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Pekarangan model for supporting food resiliency on household level in transmigration area, East Lampung

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Abstract. Pekarangan, *as one of the potential natural resources and closest to the family, can be the right and strategic choice to be used in realizing family-scale food resiliency. The research was conducted in the transmigration area of East Lampung from June 2021 to December 2021. The determination of the pekarangan sample by purposive sampling was carried out on four transmigration ethnics, i.e., the Javanese (100 samples), the Sundanese (100 samples), the Balinese (100 samples), and the Madurese (13 population), as well as local transmigration, i.e., the Lampungnese (100 samples).* Pekarangan *model is determined from species diversities in the agroforestry system and its plant multistorey condition. Species diversities and multistorey conditions are determined by Summed Dominance Ratio (SDR) and an average of the number of species per pekarangan. The results of identification found three agroforestry systems as a pekarangan model, i.e., the agroforest system (Maduranese* Pekarangan*), agrosilvopastoral (Balinese, Javanese, and Lampungnese* Pekarangan*), and agrosilvopastoralfishery (Sundanese* Pekarangan*). Each agroforestry system contributed to food sources by 54,54% (agroforest), 46,15% to 65,51% (agrosilvopastoral), and 89,28% (agrosilvopastoralfishery).*

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INTRODUCTION

An increase in population is associated with an increase in food demand, while the availability and capacity of the land are decreasing (Nurhidayah and Karjoko 2017). Increasing land productivity is done by maximizing soil processing, fertilizing, and applying pesticides. However, the land management system, due to repeated intensive agriculture, fertilization, and application of pesticides, caused a decrease in land capability (land degradation), both in terms of physical, chemical, and biological soil properties (Saturday 2018; Gupta 2019). This is also exacerbated by erosion, especially by water and wind (Saturday 2018). The higher value of land for non-agriculture (economic problems) and in addition to the decreasing ability of land (ecological problems) were the reasons for the owner to change or sell it (Nurhidayah and Karjoko 2017; Nuryaman 2017). This of course, exacerbated food problems in terms of quantity and quality of the land. Therefore, alternative land and a more sustainable land management system are needed for food fulfillment.

The East Lampung region which consisted of various transmigrant ethnic, such as Balinese, Javanese, Madurese, and Sundanese, gets 0,25 ha of land for houses and *pekarangan* per family beside the plantation land. *Pekarangan* is a typical Indonesian home garden associated with the house (Arifin *et al.* 1998; Hakim 2014). The land for houses and *pekarangan* that have been received since 1952 has experienced dynamics, especially from the biophysical side of *pekarangan*. The biophysical conditions of *pekarangan*, i.e., area, size, zoning, number of species and individual plants, vertical and horizontal diversity of plants, and the presence of livestock and fish determined the model of *pekarangan* management (Arifin *et al.* 1998, 2012). In addition, the local knowledge and culture of each *pekarangan* also influenced the dynamics of *pekarangan*, especially in relation to supporting food resiliency at the household level.

The utilization of *pekarangan* is currently more directed to the fulfillment of daily household food. Programs such as Kawasan Rumah Pangan Lestari (KRPL) in 2010–2019, Pekarangan Pangan Lestari (P2L) in 2019–now are one of the flagship programs of the Ministry of Agriculture through the National Food Agency (formerly the Food Security Agency), Indonesia. This program aimed to increase the availability, accessibility, and utilization of household food, as well as increased household income (Asmoro *et al.* 2020). The targets of the program were generally women farmer groups (KWT) who manage their *pekarangan* jointly. Thus, it is hoped that households can fulfill some of their food from their *pekarangan*.

Some of the obstacles in P2L activities, however, are related to crop and livestock issues, human resources, and institutions. Plant and livestock problems that arose were mainly high mortality rates in raising poultry, pest, and disease attacks on both seedlings and mature plants (Balitbang 2012). In terms of human resources, the shortage of manpower, busy group members, and extension workers who rarely provided assistance were obstacles to carrying out P2L activities (Sulaiman *et al.* 2019). Meanwhile, from an institutional perspective, local government support was generally still at a low to moderate level (Pusat Kajian Anggaran Badan Keahlian DPR RI 2020), and coordination between agricultural development programs has not been synergized properly (Sulaiman *et al.* 2019).

