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Indigenous knowledge of banjarese tribe farmers in paddy cultivation at tidal Swamplands in South Kalimantan, Indonesia

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ABSTRACT

Traditionally, tidal swampland has been utilized by the Banjarese tribe for farming. They have a unique indigenous knowledge in the paddy agriculture system. This indigenous knowledge is obtained hereditarily through the life experience in the interactions with the surrounding environment. By owning the indigenous knowledge, it can make the paddy agriculture in the tidal swampland sustainable. This research aimed at identifying and describing the indigenous knowledge of Banjarese tribe farmers in the tidal swampland which is commonly practiced until today. The method used in this research was a qualitative method with an ethnographic approach. In the research data collection, observation technique, documentation, and in-depth interview were used. The subjects of this study were the Banjarese tribe farmers who are supported by the key informant. The data analysis technique was conducted with triangulation technique. The research results showed that the Banjarese tribe farmers have the indigenous knowledge on season determination, land selection, land management, seed selection, planting, and harvesting. The implication of this study can give the information to the planning and development of agriculture in tidal swampland by the relevant agencies, realize the sustainable cultivation concept through the land conservation with the *tapulikampar* system, anticipate the crop failure, and realize the food sovereignty.

Key words : *Indigenous knowledge, Banjarese tribe, Paddy agriculture, Tidal swampland*

Introduction

Agricultural development faces complex challenges along with the climate change, limitation and degradation of natural resources, reduced agricultural land, and various global trade issues. The results of this research estimated in the year of 2020 Indonesia will experience rice shortage of 9.668 million tons (Effendi *et al.*, 2014). Meanwhile, the conversion rate of paddy land in Indonesia reaches 100 thousand hectares per year (Mulyani and Agus, 2017; Hidayat *et al*., 2017). The highest conversion of paddy land happens in Java island which is around 75%-80% (Mulyani and Agus, 2017). The Increased conversion of paddy land will impact on the decreasing of food supply (Purwaningsih *et al.*, 2015). One of the solutions to overcome the challenges in the paddy agriculturalsector is by utilizing the tidal swampland resources which are widely available and spread across Indonesia (one of them is in Kalimantan Island) (Balibangtan, 2015).

The tidal swampland is the land of hope of the

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present and the future in realizing the resilience, independence, and food sovereignty, especially paddy. This is in line with Haryono (2013) who stated that tidal swampland is one of the agroecology types which has a wide potential for agricultural development, particularly crops. The tidal swampland has an important role in supporting the enhancement of national food security as well as the development of system and agribusiness, knowing the width of is real potential and the availability of management technology (Adam *et al*., 2013).

The utilization of tidal swampland for agricultural business faces several obstacles. Biophysically, the main factors affecting the development of tidal swampland for agriculture are water-logging, low soil pH, the presence of toxic substances, low soil fertility with high diversity, and topographic conditions of land (Noor, 2010). Further Herwenita & Hutapea (2018) describes the obstacles found in swamplands is a physic-chemical condition with high acidity and erratic puddles. To overcome technical problems in tidal swamplands, there is available specific agriculture technology based on local wisdom that is able to lift the image of marginal land into productive land. Local wisdom is usually owned by people who have lived hereditary in the area.

This article reviewed the form of Banjarese tribe farmers' adaptationto the tidal swampland environment through the owned indigenous knowledge. Our analysis emphasized the indigenous knowledge of Banjarese Tribe farmers'indigenous knowledge in South Kalimantan (Indonesia) in utilizing the tidal swampland for paddy cultivation. By having the indigenous knowledge, the tidal swampland environment can be conserved and the sustainable agriculture can be realized.

Methodology

This research is a descriptive qualitative with an ethnographic approach. This approach aimed at describing the social behavior in the "ethnical" cultural environment based on the "natural" truth. With the concentration on the paddy agriculture on tidal swampland done by Banjarese tribe, we chose Barito Kuala region in South Kalimantan Province with these following reasons: this region has the largest tidal swampland in South Kalimantan, the majority of people are the Banjarese tribe and their livelihood as a rice farmer (BPS, 2016).

This research was conducted in October 2016 - July 2017. The first stage of field data collection was conducting observations (physical condition of land and population condition) and documentation. After that, an in-depth interview was conducted with the Chairman of the Farmers Group and the Field Extension Officer (PPL) as the key informants consisting of 4 people. Then, in-depth interviews were also conducted with 20 Banjarese Tribe farmers as supporting informants. Information on farmers' indigenous knowledge on tidal swamplands is obtained through a series of interviews both individually and in groups of farmers with direct experiences. Information explored in the application of indigenous knowledge on a paddy agricultural system in tidal swamplands, including season determination, land selection, land management, seed selection and cultivation, and harvesting. From these processes, a comprehensive description of the practices and actions taken in managing tidal swamplands and conservation efforts was undertaken.

