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 (Maduranean 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).

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 (Sabarmudin 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 ethnics 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>
<thead>
<tr>
<th>No.</th>
<th>Ethnic</th>
<th>Distric</th>
<th>The Number of pekarangan Sample/ethnic</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Sundanese</td>
<td>Pubolinggo</td>
<td>100</td>
</tr>
<tr>
<td>2.</td>
<td>Javanese</td>
<td>Purbolinggo, Way Bungur, and Pekalongan</td>
<td>100</td>
</tr>
<tr>
<td>3.</td>
<td>Balinese</td>
<td>Raman Utara and Sukadana</td>
<td>100</td>
</tr>
<tr>
<td>4.</td>
<td>Maduranese</td>
<td>Way Bungur</td>
<td>13</td>
</tr>
<tr>
<td>5.</td>
<td>Lampungnese</td>
<td>Sukadana</td>
<td>100</td>
</tr>
</tbody>
</table>

**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).

Pekaranans 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.

\[ x = \frac{1}{n} \sum_{i=1}^{n} X_i \]

\[ \bar{x} : \text{the average number of species and individuals} \]
\[ X : \text{total of the number of species and individuals per pekarangan} \]
\[ n : \text{total of pekarangan sample} \]

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:

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

\[ \text{RFi} (%) = \frac{\text{The number of pekarangan with species} \cdot i}{\text{Total of the number of pekarangan}} \times 100 \]
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

<table>
<thead>
<tr>
<th>Vertical diversity</th>
<th>Types of Plant</th>
<th>Plant Height (meter)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Height tree</td>
<td>Height &gt; 10</td>
</tr>
<tr>
<td>4</td>
<td>Small tree</td>
<td>5 &lt; height ≤ 10</td>
</tr>
<tr>
<td>3</td>
<td>Height shrub</td>
<td>2 &lt; height ≤ 5</td>
</tr>
<tr>
<td>2</td>
<td>Herbacious, medium shrub</td>
<td>1 &lt; height ≤ 2</td>
</tr>
<tr>
<td>1</td>
<td>Ground cover plant, grass</td>
<td>height ≤ 1</td>
</tr>
</tbody>
</table>

Source: Arifin et al. (1998)

Table 3 criteria for the function of plants in pekarangan

<table>
<thead>
<tr>
<th>Horizontal diversity</th>
<th>Plant function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ornamental</td>
</tr>
<tr>
<td>2</td>
<td>Fruit</td>
</tr>
<tr>
<td>3</td>
<td>Vegetable</td>
</tr>
<tr>
<td>4</td>
<td>Spice</td>
</tr>
<tr>
<td>5</td>
<td>Medicine</td>
</tr>
<tr>
<td>6</td>
<td>Starch</td>
</tr>
<tr>
<td>7</td>
<td>Industrial raw material</td>
</tr>
<tr>
<td>8</td>
<td>Others (fodder, cordwood, shelter, etc.)</td>
</tr>
</tbody>
</table>

Source: Arifin et al., (1998)

Table 4 types of complex agroforestry represented by pekarangans

<table>
<thead>
<tr>
<th>Types of Agroforestry</th>
<th>Description</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agroforest</td>
<td>Combination of tree crops with agricultural crops</td>
<td>Foresta et al. (2000)</td>
</tr>
<tr>
<td>Agrosilvopastoral</td>
<td>Combination of agricultural crops with trees and livestock</td>
<td>Russo (1996)</td>
</tr>
<tr>
<td>Agrosilvofishery</td>
<td>Combination of agricultural crops with trees and fish</td>
<td>Harun et al. (2022)</td>
</tr>
<tr>
<td>Agrosilvofisherypastoral</td>
<td>Combination of agricultural crops with trees, livestock, and fish</td>
<td>Kusmana (2018)</td>
</tr>
</tbody>
</table>

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 Species 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

<table>
<thead>
<tr>
<th>Ethnics</th>
<th>The average area of pekarangan²</th>
<th>The average number of plant species³</th>
<th>The average number of plant individuals³</th>
<th>The average number of livestock species</th>
<th>The average number of livestock individual</th>
<th>The average number of fish species</th>
<th>The average number of fish individual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Balinese</td>
<td>1.616,2</td>
<td>18</td>
<td>142</td>
<td>3</td>
<td>9</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Javanese</td>
<td>1.037,0</td>
<td>27</td>
<td>474</td>
<td>2</td>
<td>7</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Lampungnese</td>
<td>455,2</td>
<td>12</td>
<td>55</td>
<td>1</td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Maduranese</td>
<td>286,7</td>
<td>11</td>
<td>45</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Sundanese</td>
<td>697,4</td>
<td>24</td>
<td>273</td>
<td>3</td>
<td>12</td>
<td>1</td>
<td>50</td>
</tr>
</tbody>
</table>