Pekarangan as an alternative land that can be used to support food resiliency. The structure of *pekarangan* consisted of multistorey and multilayer plants with various species, especially food plants (Soemarwoto 1987). The multilayer structure of *pekarangan* plants can provide green manure and prevent erosion (Sabarnudin 2004). *Pekarangan* utilization system is also related to the local culture and knowledge of the community (Calvet-Mir *et al.* 2012; Das and Mohiuddin 2012). *Pekarangan* can support food resiliency at the household level if it is managed with an appropriate model. Therefore, it is necessary to identify a *pekarangan* model that is in accordance with the biophysical conditions and local wisdom of each transmigrant ethnicity.

METHODS

Research Site and Time

This research was carried out from June 2021 to December 2021. The research site is East Lampung Regency, Lampung Province. The *pekarangan* samples are taken from the transmigration area, which consisted of the Sundanese settlements, the Javanese settlements, the Madurese settlements, the Balinese settlements, and the Lampungnese settlements. The four ethnics were chosen because they were ethnics that have received a transmigration program from the government from the old order to the new order era, as well as local transmigration for Lampungnese. In addition, the five ethnicities were chosen because they can provide a variety of results from the pattern and use of *pekarangan* according to their respective traditions and culture. Administratively, the research location is in Purbolinggo District, Pekalongan District, Way Bungur District, North Raman District, and Sukadana District. They are districts with the majority population of transmigrants.

Data Collection

The data collection used is exploratory-descriptive. *Pekarangan* samples were determined by purposive sampling (according to the ethnic). The sample size is based on the number of houses for each ethnic (an error

rate of 5%) (Sugiyono 2014), which is 100 *pekarangan* samples. Where the houses of the Sundanese were the smallest and approximately 140–160 houses, and the number of 100 samples appears. The *pekarangan* sample of other ethnics adapted to the Sundanese for easy comparison (Table 1). The exception occurred in the Madurese. The houses of the Madurese in Way Bungur District only had 13 houses. Therefore, the houses of the Madurese were taken in their entirety. In addition, this research was also carried out during the COVID-19 pandemic by implementing strict health protocols.

Table 1 *Pekarangan* samples of transmigrant

No.	Ethnics	Districs	The Number of *pekarangan* Sample/ethnics
1.	Sundanese	Pubolinggo	100
2.	Javanese	Purbolinggo, Way Bungur, and Pekalongan	100
3.	Balinese	Raman Utara and Sukadana	100
4.	Maduranese	Way Bungur	13
5.	Lampungnese	Sukadana	100

Data Analysis

Pekarangan (typical homegarden of Indonesia) is a form of an agroforestry system that exists in tropical areas (Soemarwoto 1987; Kumar 2015). This can be seen from the land which is planted with trees, medium shrubs, and seasonal crops to produce a variety of food according to the system and local knowledge of the local community (Soemarwoto 1987).

Pekarangans of the Balinese, the Javanese, the Madurese, and the Sundanese transmigrants, as well as local transmigrants *pekarangan*, the Lampungnese were identified to find the shape of *pekarangan* model, especially the diversity of species (plants and livestock). The plant species found were then grouped to describe multilayer/multistorey. Multistorey in agroforestry is plantation crop combinations and trees (Young 1986). based on the division of vertical plant diversity (Arifin *et al.* 1998). The diversity of plant species is also grouped based on the function of the plants in *pekarangan* (Arifin *et al.* 1998). The presence of livestock and fish in *pekarangan* was also identified. The differences in local customs and knowledge of each transmigrant ethnicity in the use of *pekarangan* will give the characteristics of *pekarangan* model of each ethnicity. The average number of species and the number of individuals is calculated by the formula.

$$x = \frac{1}{n}\sum_{i=1}^{n} Xi$$

x : the average number of species and individuals
X : total of the number of species and individuals per *pekarangan*
Xi : area of the *pekarangan*-i
n : total of *pekarangan* sample

