

Local Wisdom of the Wetland Swamps Agricultural System for a Sustainable Environment

by Restu Juniah

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Local Wisdom of the Wetland Swamps Agricultural System for a Sustainable Environment

I M Sakir^{1*}, Sriati², A Saptawan³, R Juniah⁴

¹Student of Doctoral Program of Environmental Science, Graduate School, Universitas Sriwijaya, South Sumatera, Indonesia

²Faculty of Agriculture Science, Universitas Sriwijaya, South Sumatera, Indonesia

³Faculty of Political and Social Science, Universitas Sriwijaya, South Sumatera, Indonesia

⁴Faculty of Mining Science, Universitas Sriwijaya, South Sumatera, Indonesia

*icuksakir@gmail.com

Abstract. This study aims to examine the floating rice nursery techniques as local wisdom of agricultural systems on wetland swamps, and the characteristics of wetland swamps. The research method used is ethnography, which aims to describe in detail the themes or perspectives that originate from the phenomenon and the interaction of individuals or groups in culture. The results showed that the Ogan ethnic in Pemulutan had carried out a wetland swamp farming system for generations. This agricultural technique utilizes wild plants such as swamp grass (*berondong*) and freshwater algae (*reamon*) as a medium for floating rice nurseries. The use of natural resources around agricultural land is a form of local wisdom in preserving the environment. Wetland swamp agro-ecosystem with local wisdom of floating rice nurseries can maintain a sustainable ecosystem and environment. The agricultural land of the Ogan community is dominated by swollen or shallow patches of around 6.289 hectares or 59,1 per cent, middle swamps of 3.309 hectares or 31 per cent, the remaining 9,9 per cent or 1.058 hectares are deep swampland. The potential land for farming which shallow land and middle land.

1. Introduction

Indonesia has swamp areas distributed across the islands of Sumatra, Kalimantan, Sulawesi and Papua. Wetland is a potential land to be developed into agricultural food crops, especially rice. The area of swamps is around 34,12 million hectares, of which 14,18 million hectares or 41% has the potential for agricultural land, but only about 6,77 million hectares have been used for agricultural land, with details of 3,77 million hectares being opened by the government, the remaining 3.0 million hectares are non-governmental organizations [1]. The province of South Sumatra has a distribution of swampy swamps that have been planted with rice once a year. Swampland in this area is divided into two types, namely wetland swamps and tidal swamps [2]. Tidal land in South Sumatra is around 483.000 hectares, while wetland swamps are around 240.000 hectares, and about 772.000 hectares is dry land. Wetland swamps are distributed in several areas in South Sumatra, such as; Banyuasin, Ogan Ilir, Ogan Komering Ilir, Palembang, Musi Rawas, and so on.

Ogan Ilir district has an area of 266.607 hectares, consisting of 16 sub-districts, 14 sub-districts and 227 villages [3]. The districts that have the most swamplands are central Pemulutan and west Pemulutan. Central Pemulutan district has an area of 12.292 hectares, consisting of 10.650 hectares of wetland swamps, and the remaining 1.642 hectares are lowland and river areas [4]. Swamp in Pemulutan are areas of sunken plains and are bounded by one or two river embankments, or between highlands and river embankments. Based on the depth and period of inundation, swamps are grouped



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into four typologies, namely; (1) shallow swamp which is also called bund swamp, has a waterlogging height < 50 cm and a inundation period < 3 months. (2) the middle swamp is a swamp that has a waterlogging height between > 50 to 100 cm and inundation period > 3 to 6 months. (3) deep swamp, namely wetland swamp that has a waterlogging height > 100 cm and inundation period of 6 months. (4) very deep swamp which is also known as *lebung*, is a swampy area that has a pool of water around 200-300 cm and inundation period a length of inundation > 6 months or almost throughout the year [1]. This condition makes it difficult for farmers to determine the right time to carry out agricultural activities. The difficulty of rice cultivation is especially in the nursery phase, while the availability of seeds and the age of the seeds are very important in the process of agricultural cultivation. Maximum production will not be achieved when planting time arrives, but the available seeds are not ready for planting. As a solution, the farmers cultivate earlier using the floating method while the floods or inundation are still deep [4]. The floating rice which the local wisdom of the Ogan ethnic regarding the wetland swamp farming system. Agricultural land management as local wisdom of local communities has been widely applied in several countries. The people of Dusun in the rural area of Sabah, Malaysia believe that local wisdom is local belief and knowledge that is passed down from one generation to another, manifested in agricultural activities for welfare and in a harmonious relationship between humans and their environment [5]. The people of Lugbara, Uganda use local wisdom and life experiences for the management of land, flora, fauna and water to be passed on to their children and grandchildren. Beliefs, culture, values, norms, are passed down orally as resources and local knowledge to manage the environment [6].