²The 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 m²), 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

<table>
<thead>
<tr>
<th>No.</th>
<th>Plant</th>
<th>SDR value (%)</th>
<th>VD</th>
<th>Types</th>
<th>Main function</th>
<th>Zone found</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>B</td>
<td>J</td>
<td>L</td>
<td>M</td>
<td>S</td>
</tr>
<tr>
<td>1.</td>
<td>Coconut</td>
<td>45</td>
<td>36</td>
<td>14</td>
<td>20</td>
<td>21</td>
</tr>
<tr>
<td>2.</td>
<td>Mango</td>
<td>27</td>
<td>38</td>
<td>27</td>
<td>28</td>
<td>38</td>
</tr>
<tr>
<td>3.</td>
<td>Banana</td>
<td>42</td>
<td>41</td>
<td>17</td>
<td>34</td>
<td>39</td>
</tr>
<tr>
<td>4.</td>
<td>Cassava</td>
<td>27</td>
<td>36</td>
<td>12</td>
<td>31</td>
<td>39</td>
</tr>
<tr>
<td>5.</td>
<td>Water apple</td>
<td>16</td>
<td>22</td>
<td>-</td>
<td>24</td>
<td>20</td>
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<tr>
<td>6.</td>
<td>Sansevieria</td>
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<td>18</td>
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<td>7.</td>
<td>Ixora</td>
<td>32</td>
<td>19</td>
<td>14</td>
<td>18</td>
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<tr>
<td>8.</td>
<td>Aglaonema</td>
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<td>9.</td>
<td>Dragon fruit</td>
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<td>10.</td>
<td>Cayenne pepper</td>
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<td>11.</td>
<td>Guava</td>
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<td>-</td>
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<td>17</td>
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<td>12.</td>
<td>Cacao</td>
<td>24</td>
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<td>Papaya</td>
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<td>14.</td>
<td>Lemon grass</td>
<td>16</td>
<td>28</td>
<td>-</td>
<td>-</td>
<td>26</td>
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<tr>
<td>15.</td>
<td>Onion leaf</td>
<td>-</td>
<td>19</td>
<td>-</td>
<td>-</td>
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<td>16.</td>
<td>Cordyline</td>
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<td>Ginger</td>
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<td>Spur flower</td>
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<td>Jengkol</td>
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<td>Pulai tree</td>
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<tr>
<td>40.</td>
<td>Chicken</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>-</td>
<td>5</td>
</tr>
<tr>
<td>41.</td>
<td>Muscovy duck</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>5</td>
</tr>
<tr>
<td>42.</td>
<td>Goat</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>43.</td>
<td>Pork</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>44.</td>
<td>Cattle</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>45.</td>
<td>Tilapia fish</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>500</td>
<td>-</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Pekarangan</th>
<th>Trees</th>
<th>Crops</th>
<th>Livestocks</th>
<th>Fishies</th>
<th>Agroforestry systems</th>
<th>Contribution to food sources (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Balinese</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>Agrosilvopastoral</td>
<td>52,38</td>
</tr>
<tr>
<td>Javanese</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>Agrosilvopastoral</td>
<td>65,51</td>
</tr>
<tr>
<td>Lampungbese</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>Agrosilvopastoral</td>
<td>46,15</td>
</tr>
<tr>
<td>Maduranese</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>Agroforest</td>
<td>54,54</td>
</tr>
<tr>
<td>Sundanese</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>Agrosilvopastoralfishery</td>
<td>89,28</td>
</tr>
</tbody>
</table>

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 m² (Arifin et al. 1998). The comparison is presented in Table 8.

<table>
<thead>
<tr>
<th>Ethnic</th>
<th>Agroforestry systems</th>
<th>Plants</th>
<th>Livestock</th>
<th>Fish</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Spe</td>
<td>Ind</td>
<td>Spe</td>
</tr>
<tr>
<td>Balinese</td>
<td>Agrosilvopastoral</td>
<td>2</td>
<td>9</td>
<td>1</td>
</tr>
<tr>
<td>Javanese</td>
<td></td>
<td>3</td>
<td>46</td>
<td>1</td>
</tr>
<tr>
<td>Lampungnese</td>
<td></td>
<td>2</td>
<td>12</td>
<td>1</td>
</tr>
<tr>
<td>Average</td>
<td></td>
<td>*3</td>
<td>**22</td>
<td>1</td>
</tr>
<tr>
<td>Maduranese</td>
<td>Agroforest</td>
<td>4</td>
<td>16</td>
<td>0</td>
</tr>
<tr>
<td>Sundanese</td>
<td>Agrosilvopastoralfishery</td>
<td>3</td>
<td>39</td>
<td>1</td>
</tr>
</tbody>
</table>

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.

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 multisotrey 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
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 household. 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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