Identification of multistorey of plants in *pekarangan* is made by grouping *pekarangan* plants based on their height. However, before that, knowing the dominant types of plants in *pekarangan* was very important. This is done to facilitate the depiction of multistorey plants. Analysis of the SDR value of plants was carried out to describe the composition of garden plants (Kehlenbeck *et al.* 2007). Species Relative Density (RDi) and Species Relative Frequency (RFi) values must be known in advance with the following formula:

$$\text{RDi (\%)} = \frac{The\ number\ of\ individual\ of\ species\ i}{Total\ number\ of\ individual} \times 100$$

$$\text{RFi (\%)} = \frac{The\ number\ of\ pekarangan\ with\ spesies{-}i}{Total\ of\ the\ number\ of\ pekarangan} \times 100$$

$$\text{SDRi (\%)} = \frac{RDi+RFi}{2}$$

Grouping of plants based on vertical diversity by Arifin *et al.* (1998) in Table 2. Agroforestry systems related to plant diversity, especially food crops. The functions of *pekarangan* plants are grouped into 8 types of plant functions based on Arifin *et al.* (1998) in Table 3. In addition, there are also functions of livestock and fish (Arifin *et al.* 1998).

Table 2 criteria for plant height in *pekarangan*

Vertical diversity	Types of Plant	Plant Height (meter)
5	Height tree	Height > 10
4	Small tree	5 < height ≤ 10
3	Height shrub	2 < height ≤ 5
2	Herbacious, medium shrub	1 < height ≤ 2
1	Ground cover plant, grass	height ≤ 1

Source: Arifin *et al.* (1998)

Table 3 criteria for the function of plants in *pekarangan*

Horizontal diversity	Plant function
1	Ornamental
2	Fruit
3	Vegetable
4	Spice
5	Medicine
6	Starch
7	Industrial raw material
8	Others (fodder, cordwood, shelter, etc.)

Source: Arifin *et al.*, (1998)

Table 4 types of complex agroforestry represented by *pekarangans*

Types of Agroforestry	Description	Reference
Agroforest	Combination of tree crops with agricultural crops	Foresta *et al.* (2000)
Agrosilvopastoral	Combination of agricultural crops with trees and livestock	Russo (1996)
Agrosilvofishery	Combination of agricultural crops with trees and fish	Harun *et al.* (2022)
Agrosilvofisherypastoral	Combination of agricultural crops with trees, livestock, and fish	Kusmana (2018)

The model *pekarangans* were grouped by type of complex agroforestry (Table 4). Complex agroforestry is characterized by its complex vegetation structure (multistorey and multi-functional) such as forest and consists of various plant components (trees, shrubs, herbs, lianas, epiphytes, hemiepiphytes) (Foresta *et al.* 2000). Several types of complex agroforestry can be represented by *pekarangan*.

RESULTS AND DISCUSSION

Diversities of Spesies and Individual Plant in Transmigration *Pekarangans*

The diversity of species and individuals per *pekarangan* showed the diversity of *pekarangan* plants. The average number of species and the highest individual plants were found in the Javanese *pekarangan* (27 species and 474 individual plants), and the smallest was found in the Madurese *pekarangan* (11 species and 45 individual plants) (Table 5). In general, the greater number of species, the greater average number of individuals. Is the diversity of this plant influenced by the size of *pekarangan* owned by the owner? This is evidenced by the linear correlation analysis between *pekarangan* area (independent variable) on the number of species and the number of individual plants (dependent variable) (Figure 1).

Table 5 average number of species and individual plants per transmigrant *pekarangan*

Ethnics	The average area of *pekarangan*[a]	The average of					
		number of plant species[a]	number of plant individuals[a]	number of livestock species	number of livestock individual	number of fish species	number of fish individual
Balinese	1.616,2	18	142	3	9	0	0
Javanese	1.037,0	27	474	2	7	0	0
Lampungnese	455,2	12	55	1	4	0	0
Maduranese	286,7	11	45	0	0	0	0
Sundanese	697,4	24	273	3	12	1	50

[a]The mean value is significant on α (0,000 < 0,05)

The results of the linear correlation analysis showed that the coefficient of determination was small, namely 0,2356 for the average number of species and 0,1364 for the average number of individuals. This indicated that plant diversity is only determined by 13,64% and 23,56% of *pekarangan* area (Figure 1). The correlation shown is very weak, so the area of *pekarangan* does not significantly affect the diversity of *pekarangan* plants. This can be seen in the Balinese *pekarangan* which has the largest average area (1.616,2 m^2), the average number of plant species under the Javanese and Sundanese *pekarangans*, which have a smaller *pekarangan* area.