Indonesia as an archipelagic country has different customs, cultures and traditions from one region to another. These differences are based on regional characteristics, topography, seasons and the influence of ethnic diversity. Data from the Central Statistics Agency (CSA) and ISEAS (Institute of South Asian Studies), there are around 633 ethnic in Indonesia [7]. From each of these ethnic groups, each of them has a culture, language, traditions and local wisdom to preserve and sustain the environment.

The Muna tribe, Southeast Sulawesi maintains the balance of nature through traditional agricultural land management. Preparation of agricultural land is carried out with a slash and burn system, cultivation with an intercropping system, processing agricultural products into durable and long-lasting [8]. The pattern of the wisdom of *surjan* rice farmers in Kulon Progo, Yogyakarta in conserving agricultural land from generation to generation, is a symbol of the relationship between farmer wisdom patterns and components of agricultural ecosystems that can be conserved, thus helping to create a more stable agricultural ecosystem with the diversity of plants planted, so it is not easy attacked by pests and the diversification of crops that can provide more benefits for farmers [9]. The Balinese people introduced *Subak* as one of the local wisdom of an environmentally-based agricultural system. *Subak* is a traditional water distribution organization in paddy fields. The *subak* organization has four elements, namely, agricultural land, water sources, *subak* members, and *subak* temple [10]. The agricultural community in the ancient Sileng river valley, Borobudur district, introduced the *Oloran Sawah* irrigation model as a form of local wisdom in the use of agricultural land. *Oloran Sawah* is an irrigation system that functions to channel water to agricultural land and reduce the quantity of water when it is excessive reduce so that environmental sustainability and the community's economy are well maintained [11]. Meanwhile, the Ogan ethnic in Pemulutan district, Ogan Ilir regency, South Sumatera province carried out agricultural techniques by applying floating rice nurseries as a form of local wisdom in implementing the wetland swamp farming system. The purpose of this research are to find out about; 1) Floating rice nursery system as local wisdom of wetland swamp management. 2) Characteristics of wetland swamps.

2. Materials and methods

The approach method in this research is ethnography, which describes in detail about the theme or perspective that comes from the phenomenon and the interaction of individuals or groups in their culture [12]. The research was conducted from January to July 2020 in 25 villages of Pemulutan district, Ogan Ilir, South Sumatra, Indonesia. In this study, interpretations were carried out, described

in-depth and detailed in context; 1) Floating rice nursery system as local wisdom of lowland swamp management. 2) Characteristics of wetland swamps.

3. Results and discussions

3.1 The floating rice nursery system

The original inhabitants of the Pemulutan community are the Ogan tribe consisting of 3 sub-tribes, namely; Pegagan Ulu tribe, Penesak tribe, and Pegagan Ilir tribe. The Ogan community, who live in the lowlands and along the riverbanks in Pemulutan, belong to the Pegagan Ilir Tribe group. The Ogan river is one of the water sources used by the local community for their daily needs. The condition of wetlands or low swamps in Pemulutan District strongly supports most of the Ogan ethnic groups to work as swamp farmers. The agricultural system carried out by the community on low swamplands with floating rice nurseries.

The floating nursery technique is carried out on a raft media, made of swamp grass (*brondong*), then combines it with freshwater algae (*reamon*) to make a raft, so that the growing rice seeds will not sink, and will float on the surface of the water which there is no need for watering [13]. Materials and tools for making a raft for a floating rice nursery using popcorn, reamon and rope. The average size of a raft is 1.5x3 m for one stretch. There are 4 stages of the nursery; the first stage, the seeds are soaked to separate superior seeds and pulp; the second stages are seedling immersed in sacks a wet state for two days. The third stage, are seedling removed from a sacked and then spread on a tarp or other material for one day with the aim accelerating the process of sprouting. The fourth stage sprinkles rice seeds on the floating nursery evenly at a rate of 10 kg for one stretch. Before the sprinkling rice seeds on the prepared media, they must first to give a *bangle* mixture to avoid pests and diseases. The floating nursery lasts for about two weeks after the seeds are about 15 days old, they are transferring to a vase for the second nursery.

