Permaculture gardening, the first step of food sustainability in the tropical freshwater wetland

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Abstract. Climate change has been causing severe damage in Kalimantan, such as forest fires in the dry season and flooding in the monsoon rain has been understood. Both of these results in loss of social-economic properties and environmental assets, and possible to create a climate emergence, especially in wetlands. The research about how the local people use traditional ways to revive their food and income through Permaculture garden in wetland has been conducted from 2018 – 2020. This research aims to elucidate the local people capability in use their local wisdom, traditional knowledge and ecological attitude on providing food in the transition of the wetland environment, through implementation of Permaculture concepts, learning and interaction. About sixty voluntary respondents involve in forum group discussion, deep interview, and Permaculture gardening. The result shows that informal and local unique interaction among the local in implementing traditional, ecological knowledge and attitude in Permaculture gardening able to produce vegetables and fruits for daily, monthly and annual income. Thus, the observation of the implementation and the interaction on the concept of Permacultures may be possible to ensure us about the local sustainable food provision.

1. Introduction
Siluet of the morning sunset spotted to the carpet grass. Sometimes, fresh wind flows touch the skin, and he faces straight forward, enjoying a cup of coffee and cigarette. Smoke bubbles flow out from the mouth and nose. That is perhaps the imagination about the paradise of a hundred of the third generation of inhabitants who live in a natural freshwater swamp little village, Jajangkit. There was no access and communication facilities connected to this is a huge riparian forest in the swamp area since 1967. This village suddenly famous after at least a hundred of years isolated in the middle of wetland, where surrounded by Kangaroo giant grass, because of it is appointed to be a huge of 750 hectares agricultural area.

By observing daily local agricultural activities, this research will examine whether the locals can express their willingness to stand against pressures of changes by clarifying their efforts in interaction on planning, planting, harvesting, using environmental ethics, implementing their ancient knowledge and tradition in the concept with the Permaculture model for providing a sustainable food supply and creating income with their local wisdom.

2. Methods
Three years ago, the observation was done when Jajangkit, the wetland ecosystem was set up as an agricultural area for support food security. Information about the reasons for government policy, local opinions, and hopes were collected from gray literature and in-depth direct interviews with thirty key
persons. These chosen people have grown and lived in villages. To develop a discussion, these ten people choose and appoint other people who are willing to manage their environment for better income and life, using a snowball method. Information was gathered from a direct discussion in a small group with previous appointments and by phone. Problems and solutions can be directly collected and recorded, but several times need advice for coordinating with other stakeholders. Their skill and work attitudes were recorded from their participation and involvement in daily work in gardening at the field, like preparing and fertilizing gardens, planting plants, harvesting, and also their work results, as adapted from [1], [2], [3].

3. Result and Discussion
Jejangkit is a village originally set up by fishermen, the locals are actually a local migrants who came about 70 years ago, follow the tide fluctuation of water for catching fish, and now turn into the third generation. The village is situated in another corner of Barito river swamp, this area such as a watershed, which is retaining water from down north-eastern and middle-eastern parts of South Kalimantan, Indonesia Borneo. Jajangkit becomes flooded on several weeks or months depends on the monsoon period.

Three years ago provincial and central government decided to create a vast agricultural area, where Jaanggan was set up inside. Within a short time, those built the road, slash a vast swamp and plan to be a rice field area, about 750 ha, and create irrigation by flowing water from the Riam Kiwa and Martapura River. They also divide the landscape into small plots, with 2 – 5 hectares, and lets the institutional task force for manage the lands and growing rice for implementing food security programs. Unfortunately, without clear reasons, the central government suddenly discontinues its support, and the local government officially rises a program for an eco-park for education, tourism and open spaces.

In uncertain policy and situations create confusion for the locals to participate in government programs. Shortly, locals need food and economic supports. Otherwise, the locals will be interested in selling all their properties to the developers who will change the landscape for building and housing. Then, the locals will move due to loss in the economic competition, and the wetland environment may be completely altered.

First, we personally inform about 30 people for a meeting and discuss the possibility of collectively planting food plants. Our first meeting seems welcome by the and many of them are likely interested in the topic of our meeting. A week after the first meeting, we had a second meeting that only was attended by 13 people. The result of that meeting only 6 people express clearly interested to collectively creating a permaculture. Others explain that they will be better to wait for the result from the first group, rather than fail. They promise will joint anytime if they think the method made them happy.