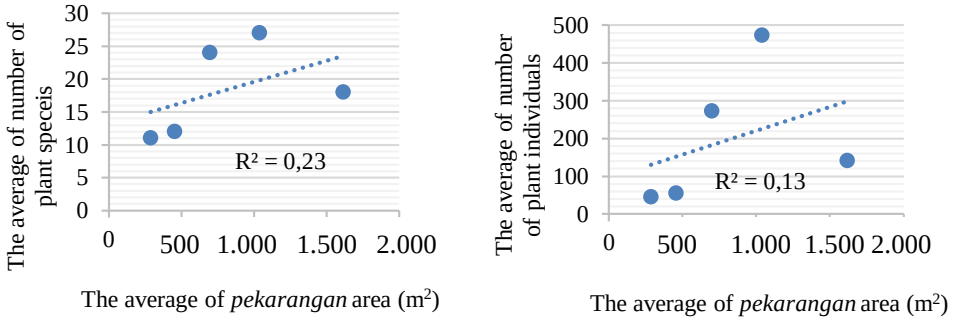

Figure 1 correlations of *pekarangan* area to the number of species and individual plants

Multistorey of Plant in Transmigration *Pekarangans*

The results of SDR analysis value of plants showed the composition of plants in *pekarangan* of each ethnicity (Table 6). The SDR value of plants can be used as a reference in describing multistorey of plants. The SDR value provided a reference for what species was dominant and what percentage of the dominance value was. Therefore, it will be easier to describe multistorey based on the list of dominant species.

Table 6 plants, livestock, and fish with high SDR values based on the average number of species/*pekarangan*

No.	Plant	SDR value (%)					VD	Types	Main function	Zone found
		B	J	L	M	S				
1.	Coconut	45	36	14	20	21	5	Tree	Fruit	Back yard
2.	Mango	27	38	27	28	38	4	Tree	Fruit	Front yard
3.	Banana	42	41	17	34	39	3	Tree	Ftruit	Back yard
4.	Cassava	27	36	12	31	39	2	Shurb	Starch	Side yard
5.	Water apple	16	22	-	24	20	4	Tree	Fruit	Front yard
6.	*Sansevieria*	-	21	18	16	17	1	Herb	Ornamenal	Front yard
7.	*Ixora*	32	19	14	18	-	1	Shurb	Ornamenal	Front yard
8.	*Aglaonema*	-	23	19	21	25	1	Herb	Ornamenal	Front yard
9.	Dragon fruit	25	20	-	-	22	2	Herb	Fruit	Side yard
10.	Cayenne pepper	15	33	-	-	29	1	Shurb	Spice	Side yard
11.	Guava	-	16	-	16	17	4	Shurb	Fruit	Side yard
12.	Cacao	24	28	-	-	27	3	Tree	Industrial	Side yard
13.	Papaya	15	37	-	-	25	3	Tree	Fruit	Back yard
14.	Lemon grass	16	28	-	-	26	1	Shurb	Spice	Back yard
15.	Onion leaf	-	19	-	-	17	1	Herba	Spice	Front yard
16.	*Cordyline*	24	-	-	16	-	2	Shurb	Ornamenal	Front yard
17.	Ginger	-	28	-	-	26	1	Herb	Spice	Side yard
18.	Spur flower	-	17	13	-	-	1	Shurb	Ornamenal	Front yard
19.	*Jengkol*	-	16	-	-	16	5	Tree	Vegetable	Back yard
20.	Japanese frangipani	21	17	-	-	-	1	Shurb	Ornamental	Front yard
21.	Turmuric	-	21	-	-	29	1	Herb	Spice	Side yard
22.	Crystal anthurium	-	18	17	-	-	1	Herb	Ornamenal	Front yard
23.	Galangal	-	33	-	-	31	2	Herb	Spice	Side yard
24.	Jackfruit	-	36	-	-	34	4	Tree	Fruit	Back yard
25.	Croton	24	-	-	16	-	2	Shurb	Ornamenal	Front yard
26.	Rambutan	-	17	-	-	18	4	Tree	Fruit	Side yard
27.	Acacia	-	18	18	-	-	5	Tree	Industrial	Back yard
28.	Avocado	-	-	19	-	-	4	Tree	Fruit	Back yard
29.	Bougainville	45	-	-	-	-	2	Shurb	Ornamenal	Front yard
30.	Plumeria	23	-	-	-	-	3	Tree	Ornamenal	Front yard
31.	Sweet leaf	-	-	-	-	15	2	Shurb	Vegetable	Side yard
32.	Longan	-	-	-	-	22	3	Tree	Fruit	Front yard
33.	Cananga	18	-	-	-	-	3	Shrub	Ornamenal	Front yard
34.	Coffee	-	17	-	-	-	3	Tree	Industrial	Back yard
35.	Lantana	16	-	-	-	-	1	Shurb	Ornamenal	Front yard
36.	Euphorbia	-	-	13	-	-	1	Herb	Ornamenal	Front yard
37.	Tree spinach	-	-	-	-	23	2	Shurb	Vegetable	Side yard
38.	Pulai tree	-	17	-	-	-	5	Tree	Industrial	Back yard
39.	Soursop	-	-	-	-	16	3	Tree	Fruit	Side yard
40.	Chicken	5	5	4	-	5	-	Poultry	Meat	Back yard
41.	Muscovy duck	-	-	-	-	5	-	Poultry	Meat	Back yard
42.	Goat	-	-	-	-	2	-	Mamal	Meat	Back yard
43.	Pork	2	-	-	-	-	-	Mamal	Meat	Back yard
44.	Cettle	2	2	-	-	-	-	Mamal	Meat	Back yard
45.	Tilapia fish	-	-	-	-	500	-	Fish	Meat	Side yard