According to Maisaroh (1956), the making of floating seedlings has done since his ancestors. The local varieties that often used at that time were the handle because they were pest resistant and the seeds could be using continuously. However, now it is rarely used because the planting to harvest period takes about four months. The causes farmers to rarely use these varieties, because the hydrology of water is difficult to predict, while the irrigation system still depends on nature. Sobri (1970), one of the leaders of the farmer group explained, the floating nursery is done on average in April-May under normal conditions, but in 2020 many of the farmers have done two nurseries because the age of the nurseries is around 20-30 days, but the land agriculture has not subsided. Many drowned because there was no land for the second nursery. Furthermore, Sobri explained, local wisdom believed that a still trusted in managing agricultural land to date, namely farmers must refer to the *Hijri* calendar. The calendar calculation is given the meaning of date 1 = root, date 2 = stem, date 3 = leaves, and date 4 = fruit. The people Ogan tribe believe that when planting on that date, the results obtained are by the following with the calendar. Therefore, farmers will plant rice on the 4th, 8th and 16th in the hope that it will have abundant yields which the symbols believed by the local community.

The Ogan tribe maintains nature preservation according to local values, norms, culture and traditions that have passed down from generation to generation. Local wisdom is a cultural wealth that grows and develops in a society that is known, trusted, and recognized as elements capable of strengthening the social order for society [14]. Local wisdom is an implementation of environmental functions, namely; as a provider of Natural Resources, carbon sinks, and aesthetic value [15]. Pemulutan community also used refugia, which place to protect natural enemies such as; sunflower (*Helianthus annuus*), sesame (*Sesamum indicum*), paper flower (*Zinnia sp*), knicker (*Cosmos caudatus*) and chicken dung flower (*Tagetes sp*), to increase agricultural products based on local wisdom, and able for sustain environmental agroecosystems. [16]. The local wisdom farming community in Pemulutan is to utilize wild plants that grow in swampy swamps such as; swamp grass (*brondong*), and freshwater algae (*reamon*) [4]. This plant is using to make rafts as a medium for floating rice nurseries. The Agricultural cultivation has been applied by Pemulutan community for decades. This research is a synergy of swamp farming system as a form of local wisdom of sustainable environmental management. The breakthrough from this research is to develop a swamp farming

system to increase the productivity of agricultural products. The agricultural of system approach is a form of collaboration of local wisdom from farming communities to maintain the balance of the swamp ecosystem.

The floating nursery in Figure A is the initial it called zero Days Before Planting (DBP). At this stage, the farmers have not prepared the land for planting because the inundated water are still in the range of 50-100 cm. In figures B and C, the nursery has entered five Days Before Planting (DBP) and ten Days Before Planting (DBP). At this stage, the farmers have started to land clearing grass and other wild plants in preparation for the second stage of the nursery. Figure D When the floating nursery enters 15 Days Before Planting (DBP), farmers begin to move the second seedbed to the bowl/edge in the embankment which has started to recede by using a small boat. The second nursery carries out to avoid sinking rice seeds because the media used is experiencing degradation in function. This transfer is intending to maximize the growth of rice seedlings. The last stage going through the second nursery is planting when the agricultural land begins to recede. The rice seedlings from the second nursery were moving from the vases by using small boats, then a plant by cooperation. The varieties that are often used by farmers in cultivating lowland swamp rice are *IR 42, Ciherang, Inpari, Serai, Kuning, Pegagan, and Seputih*. The following is a floating rice nursery process from zero Days Before Planting (DBP) to 15 Days Before Planting (DBP) :



Figure 1. The seedling 0 days and 5 days before planting



Figure 2. The seedling 10 days and 15 days before planting

Pemulutan community farming system using floating nursery techniques is a form of adaptation of wetland management. This environmental adjustment is local wisdom in the use of agricultural land agro-ecosystems. Floating rice nurseries are local wisdom of lowland swamp farming systems which always experience an abundance of water. Floating cultivation system is the only feasible way to cultivate crops during periods of high flooding and prolonged wetlands [17]. Local wisdom is part of the Pemulutan community's efforts to survive in accordance with environmental conditions. The routine of the community in managing lowland swamp farming is to meet their daily needs. The local wisdom of the swamp farming system is Pemulutan people's knowledge, beliefs, norms, culture and traditions that are passed down from generation to generation. The local wisdom of the Pemulutan community from the Ogan tribe is a cultural heritage that must be preserved. Local wisdom is created as a form of interaction between humans and their environment in fulfilling their daily needs. The process of forming local wisdom in Pemulutan society originated from the dependence on the potential of natural resources and the environment. As a result of this dependence on nature, people are always

wise in protecting the swamp ecosystem for environmental sustainability. Public knowledge as a traditional ecological form of using local rice varieties in agricultural land is a dynamic system, adopting various ecological, socio-economic and cultural changes [18].

