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Drivers and impacts of changes in swidden cultivation: A social resilience perspective on Dayak Desa Communituy, Ensaid Panjang West Kalimantan

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Abstract:*The objective of the study is to describe the local community agricultural changes and local community resilience in Ensaid Panjang, Sintang West Kalimantan. This study confirms that local culture in faming has been changes from slash-and-burn agriculture to modern agricultural techniques. Swidden agriculture has been recognized as part of the life everywhere in Ensaid Panjang. For indigenous community in Ensaid Panjang, the introduction of Javanese through transmigration programs, agricultural modernization and oil palm plantation development are crucial factors to changes and declines the traditional agricultural systems. Such changes are likely influence community adaptation through intensive agricultural practice by establishing wet rice field and increasing the intensification on rubber cultivation. Such two trend of local community response in agricultural sector changes may at first glance seem contradictive to sustainable development. Socio-economical impact of the intensification in agriculture has been identified, including loss of traditional works togetherness in fields, increase of labor system with salary, and domination of particular people with high work capital and rice field. The ecological consequences including forest access limitation, soil vulnerability to pollution and lands degradation.*
Keywords *- slash-and-burn, Dayak, agriculture modernization*

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I. Introduction

Local and indigenous knowledge are one of the fundamental instruments in sustainability of local community in the world. These kinds of knowledge have been reported important in the long-term uses of natural resources. This knowledge has been developed by most of the indigenous community as one of the human strategy to uses natural resources sustainably. The spectrum of the knowledge has been identified varies, ranging from knowledge to use particular plant in medical aspects to the sustainable uses of resources from production both in terrestrial and aquatic ecosystem. [1] [2].

The swidden agriculture through slash-and-burn practices are one of the important parts of sustainable agricultural practices in many indigenous communities in the world. Slash-and-burn is probably one of the oldest practices of agriculture practices. Slash-and-burn agricultural is carried out in a different way depending of the types of forest lands, size, social and spirituals aspect. Scholars point out that slash-and-burn is crucial to ensure the sustainability of harmonious human and nature relationships, especially in term of food production and nature conservation. The sustainability of slash-and-burn agricultural practices is reached when the inflow and outflow in the system are the same. There are no resources exploitation which are able to disturb natural balance of the system. Ecologically, it is agreed that slash-and-burn does not depend systematically upon outside input to increase crops production, including chemical pesticides and fertilizer. Rotation is the key aspect in traditional swidden agriculture. The sustainable slash-and-burn agricultural practices provides a range of ecosystem services, including maintaining biodiversity. Traditional slash-and-burn in developing countries is often closely linked to traditional belief [3] [4] [5].

Recent critics for slash-and-burn practice are emerging and it is claimed as factor for massive forest fire in Kalimantan and Sumatra. Many forests are destroyed by massif slash-and-burn practices for low cost of land clearing and rapid income. Given the diversity of the people interest in land management, it is not surprising that each groups have different views regarding the use of forest and lands. An example of how people look forest resources differently is found in Kalimantan, Indonesia. In many areas, slash-and-burn

agricultural practices have been shifted from traditional and sustainable to modern and massive land burning. Another important issues in which slash-and-burn agriculture activities contribute to global warming is massive vegetation clearing. The burned and degraded forest potentially decreases the ability of tropical ecosystem in carbon capture and sequestration. The issue of slash-and-burn agricultural practice as factor for forest fire and tropical ecosystem degradation is of course viewed in a number of different view of point depending on intensity of burning activity and size of opened and burned area [6] [7] [8] [9].

Modernization in agricultural sectors currently becomes important methods and approach to maximize crops production in limited lands area. The increasing demand for food could lead to a further forest clearing for crops productions. Modernization in agricultural sector offer the greatest potential income generation and crops productivity increases. Recent agricultural modernization often introduces modern practices and techniques, in which it is widely reported contributes to the environmental degradation [10] [11] [12]. Scholar point out that environmental degradation has reached crisis proportion and could soon become irreversible. Soil erosion, soil contamination, aquatic ecosystem eutrophication and loss of fertile soils are the most serious problems of land degradation. There is prediction that continued land degradation may result in food insecurity in the near future. There are also significant loss of biodiversity has occurred in agricultural lands [13].