Notes: VD: vertical diversity, 5: hight > 10 m, 4: 5 m< height ≤ 10 m, 3: 2 m < height ≤ 5 m, 2: 1 m <height ≤ 2 m, 1: height ≤ 1 m

Pekarangan Agroforestry Models

The variety of species of plants, livestock, and fish described an agroforestry system which also means describing the model of *pekarangan*. Based on Table 7, there are 3 complex agroforestry systems found, i.e., agroforest model in the Maduranese *pekarangan*, agrosilvopastoral model in the Balinese, Javanese, and Lampungnese *pekarangans*, and agrosilvopastoralfishery model in Sundanese *pekarangan*. This analysis is based on an understanding of complex agroforestry systems as well as multistorey crops.

Tabel 7 complex agroforestry systems as *pekarangan* models

Pekarangan	Trees	Crops	Livestocks	Fishies	Agroforestry systems	Contribution to food sources (%)
Balinese	1	1	1	0	*Agrosilvopastoral*	52,38
Javanese	1	1	1	0	*Agrosilvopastoral*	65,51
Lampungbese	1	1	1	0	*Agrosilvopastoral*	46,15
Maduranese	1	1	0	0	*Agroforest*	54,54
Sundanese	1	1	1	1	*Agrosilvopastoralfishery*	89,28

1: exist, 0: n/a

Agroforestry systems are related to land efficiency (Nair 2005). Comparison of the diversity conditions of *pekarangan* will not be appropriate if directly compared the diversity of species per *pekarangan*. Therefore, the comparison of diversity is carried out on the basis of the unit area of *pekarangan*. In this study, a minimum ecological *pekarangan* size was used where vertical and horizontal diversity was found, which was 100 m^2 (Arifin *et al.* 1998). The comparison is presented in Table 8.

Table 8 the average number of species and individuals of plants, livestock, and fish per 100 m^2 of *pekarangan* area

Ethnics	Agroforestry systems	Plants		Livestock		Fish	
		Spe	Ind	Spe	Ind	Spe	Ind
Balinese	*Agrosilvopastoral*	*2	9	1	1	0	0
Javanese		3	46	1	1	0	0
Lampungnese		2	12	1	1	0	0
Average		*3	**22	1	1	0	0
Maduranese	*Agroforest*	4	16	0	0	0	0
Sundanese	*Agrosilvopastoralfishery*	3	39	1	2	1	72

Notes: *Values are rounded up; **Values are rounded down

Pekarangan as Agroforestry System for Supporting Food Resiliency on Household Scale

Pekarangan is one of Indonesia's local agroforestry systems (Soemarwoto 1987). In its development, *pekarangan* is referred to as traditional agroforestry because it is developed by the farmers/*pekarangan* owners themselves. Along with the development of science and technology, the current agroforestry system has developed into modern agroforestry. Modern agroforestry has the understanding that agroforestry systems came from the findings and developments by experts (Foresta *et al.* 2000). Since the establishment of ICRAF as an institution that specifically paid attention to agroforestry, they are now much more developed.