3.2 The characteristics of wetland Swamps

South Sumatra has tidal areas of around 483.000 hectares, while swamplands of about 240.000 hectares, the remaining 172.000 hectares are dryland. Swampland which distributed in various in South Sumatra such as; Banjarnasin, Ogan Ilir, Ogan Komering Ilir, Palembang, and Musi Rawas. The swamps can also refer to as wetland, lowland, peatland, inland and deepwater land. Wetland describes the area as wet throughout the year with rainfall of 2.000 mm per year and has wet months of 5-7 months [19]. The Swamp island that is not directly affected by the tides, but always experiences inundation. Inundation water surface ranges from > 50 cm to 200 cm, and the inundation period is at least 3 months to one year. This inundation is located in a basin area and is an affected by tidal movements of the sea/river. The swamp is a water storage area of a watershed, which divided into three types, namely; Shallow back swamp, middle and deep back swamp, and inundated in the rainy season with a depth of 100 cm for > 6 months [20]. The inundation period in the rainy season can not be predicted with certainty.

Wetland describes the area as wet throughout the year with rainfall of 2.000 mm per year and has wet months of 5-7 months [19]. The swamps will experience static inundation of the water is very difficult to flow. Inundation in lowland swamps disappear during the dry season, and at that time it is usually used for agriculture. The changing season in normal conditions between October to March is the rainy season, while April to September is the dry season. The level of rainfall will last for 5 to 7 months, making it difficult for farmers in rice fields to plant rice because the conditions of the land still inundated. The following is a graph of the distribution of lowland swamp types based on the 2015 to 2019 depth level in 25 villages in Pemulutan District, Ogan Ilir Regency, South Sumatra, Indonesia.

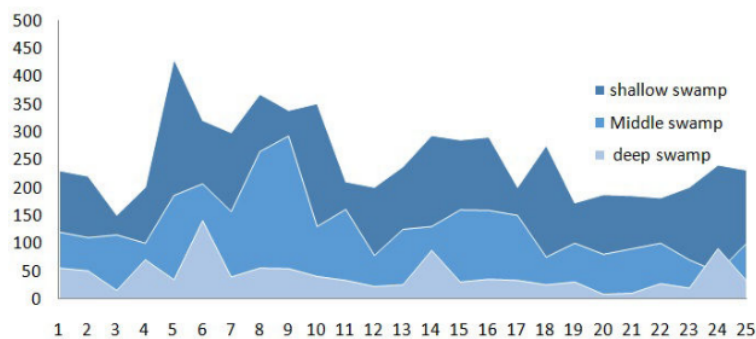


Figure 5. The wetland depth levels are shallow swamp has a waterlogging height <50, the middle swamp has a waterlogging height between >50 to 100, and deep swamp has a waterlogging height >100

Lowland swamps in Pemulutan always experience varied inundate fluctuation range from > 50 cm to 200 cm. This inundation is located in a basin area and is not affected by tidal movements of the sea/river [20]. Pemulutan area dominated with shallow backland, ranging from 6,289 hectares or 59.1 per cent, deep fields of 3,309 hectares or 31%, the remaining 1,058 hectares are deep fields or 9.9%. The inundation period in the rainy season is unpredictable. Maximum production will not achieve when planting time arrives, but the available seeds are not ready for planting. As a solution to the problem of rice plant nurseries in lowland swamps when floods or inundation are still deep, farmers conduct earlier cultivation using the floating nursery method [4]. This floating nursery technique is a characteristic of the Ogan ethnic lowland swamp farmers in Pemulutan. The application of lowland swamp farming systems is a form of local wisdom in preserving the environment. Economically, a

swamp with all that is in it is an economically valuable natural resource with the intervention of knowledge and technology which can provide added value. Socially and culturally, a swamp is a residence for millions of people who interact with each other and even depend on swamp resources so that it has its socio-cultural values and community-style [21].

4. Conclusion

Pemulutan community from the Ogan tribe has carried out a low-swamp farming system for generations. Agricultural systems that carried out by utilizing wild plants that grow on lowland swamps such as; swamp grass (*berondong*), and freshwater algae (*reamon*) as floating rice nursery media. This plant used to make rafts as a medium for the floating rice nurseries. The Floating nursery is done by; soaked seeds to separate superior seeds and pulp. Then the seedling brooded in a sack for two days in a wet state. Take it out and then lay it out on a tarp or other material for one day of accelerating the process of sprouting. Sprinkle rice seeds on the floating nursery evenly at a rate of 10 kg for one stretch. After the seedling 10-15 days old, they transferred to a vase for the second nursery. The floating seedling technique is a form of local wisdom for sustainable environmental management. Agricultural land in Pemulutan dominated by a bund or shallow patches, namely 6,289 hectares or 59.1%, the remaining 3,309 hectares of land is middle land or 31%, and 1,058 hectares are deep fields or 9.9%. The bund and middle backland are potential land for agricultural cultivation on lowland swamps.

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