Indigenous community in Kalimantan has been known as one the tribal community with strong traditional agricultural system, including slash-and-burn or swidden agriculture. Among the indigenous community in Kalimantan, slash-and-burn agricultural practices is a key component of the Dayak community. The cultural and ecological values of slash-and-burn techniques may be important in some Dayak community. As many form of indigenous knowledge, sustainable slash-and-burn to manage agro-ecosystem in Kalimantan has been threatened due to rapid modernizations [4]. In the perspective of local community survival, it is very crucial to identify the local community's responds and strategy for adaptation of living in recent rapid changing words. Scholar point out that local community have to increase their capacity and develop new strategy[14] [15] [16]. As far, there are no studies to identify and describe the adaptation of local community in Dayak community in Ensaid Panjang after traditional community loss land access for traditional agricultural activity. The aims of the study is to identify the external factors contribute to the decrease of traditional agricultural practice and describes the community adaptations in farming culture among local people in Ensaid Panjang, Sintang.

II. Methodology

Field work was implemented at Ensaid Panjang village, Sintang West Kalimantan. Participatory rural appraisal were implemented to collect data and information comprehensively. This study focuses on the Dayak Desa population living in and around the Ensaid Panjang. Depending mainly on forest resources product, Dayak Desa community mostly settle in remotes settlement. Dayaks Desa community in Ensaid Panjang have managed non-timber forest product for generation. Fundamentally, these community have relied of non-timber forest product for subsistence needs. The traditional law in the past provides traditional access right to forest, especially right to use forest for spiritual and economical value. Traditionally people depend on forest to support their economical needs by extracting food, medical material, tools and rattan. Recent Ensaid Panjang village consist of 167 households with the total population of 626 residents. The majority of local dweller in Ensaid Panjang was farmer. In Ensaid Panjang both men and women work in agricultural farm.

In order to collect data and information regarding drivers and impacts of changes in swidden cultivation among Dayak Desa in Ensaid Panjang, an observation and in-depth interviews were implemented. The field observation regarding to recent rural situation were made comprehensively. Both men and women were included in an interview. Ultimately, the question pertaining to aspects that are perceived as crucial factor for the declines of traditional agricultural system. Informant were asked to indicate their response to the decrease of slash-and-burn agriculture techniques, especially in Ensaid Panjang area. The secondary data related to the villages demography was examined wherever it is possible to collect. All of the data and information were recorded and documented using field note and photographs. Data were analyzed descriptively.

III. Result and Discussion

The swidden agricultural practices

Traditionally, many economic activities among Dayak Desa are based on the agricultural sectors. In Ensaid Panjang, the situation is more traditional, with a slash-and-burn agriculture or swidden agriculture as an ultimate approach in farming. Swidden agriculture has been practiced among Dayak Desa community in Ensaid Panjang following systematical steps, starting from selecting and opening land for cultivation using fire, cultivating crops, harvesting crops and then left (called fallow period) to provide regenerations of rubber and tree species after a few years. Among Dayak Desa community in Ensaid Panjang, slash-and-burn agricultural methods is complex farming systems (Fig. 1). Swidden often started by land clearing (cutting shrubs and grasses), drying, and burning. Planting was done immediately after burning completely finished and the arrival

of rains. Once planting is completed, the fields are generally maintained following traditional roles. Fallow period is important because it is typically long and provides opportunities for woody plant regenerations. Informants point out that the duration of fallow varies following local climates conditions. In the low population density, swidden agriculture is one of the productive and sustainable agriculture farming. Typically, these practices similar with other indigenous community in developing countries. The variation occurs and it is fundamentally caused by the environmental factors (i.e. soil, climate, water availability) [1] [2] [3] [6] [17] [18].

Since the modernization and introduction of new technology in agriculture, the slash-and-burn agriculture practices has declined significantly. Slash and burn is often associated with ecosystem degradation. Slash-and-burn was seen as an important factor for systematic tropical forest degradation. Scholars point out that recent problem in traditional agriculture are too complex [6] [7]. In Ensaid Panjang, recent problems with traditional sustainable slash-and-burn is that the lands cannot support an effective and sustainable slash-and-burn agricultural practices. Traditional Dayak's slash-and-burn is complex system and able to sustain with adequate support of lands and sustainable consumptions. Decrease of available lands for swidden agriculture lead to the decrease of traditional agriculture farming among Dayak Desa community in Ensaid Panjang.