In general, *pekarangan* of transmigrant ethnics in East Lampung is a traditional agroforestry system whose development is influenced by the customs and culture of each ethnic. The mention of agroforest, agrosilvopastoral, or agrosilvopastoralfishery systems is only for ease of identification. The agroforest system can support the contribution of food sources as much as 54,54%, while the agrosilvopastoral system can

support the contribution of food sources between 46,15% to 65,51% (Table 7). In the agrosilvopastoralfishery system, the food sources that can be supported by this system are up to 89,28% (Table 7). This showed that the more complex the combination of agroforestry systems, the greater the available food sources.

In the agroforest system exemplified by the Maduranese *Pekarangan*, there are three dominant functions of plants, namely ornamental plants, fruit trees, and starch-producing plants. Details of the plants can be seen in Table 6. The existing plant components consist of tree, shrub, and herbaceous species. Plants consist of trees with a height of > 10 meters to shrubs or herbs with a height of < 1 meter. Its multisotrey condition is shown in Figure 2.

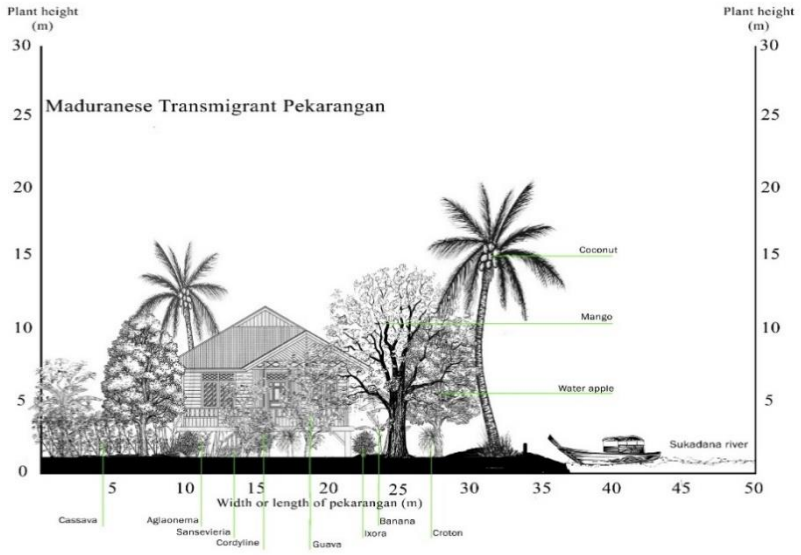

Figure 2 the multistorey condition of Maduranese *Pekarangan* with an agroforest system

In the agrosilvopastoral system exemplified by the Balinese, Javanese, and Lampungnese *Pekarangans*. In the Balinese *Pekarangan*, there are 5 dominant plant functions, i.e., ornamental plants, fruit plants, starch-producing plants, spice plants, and industrial raw material plants. In the Javanese *Pekarangan*, there are 6 dominant plant functions, namely ornamental plants, fruit plants, starch-producing plants, spice plants, vegetable plants, and industrial raw material plants. In the Lampungnese *Pekarangan*, there are 4 dominant plant functions, namely ornamental plants, fruit plants, starch-producing plants, and industrial raw material plants.

In addition, there are also three types of livestock in the Balinese *Pekarangan*, 2 types of livestock in the Javanese *Pekarangan*, and 1 type of livestock in Lampungnese *Pekarangan*. The list of plants and livestock can be seen in Table 6. The plant components in the three *Pekarangans* consist of tree, shrub and herbaceous species. Plant height varies from less than 1 meter to more than 10 meters. The multistorey condition of the Balinese *Pekarangan* is shown in Figure 3, the Javanese *Pekarangan* by Figure 4, and Lampungnese *Pekarangan* by Figure 5.

In the agrosilvopasturalfishery system exemplified by the Sundanese *Pekarangan*, there are 6 dominant functions of plants, namely ornamental plants, fruit trees, starch-producing plants, spice plants, vegetable crops, and industrial raw material plants. There are three types of livestock and 1 type of fish. Details of the plants can be seen in Table 6. The existing plant components consisted of tree, shrub, and herbaceous species. Plants consist of trees with a height of > 10 m to shrubs or herbs with a height of < 1 m. Livestock and fish that are kept consist of 3 species of livestock and 1 species of fish. Its multisotrey condition is shown in Figure 6.