To maintain the validity of the research findings in the field, cross-check based on the observation results, interviews, and documentation was conducted. The data analysis was done by using a triangulation technique (data reduction, data presentation, and verification). The interview results were reduced by choosing the substantial matters which are appropriate to the research focus. Then, the reduced interview results would be presented in the descriptive form. At the same time, we conducted data cross-check (data verification) with the secondary data.

Results and Discussion

The research results showed that the agricultural system of Banjarese tribe known as "*bahuma*" has been persisted by the society hereditarily. They formed a knowledge system based on experiences and various trials thus it becomes adaptive to the surrounding environment. This was done in order to stay alive in the environment they live in which is considered as a marginal land.

The indigenous knowledge has been applied until today in the paddy agricultural system in tidal swampland. The indigenous knowledge includes the knowledge on season prediction, land selection (fertile and non-fertile land), water management, land management, seed selection and paddy culti-

vation, as well as paddy harvesting process. Plants, animal, and other natural elements have been used as signs in the cultivation process in tidal swampland.

Determination of Dry and Rainy Seasons

In determining the coming of the dry season, Banjarese tribe farmers made the tree of *hambawang/ kuwini* (*Mangiferaodorata*) as the sign. *Hambawang* tree which starts to produce bloom is the sign of the coming of the dry season. If the color of the flower is deep red, it means that the dry season will be longer, but if the color of the flower is pink it means that the dry season will be short.

In addition to observing plants, animal behavior is also a sign of the arrival of the dry season. Animals are used as a sign of the coming of the dry season is the fish and birds that usually live in swamp areas. Types of fish usually found in tidal paddy field include *sapat (Trichogastertrichopterus), papuyu/ betok (Anabas testudineus),* and *haruan/gabus (Channastriata).* If a fish like a *sapat, papuyu or haruan* have started to move into the river, a sign of the dry season is imminent. The fish feels the water in the fields begin to recede and warm. Therefore the fish will look for deep water to survive.

The arrival of *hayam-hayam* birds (a kind of heron) in the swamp area to lay eggs is a sign of water will be-*rintak* (low tide). Based on the observations and experiences experienced by the Banjar tribe farmers, *Hayam-hayam* eggs will hatch when the water begins to recede so that the birds are easy to find prey. This event is a sign of the dry season will come.

The prediction of the coming of the rainy season can be determined from the animal and plants behavior that grow on the swamp area. The sign of the rainy season is also known as the term *Tanda Pucuk Barat/* west peak sign. The existence of *kalimbuai* (snails) in abundance in the swamp area is a sign of the rainy season coming soon. Similar to other regions, the Banjarese farmers believe if the frogs and toads start to produce sound then the rain will immediately come. Another sign is when the white birds/sea birds start coming to the swamp area, it indicates that the rainy season will come. The signs of the coming of the rainy season can be seen from *kapat* phenomena (rain-dry-rain-dry) in a short interval. Forty days after *kapat* happens, usually the marsh will be back to *layap* (overflowing). This *kapat* phenomenon is also the sign for the farmers to start planting the paddy seedling (*manaradak*).

The Banjar tribe farmers also notice the growing vegetation in the swamp area which is a sign to predict the coming of the rainy season. Based on the results of interviews, if *papayungan* grass (*Cyperus papyrus*) that grows on the ground begin to turn yellow and fall then it indicates that the water will be *basurung* (overflow). In addition, they can also find out the *banyu dalam* duration or the season (abundant water) by paying attention to the *lumbu* plants (taro) that began flowering. This marks the middle of the *banyu* season. While the leaves of *pipisangan* grass (*Polygonum sp*) are slightly yellow color indicating the water still inundated the rice fields, in the language of the Banjar tribe called *lambat batarik*. The same is done by farmers in Uganda. The results of Orlove *et al.* (2009) show that farmers in Uganda predict the rainy season by seeing flowering coffee plants and the arrival of birds of *ggulu* (*Bucorvusabyssinicus*).

The knowledge about climate is important for farmers. As stated by Suciantini (2015) that one of the environmental components determining the success of plant cultivation is climate. The predictable season changes will minimize the risk of crop failure. It is aligned with Roncoli (2009) who stated that a climate forecast is one of the many information sources that can be utilized by the decision makers to decrease the risk and to optimize the profit. Furthermore, Orlove *et al.* (2009) explained: "...farmers' indigenous knowledge constitutes a resource of great potential value to agencies that develop and disseminate forecasts...". This is also in line with the opinion of Materer *et al*. (2001) describe the importance of climate in our daily lives shown in the richness of indigenous knowledge based on weather and climate forecasts.