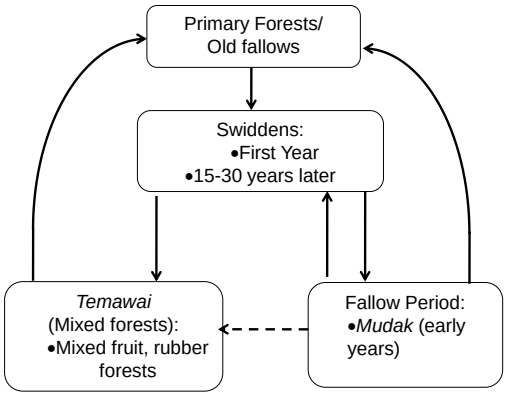

Fig. 1. The cycle of swidden agriculture in Ensaid Panjang

Promoting past models of sustainable slash and burn agriculture may not be easy however. Local people also may find it hard to see the benefits of slash-and-burn agriculture practices. It is especially important in the community with high density of population. Arrival of the community increase the number of food consumption, land for settlement and decrease space for traditional agricultural practices.

Pressures on swidden agriculture

Within past three decades, shifting agriculture with rotation system has been difficult to implement. Informants point out that the decline of access to forest and lands is the ultimate factor among Dayak Dea community to discontinuous traditional swidden agricultural practices. Decrease of slash-and-burn practices gradually lead to the demise of swidden cultivations. External factor has been identified as an ultimate pressure on swidden agriculture (Table 1).

Table 1. Some important external factors contribute to the decline of swidden agricultural farming in Ensaid Panjang

External factors	Significant issues
Transmigration program	Introduction of new culture, modernization, increase number of human density and decrease of area for swidden agriculture
Plantation	Concession of traditional lands for swidden agriculture to plantation area controlled by private sector
Biodiversity conservation	Protection of 750 ha forest as protected forest to facilitate biodiversity conservation

Firstly, transmigration programs has been identified as early factors to the decline of sustainable slash-and-burn agricultural practices. Introduction of 88 Javanese family in 1984 has occupied 300 hectare of land in Ensaid Panjang. Most of the land traditionally belong to local community of Dayak Desa as Adat lands. Inside the 300 hectare of lands, there were lands under Dayak's traditional farming regime, including fallow lands (locally called pemudak) agroforestry lands (locally called tembawang) and secondary forest. The transmigration program which was launched during New Order era significantly contributes to living system of local community [19] [20]. The recent introduction of Javanese transmigrant in the local political and social system has brought conflict on land utilization between local community and central government. Impact of

transmigration programs not only affect physical environmental changes in Ensaid Panjang, but it is significantly changes the population composition and demography, in which it is contribute to the social, economical and political changes. Increase of population creates severe problems of rural infrastructure and housing. Increase of population combined with new introduces culture result in particularly indigenous community shock. This situation is common among recipient community in many target area of transmigration program [20].

Secondly, economic earning based on the plantation industry is crucial in declining sustainable slash-and-burn agriculture in Ensaid Panjang. Recent pressure on traditional living system in Ensaid Panjang comes from capitalism and globalization in agricultural sector. Recent policy in forestry and investation, especially policy regarding foreign investment open new opportunities for investors in oil palm, contributes to the recent conflict between investors and local community. Recent regional autonomy has also politically facilitated local and regional government to issue legal permits in forest utilization by private sector and increase forest conversion to oil plantation. Hundreds hectares of lands which is traditionally important to support traditional live of Dayak Desa community has been registered and legally under control of privates company. Economically, the labor opportunities offered by oil palm plantation attracted some local people to work in plantation. Working in oil palm plantation, however, needs skills in which it is limited among local community member in Ensaid Panjang. There is, however, no indication for local community to convert and plant their orchards fields to oil palm fields. Beside ecological degradation, oil palm plantation contributes to the socio-economical aspect of local community who depend on the forest ecosystem [21] [22]. The allocation of lands for oil plantation overlaps with adat lands. The status of adat lands was under pressure because there is no legal formal aspect for the declaration of particular areas as adat lands. The expansion of oil palm plantation also contributes to the decrease in agro-forestry system. Oil palm company recommend and provide direction to the local dwellers to stop burning because it is potentially affect fire in plantation area.