The locals have arranged their garden space based on their experience, it is no messy even though it has no specific pattern, but the composition has already been completed. They plant flowers and medicinal plants, such as citrus, ginger, and lemongrass, with a distance of approximately five oten m from the front of the house. Fish pond approximately 10 to 50 m on the right side and swollen grass on the left side. On the backside, they built a toilet, a kitchen, and a water tank. They got water from the ground using a water pump and flowed into the tank. About 50 m to 200 m away from the house, they plant fruits, such as Coconut, Cassava, Chilly, Bitter beans, Citrus, Mango, Banana, and Paddy. It is comparable to that in Bangladesh [4]. See Figure 1.

They create about four meters wide, and about two hundred meters long, with eight to ten parallel dikes and plant a variety of vegetables on top of it. Therefore, they have different harvesting times, respectively. The famous harvesting is Chili; this commodity influences local economic inflation, due to almost all of the people keen on this fruit for "sambal" an Indonesian appetizer. Sambal always presents in low-economic-level food stalls to high-class restaurants. The market price much fluctuation, in the harvesting season, drops to approximately USD 2 and, in the rare situation, increases to USD 15 per kilogram. This condition is a challenge for them to find a solution. See Figure 2 and Table 1.
Figure 1. Garden around the yard

Figure 2. Snake bean was planted side by side along irrigation canal, while water chestnut grow well in the shallow-dry canal.

Table 1. Average of yield, income and saving from about 1 hectare vegetables garden

| No | Plants     | Yield | Unit | Months | Income (US$) | Saving (US $) |
|----|------------|-------|------|--------|--------------|---------------|
| 1  | Snake bean | 4     | tonnes | 3     | 1600        | 465           |
| 2  | Cucumber   | 5     | tonnes | 3     | 1200        | 600           |
| 3  | Water Melon| 2     | tonnes | 4     | 900         | 380           |
| 4  | Chili      | 2     | tonnes | 4     | 2000        | 800           |

The locals spend their daily expenses on food, their monthly and yearly expenditure for maintaining work equipment, such as wooden canoes, chain saw, water pump, hand tractor, and even motorcycle. They also must have savings for individual costs, such as a holy traveling pilgrim to Mecca, health covered for hospital payment, or house renovation costs, and payment for the wedding ceremony for their children. They never save in or borrow some money in the banks, but they invest in land assets or planting slow-growing plants and plantations. Therefore, they will sell the assets in certain conditions and use it for huge payments or heritage property to their families, as similar to the grassroot community in India [5].

If the monsoon alters the normal water level fluctuation, paddy harvesting may be a failure. The locals must have options to get carbohydrate sources. In this case, they choose to plant beans because they have markets to receive fresh ones and may dryer grain too. Cassava has more retention to seasonal disturbances, but the failure also possible in the long dry season or in hard monsoons, which soaks the tubers in floodwater. The locals also plant the tubers in the portable waterproof bags, which contain soil compost mixed with fertilizer into a growth medium for planting sweet potatoes. They
plant horticultural crops for provide food, and multicropping system is more benefit yields. See Figure 3.

**Figure 3.** Chili harvest is along the year, but Water Melon is a significant income sources in dry season.

The locals also argue about planting slow-growing trees, as a saving for the future. They mimic their ancestors for grow a wetland mango, Kasturi, which is tolerant to acidic soil, low pH. This plant is well known as an endemic fruit tree living well in shallow wetland areas in Kalimantan. The fruit has black-purple skin color, with an orange color and a sweet-alcoholic fleshy taste inside. However, they try to grow Mahogany for commercial wood, and they will harvest in the next ten or twenty years. This action is different to the farmer in China, where the local Government will decide to support the local industries [6].

The success of permaculture and locals, particularly low-income groups, is dependent on wetland resources to sustain their livelihood relationship undoubtedly provide an opportunity for locals to reconnect with food production, accumulation (new green development), and local economic-growth-led policies (local food as a tool in rural autarky, the possible use of “Dana Desa”). Local rural societies can take over the management of public assets and investments in advantaged neighborhood (increase to health and wellbeing services, public space management, etc.) [7]. The local belief that the permaculture model can benefit them on a personal level; they can feel more empowered, health and safety, grounded and able to make appropriate decisions in managing the garden. On a social level, permaculture connects the locals and enables synergistic and cooperative relationships to each other.

Although, local communities depend heavily on wetland resources, they still do not recognize the full ecosystem services of wetlands. Hopefully, permaculture becomes a direct or indirect, new tool or justification for a new wave of social dan financial capital growth in this village. See Figure 4.

**Figure 4.** Family has better living with family, work and educate children in the garden
4. **Conclusion**

In conclusion, Permaculture gardening can help alleviate poverty and improve quality and access to food, water use and shelter, so the locals hope that they can meet their needs in nonpolluting and non-damaging ways. In the future, they hope that permaculture can restore and protect the environment, increase biodiversity, and preserve and regenerate their fundamental resources of life; soil, water and trees for sustainability.

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