Land Selection

Based on the knowledge and the life experience in the tidal swamp area, Banjarese tribe farmers can determine the condition of soil fertility. They do a land assessment first before determining the location of farming. Land assessment is done based on vegetation growing on the land. There are certain types of vegetation that are often used as indicators to determine soil fertility. For example, *parupuk* tree (*Phragmites sp*), *purun tikus* (*Eleocharisdulcis*), *kumpai miang (Hymenachneinterrupia Buese),* and *binderang (Scleriaoblata)* characterize acid soil (infertile). Further information was obtained from the Field Exten-

sion Officer (PPL) that the presence of *galam* tree (*Melaleuca Cajuputi*) characterizes soil acidity with pH ≤ 3. *Karamunting* plants (*Melastoma malabatharicum*) with pink flower, also called *Rhododendron of Singapore* shows the poorest nutrients in the soil. While the characteristics of fertile soil (good for cultivation) can be seen from plants such as *balaran (Ipomoea alba), kasisap (Richardia brasiliensis Gomez), pipisangan (Polygonum sp)* and *pakulambiding (Stenochlaena palustris).*

Furthermore, Birmingham (2003) describes indigenous knowledge of soil conditions in relation to land use will enrich the knowledge of soil typology. The information on soil typology is important for research development to increase the land use and land resources by local societies (Dawoe *et al*., 2012; Barrera-Bassols *et al*., 2006). With the knowledge possession especially on the soil characteristics, Banjarese tribe farmers are capable of utilizing and overcoming the problems in the tidal swamplands.

Water Management

The agricultural system in tidal swampland done by the Banjarese tribe generally is still traditionally managed. One of the ways is by traditionally implementing water management technology. The water management technology is by applying one-way system (*handil*) and *tabat* system. The *handil* system on flood typology A and B is a water management system traditionally by opening the land and creating indented channels that go inside from the banks of the big river. The *tabat* system of overflow typologies C and D is a water channel system that is blocked/*tabat* by a stoplog (Watergate) to keep the groundwater surface to fit the needs of the plants and to allow rainwater to accumulate in the canal. Based on information from the Field Extension Officers "... on paddy agricultural systems, generally farmers in tidal swamplands use the water that enters through *handil* to the quaternary channel and then retained by making a block/*tabat* (dam overflow). *Tabat* was made and functioned from the land preparation until planting time. *Tabat* is then open when the paddy needs drying, that is when the paddy is ripening until harvest…"

The application of water management technology in the form of *handil* and *tabat* in tidal swamp land shows the Banjarese Tribe local wisdom on the environment. On peatlands, *handil* and *tabat* contain wisdom values to keep the water so that the peatland does not get dry or burn-risky. The traditional technology practiced by the Banjarese Tribe on swampland is aligned with the opinion of Suryana (2016) that the technology utilization in developing the agribusiness on swamplands should concern the cultural and local wisdom aspects of the surrounding society.

Land Management

In paddy cultivation in swampland, the Banjarese indigenous knowledge tribe implements the *tabas-puntal-balik-ampar (tapulikampar) system. Tabas* means doing the land clearing using *Tajak* tool that is a kind of long machete with a rod. The slashed weeds or paddy straw is arranged on the field created as straw bales with the diameter around 30-40 cm, this work is called *puntal* or *memuntal*. The collection of this organic material is abandoned until the next 30 days and the tossed and turned so that until decompose evenly, this work is called *balik* or *membalik*.

After the composing of the organic material is considered enough, the lumps of the organic material are then choped or separated for then spread across the field surface. This effort is called *ampar* or *ma-ampar*. This is in line with the results of Susilawati (2016) research of land preparation with the return of grass/straw can decrease soil acidity from pH 3.0 to pH 6,0. Thus, it can be said that *tapulikampar* activity can prevent the occurrence of the production of acids, especially pyrite and serves as conservation of environmentally friendly land.

Seed selection and paddy cultivation

Most of the paddy cultivated in the tidal swampland is dominated by indigenous varieties. The well-known local varieties cultivated on tidal swamplands in South Kalimantan are variety group of *Siam, Bayar, Pandak,* and *Lemo*. Siam Mutiara variety is mostly planted by the Banjarese tribe society. Based on the results of interviews with farmers and extension workers (PPL), *siam mutiara* has several advantages such as: minimal use of pesticides, minimal use of artificial fertilizers, minimal maintenance, use of fewer seeds (more rice seedlings), tolerant to tidal swamp environment, and the shape and taste of rice that people love the Banjar Tribe so that the selling price is higher.