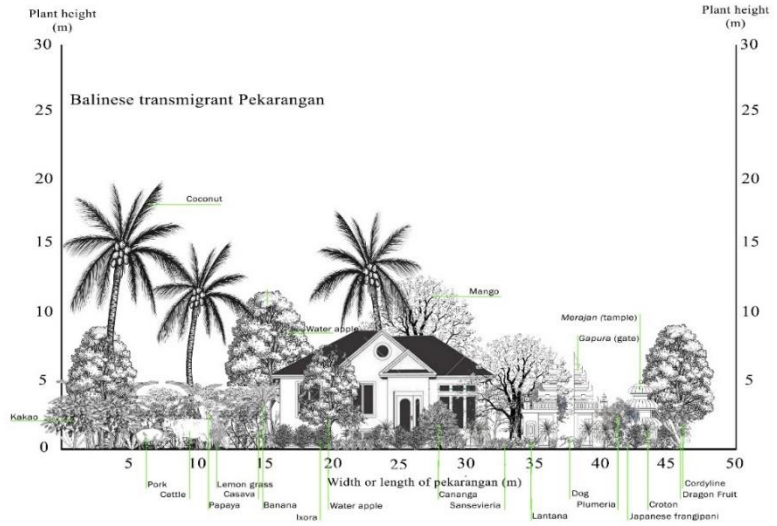

Figure 3 the multistorey condition of Balinese *Pekarangan* with an agrosilvopastoral system

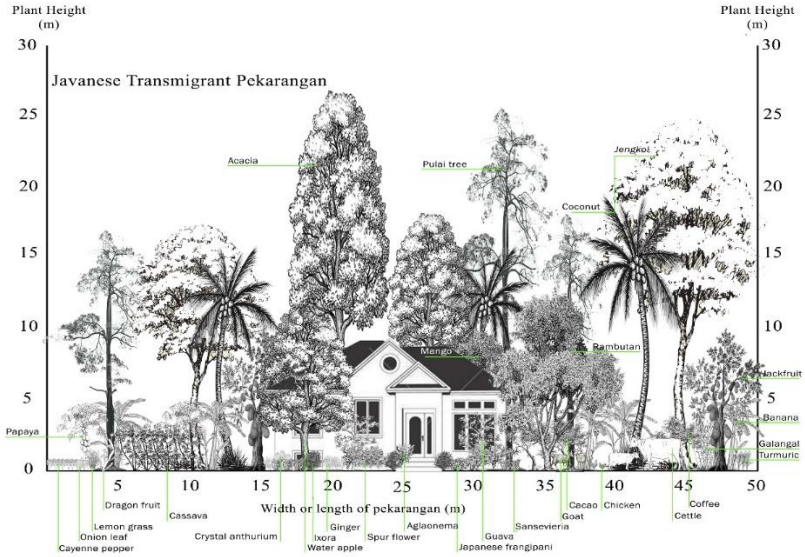

Figure 4 the multistorey condition of Javanese *Pekarangan* with an agrosilvopastoral system

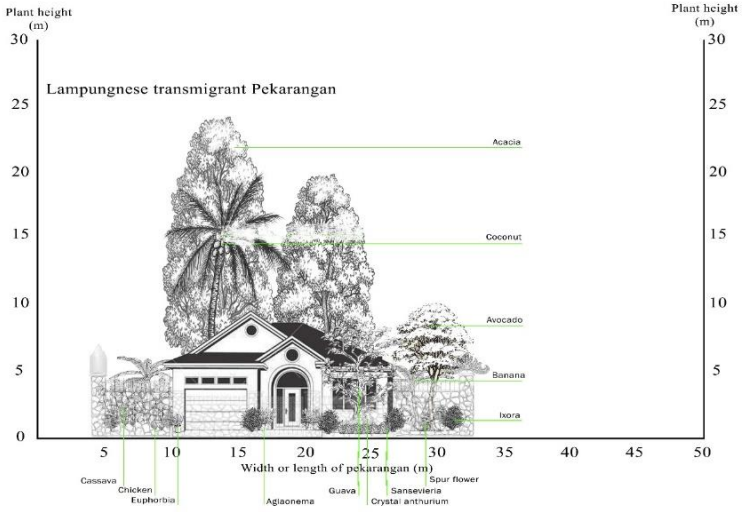

Figure 5 the multistorey condition of Lampungnese *Pekarangan* with an agrosilvopastoral system

