic ginger	Kencur	Kencor	Md	Rz	43
Lagenaria leucantha (Duchesne) Rusby	*Cucurbitaceae*	Calabash	Labu air	Labuh Lente	Fd	Fr	2
Lannea coromandelica (Houtt.) Merr.	*Anacardiaceae*	Indian ash tree	Kayu jaran	Ki jaran	BM, Sh, FW	Tb	6
Leucaena leucocephala (Lam.) de Wit	*Fabaceae*	White leadtree	Lamtoro	Lantoro	Fd, Fo	Se, Le	3
Luffa acutangula (L.) Roxb.	*Cucurbitaceae*	Oyong/gambas	Oyong	Langkèr	Fd	Fr	2

Table A1. *Cont.*

Plant Taxon (Species)	Family	English Name	Vernicular Name		Utilization *		RF **
			Indonesia	Madurese	Ctg	PU	(%)
Manilkara zapota (L.) P.Royen	*Sapotaceae*	Sapodilla	Sawo	Sabu manila	Fd	Fr	88
Mangifera indica L.	*Anacardiaceae*	Mango	Mangga	Pao	Fd, Cm, Sh	Fr	76
Manihot esculenta Crantz	*Euphorbiaceae*	Cassava	Singkong	Sabbrêng kaju	Fd	Tu	13
Morinda citrifolia	*Rubiaceae*	Indian mulberry	Mengkudu	Koddhu'	Md	Fr	3
Moringa oleifera Lam.	*Moringaceae*	Moringa	Kelor	Marongghi	Fd	Le	73
Morus alba L.	*Moraceae*	White mulberry	Murbei	Murbei	Fd	Fr	4
Muntingia calabura L.	*Muntingiaceae*	Cotton candy berry	Kersen	Kersen baleci	Fd, Sh	Fr	33
Musa spp.	*Musaceae*	Banana	Pisang	Geddeng	Fd	Fr	98
Nephelium lappaceum L.	*Sapindaceae*	Hairy lychee	Rambutan	Rambutan	Fd, Sh	Fr	4
Ocimum basilicum L.	*Lamiaceae*	Sweet basil	Kemangi	kemangék	Fd	Le	3
Opuntia spp	*Cactaceae*	Prickly pear	Kaktus	kaktus	Or	St	1
Pandanus amaryllifolius Roxb.	*Pandanaceae*	Screwpine	Pandan wangi	Pandhen Ro'om	Fd	Le	13
Passiflora edulis Sims	*Passifloraceae*	Passionfruit	Markisa	Markisa	Fd	Fr	2
Pennisetum purpureum Schumach.	*Poaceae*	Elephant grass	rumput gajah	Rêbbhê ghêjhê	Fo	Le, St	8
Persea americana Mill.	*Lauraceae*	Avocado	Alpukat	Apokat	Fd, Sh	Fr	12
Phaseolus aureus Roxb.	*Fabaceae*	Mung bean	Kacang Hijau	Arta'	Fd, Fo	Se	23
Phoenix dactylifera L.	*Arecaceae*	Date palm	Kurma	Korma	Fd	Fr	1
Piper betle L.	*Piperaceae*	Betel pepper	Sirih	Sêrre	Md	Le	28
Piper retrofractum Vahl	*Piperaceae*	Javanese long pepper	Cabe jamu	Cabbhi jhêmo	Md, Cm	Fr	65
Pluchea indica (L.) Less.	*Compositae*	Indian pulchea	Beluntas	Beluntas	Fd, Md	Le	13
Psidium guajava L.	*Myrtaceae*	Guava	Jambu Biji	Jhêmbhu bighi	Fd	Fr	19
Psophocarpus tetragonolobus (L.) DC	*Fabaceae*	Winged bean	Kecipir	Kecêpêr	Fd	Fr	1
Pterocarpus indicus Willd.	*Fabaceae*	Burmese rosewood	Angsanah	Sana Kembhâng	BM, Sh	Tb	5
Punica granatum L.	*Lythraceae*	Pomegranate	Delima	Dhalima	Fd	Fr	8
Rosa spp.	*Rosaceae*	Rose	Mawar	Kembhâng Mawar	Or	Fl	13
Salacca zalacca (Gaertn.) Voss	*Arecaceae*	Snake fruit	Salak	Salak	Fd	Fr	15
Samanea saman (Jacq.) Merr.	*Fabaceae*	Rain tree	Kayu hujan	Kaju ojhân	BM, Sh, FW	Tb	8
Sandoricum koetjape (Burm.f.) Merr.	*Meliaceae*	Cotton fruit	Kecapi	Sentol	Fd	Fr	1
Sansevieria trifasciata Prain	*Asparagaceae*	Snake plant	Lidah mertua	Mandafika	Or, Md	St	15
Sauropus androgynous Merr	*Phyllanthaceae*	sweet leaf	Katuk	Kelakor	Fd	Le	15
Sechium edule (Jacq.) Sw.	*Cucurbitaceae*	Chayote	Labu siam	Manisah	Fd	Fr	6
Sesbania grandiflora (L.) Pers.	*Fabaceae*	Vegetable hummingbird	Turi	Toroi	Fd, Fo	Fl, Le	35
Solanum lycopersicum L.	*Solanaceae*	Tomato	Tomat	Tomat	Fd, Cm	Fr	10
Solanum melongena L.	*Solanaceae*	Eggplant	Terong	Têrrong	Fd	Fr	33
Sonchus arvensis L.	*Asteraceae*	Perennial sowthistle	Tempuyung	Tempuyung	Or	Rz	27
Spondias cytherea Sonn	*Anacardiaceae*	Golden apple	Kedongdong	Kedundung	Fd	Fr	13

Table A1. *Cont.*

Plant Taxon (Species)	Family	English Name	Vernicular Name		Utilization *		RF **
			Indonesia	Madurese	Ctg	PU	(%)
Swietenia macrophylla King	*Meliaceae*	Big leaved mahogany	Mahoni	Mahoni	BM, Sh, FW	Tb	6
Syzygium aqueum (Burm.f.) Alston	*Myrtaceae*	Water apple	Jambu Air	Jhembuh Klampo'	Fd, Sh	Fr	48
Syzygium cumini (L.) Skeels	*Myrtaceae*	Black plum	Jamblang	Duwet	Fd, Sh, FW	Fr	10
Tamarindus indica L.	*Fabaceae*	Tamarind	Asem	Accem/komancer	Fd	Fr, Sh	7
Tectona grandis L.f.	*Lamiaceae*	Teak	Jati	Jhâte	BM, Cm	Tb	32
Vigna sinensis L.	*Fabaceae*	Long bean	Kacang panjang	Otok	Fd, Fo	Fr, Le	13
Zea mays L.	*Poaceae*	Corn	Jagung	Jâghung	Fd, Fo	Fr	78
Zingiber officinale Roscoe	*Zingiberaceae*	Ginger	Jahe	Jhâi	Fd, Md	Rz	46

* Abbreviations (utilization): BM = Building Material, Cm = Commercial, Ctg = Category, Fd = Food, Fl = Flower, Fo = Fodder, Fr = Fruit, FW = Firewood, Le = Leaf, Md = Medicinal, Or = Ornamental, PU = Part Use, Rz = Rhizome, Se = Seed, Sh = Shading, St =steam, Tb = Timber, Tu = Tubers. ** RF (%) = relative frequency.

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