The cultivation process of local paddy variety intidal swamplands was conducted by seedling-shifting cultivation until three times before being planted back in the fields. The processes of shifting cultivation on local paddy seedlings are called

taradak, *ampak* and *lacak*. The planting of rice seedlings in the first stage is called *taradak/manaradak* (Banjarese language) for ± 21-30 days in a dry land. After 30 days, the seedlings of paddy yielded from *Taradak* were transferred to the second stage seeded. The *ampak* location is located on the edge of the paddy field; the process is sealed (*ampak*) for ± 30-40 days. The goal is to get a greater amount.

The next step after the *ampak* is *lacak* (Banjarese language), that is, dividing and planting paddy seedling from rice to 10-15 parts of rice seedlings. The duration of planting seedlings is ± 60 days. *Lacak* activities aim to produce more seedlings than the second stage (*ampak*). Based on the results of interviews with farmers and field extension workers, the *lacak* activity also aims to enable paddy seedlings to adapt to tidal swamp conditions. By seedling shifting cultivation, it will be obtained seedlings that are high enough and strong to be planted in the puddle of water in the tidal fields.

The use of local paddy varieties (*Siam, Bayar, Pandak*, and *Lemo*) by the farmers is in line with the research results of (Khairullah *et al*., 2005) that local paddy variety can be cultivated in tidal swampland with the high acidity and iron level. The local paddy variety is the paddy variety that has been long developed in certain regions with a good adaptability, thus the variety has a unique characteristic. The paddy on tidal swampland is typically tolerant to Fe toxicity (Suhartini, 2004). According to Khairullah *et al.* (2005), the mechanism of tolerance of Fe toxicity in local rice varieties is either overcoming or prevention.

The advantages of shifting cultivation systems are also shown from the results of Thamrin and Asikin (2005) research that the shifting cultivation made several times is very disturbing the development of stem borer larvae, and can even result in the death of instar larvae one and two. Further is explained by the trimming on the seeding before planting can also decrease the population of borer pest egg group. That way can reduce the damaged paddy as much as 6.0% (Thamrin and Asikin, 2005).

Harvest

Generally, farmers in Indonesia use a sickle to harvest the paddy, as the farmers in Java and Sumatra islands (Helmi, 2015). Based on the interview results, the Banjarese tribe farmers in South Kalimantan do not use a sickle to harvest paddy. Instead, they use a traditional tool called *ranggaman* (ani-ani). They do not use a sickle because it makes the unripe paddy will also get harvested. This will surely create a loss for the farmers. The reason behind the usage of *ranggaman* (ani-ani) is related to the local paddy variety characteristics. One of the characteristics of local paddy variety in swampland is the uneven ripening (Wahdah, 2012). Eventually, the use of *ranggaman* (ani-ani) will make it easier for the farmers to choose the ripe paddy and to minimize the paddy grains to fall on the ground when harvested.

The indigenous knowledge generated from human and environmental adaptation processes in tidal swamplands will produce an adaptive and sustainable agricultural practice. This is in line with an opinion (Phungpracha *et al.*, 2016) which explains traditional ecological knowledge is essential for the sustainability of natural resources and agro ecosystems.

The sustainability of agriculture in tidal swamplands is an indicator of success in managing ecosystems, so the ecosystem provides results over a relatively long period of time. This is in line with the opinion of Yunita (2012) that indigenous knowledge is considered very valuable and has its own benefits in the life of farmers in the swamp ecosystem. However, the implementation of a sustainable agricultural approach in Indonesia should be in harmony with the environment to maintain productivity growth to meet human needs.

The exploration of information on indigenous knowledge of the society and the innovations adopted by the farmers can illustrate the pattern of natural resource management around it. The indigenous knowledge and innovation adopted by the farmers were collected and then arranged and analyzed to be more structured farmer's knowledge model thus it is easily applied by other society. The constructed and developed understanding model by farmers can be a feedback to complete and enrich scientific models. The importance of studying the farmers' indigenous knowledge aims at supporting the local commodity sovereignty to keep developing, anticipating the loss due to crop failure, and realizing the sustainable agriculture.

Conclusion and Recommendations

The tidal swampland is categorized as marginal land that has a big potential to develop agriculture. The Banjarese tribe farmers have a unique indig-

enous knowledge in the paddy agriculture system (*bahuma*) on the tidal swampland. The indigenous knowledge they implemented from the season determination, land selection, land management, seed selection, cultivation, and harvesting. Recommendations from this study that are for the society to keep conserve the indigenous knowledge they have; for the government (central and regional) to encourage the studies on society's' indigenous knowledge through the agriculture and other relevant agencies so that in the resource and environmental management on swampland are sustainable.

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