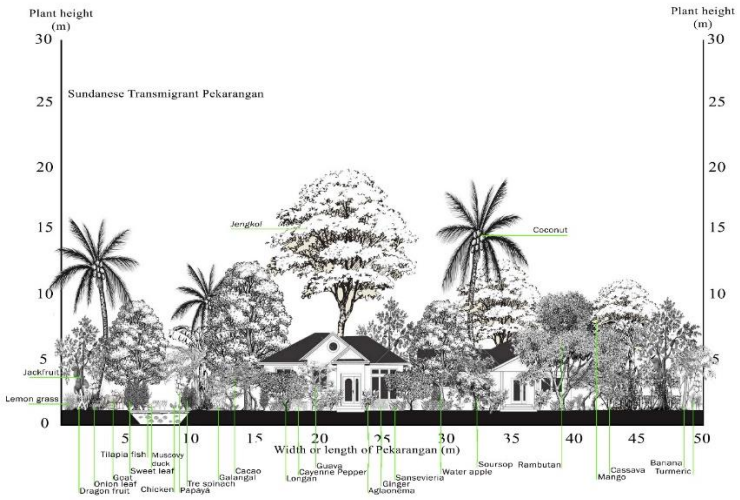

Figure 6 the multistorey condition of Sundanese *Pekarangan* with an agrosilvopastoralfishery system

The discovery of three agroforestry systems in *pekarangan* provided illustrations that not all applications of government programs related to the utilization of *pekarangan* can be generalized in every location. This is related to the locality and culture that they practiced from generation to generation. Adjustment of the program to community practice in managing their *pekarangans* can provide the potential for better program sustainability, in addition to a mentoring and evaluation process. The evidence obtained from this transmigration *pekarangan* can be an example of the use of *pekarangans* based on local wisdom.

Challenges of Pekarangan Agroforestry Systems

Agroforestry aims to increase productivity and efficiency in the use of land and plant resources, improve the quality of soil and water resources, and improve community welfare (Rauf 2004). The main products of *pekarangan* agroforestry can be divided into 2 forms, i.e., direct and indirect products. Products are directly related to the benefits received directly by the owner, such as food, fodder, and industrial raw materials (seeds, wood, fiber, etc.) (Widianto *et al.* 2003; Ali *et al.* 2020). Moreover, it can be sold as economical addition to householder. Undirect product is related to the benefits of environmental services for the owner and the surrounding community, such as climate amelioration, reducing run-off flow, water conservation, prevention nutrient leaching and soil erosion (Sabarnudin 2004; Murtilaksono *et al.* 2020). Apart from providing positive benefits, home garden agroforestry also faced challenges. Several things that must be considered are related to increasing productivity and sustainability of the agroforestry system (Widianto *et al.* 2003), especially in supporting food resiliency at the household level.

Increasing productivity is related to improving management methods, while the sustainability of *pekarangan* agroforestry system is related to productivity considerations. The sustainability of the agroforestry system to support food resiliency at the household level through the pekarangan needs to be well planned. How the system can survive and provide continuous benefits, especially in the provision of food. Food sources from *pekarangan* must be maintained and improved with better management.

CONCLUSION

Pekarangan, as an agroforestry system can provide a food source that contributes to supporting household-scale food resiliency. Three agroforestry systems were found as *pekarangan* models, i.e., the agroforest system (Maduranese *Pekarangan*), agrosilvopastoral (Balinese, Javanese, and Lampungnese *Pekarangans*), and agrosilvopastoralfishery (Sundanese *Pekarangan*). These are in accordance with the conditions of *pekarangan* and the local wisdom of each ethnicity. Apart from having a positive impact,

pekarangan agroforestry also faced challenges. The challenges faced are related to the productivity and sustainability of *pekarangan* agroforestry system. It is necessary to implement a *pekarangan* management strategy to overcome this problem so as *pekarangan* continues to provide a source of food and nutrients for the householders.

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