The dynamic of relationship between local government, private sectors and community in Ensaid Panjang are complex. Weak laws, corruption and ineffective enforcement are another factor for lands acquisition issues, land conversion and sustainability of swidden agriculture. There are prohibition law produced by central government to control forest resources utilization, including extraction of non-wood forest product. They may also be lack of human resources to control regulation implementation in the field. Conflict often occurs between local people and private company. There are still problems of partnership among private sector and local community [23] [24].

Thirdly, central government concern to the Kalimantan's biodiversity issues also contribute to the decrease of swidden agricultural practices in Ensaid Panjang. To protect the remaining biodiversity in Sintang, a 750 hectare of forest in Bukit Rentap has been declared as protected forest in 2000. The central and provincial government recognizes that protection of Bukit Rentap is essential to support sustainable development in West Kalimantan, especially in Sintang area. The central government is also recognizes that the protection of such area is crucial for reduction of global warming issues caused by forest fire. Kalimantan is home to the abundance biodiversity, and therefore many attentions have been paid to the biodiversity conservation. Many of Kalimantan's biodiversity remain vulnerable to human activity, and therefore it is crucial to declare some area as protected area [25] [26]. Without protection many of the biodiversity and ecological services of Bukit Rentap would no longer exist in Kalimantan. Since the declaration of Bukit Rentap is protected forest, direct use of the area is designed to be limited and controlled. A problem is, most of the protected area situated within traditional home ranges of Dayak Desa. In the past, forest can yield a number of non-wood product, including fruits and honey. Since the declaration implemented, there are punishment for people who make activity inside the forest (i.e. slash-and-burn activity, collecting wood and other non-wood product). The tapping of rubber sap, however, permitted as a non-wood forest product. The regeneration of rubber seedling, however, not permitted in protected forest.

Issues of population, economic growth and conservation are all linked to sustainable slash-and-burn agricultural practices. Informant point out that recent development in Ensaid Panjang may also cause a social effect that has been said "uncertain future". Informant point out that social changes resulting from rapid development and modernization may also be irreversible. When irreversible development is occurred, future alternative become limited [29]. In such a acse, an alternative strategy often developed by local dwellers, including local community in Ensaid Panjang.

Intensifications and their impacts on community resilience

Lands for agricultural activity area becoming scare resources in Ensaid Panjang. Development in area in which agricultural lands is limited and scare can increase population pressure on land and stimulate intensive agriculture farming system. Intensification in agriculture sector become important point in local community adaptation. In case of Ensaid Panjang, there are two observed local adaptation in response limited lands for traditional agriculture.

1. From shifting to permanent cultivations

Informant point out that sustainable swidden agriculture system has recently been disturbed by the implementation of intensive farming system. Over the past decade, the local community in Ensaid Panjang have converted much of the slash-and-burn agriculture into wet rice fields. According to informants, most of the now existing swidden lands are converted into wet rice fields. Government point out that the introduction of wet rice program is an important step to ensure food security in Ensaid Panjang and decrease human activity in slash-and-burn agricultural practices. The prohibition to cut and burn lands as a clearing method in swidden agriculture steps was supported by oil palm company. Depending on the amount of available lands, recent local peasant in Ensaid Panjang spend between several days to prepare rice fields.

In the situation where local community has limited access to land in practicing slash-and-burn agriculture, central government recommend farmer to changes swidden agriculture to permanent agriculture by introducing and promoting permanent rice field techniques. During 2016-2017, land clearing activities were implemented to prepare wet rice field. About 70 hectare of shrubs lands and vegetated lands were cleared. Local dweller was requested to organize their self into farmer group. It is significantly important to manage farmer group and introduce many technological aspect and assistance program to local farmer. Seeds with superior genetic traits were distributed to increase crops yield, and the role of local rice seeds decline. There are chemical fertilizer and technical assistance for intensive agriculture. There are also modern equipment grant to enhance the role of intensive agriculture to produce crops (i.e. hand tractor, water pump). Scholar point out that many countries has made a major commitment to the establishment and development of various mechanisms and assistance to support intensive agriculture. In many regains, this effort has been reported success to increase rice grains yields. The entire program, however, related to social and environmental impact [27] [28]. Some of the rice field able to produce rice 2-3 times a year. It is particularly found among rice field in adjacent to the Bukit Rentap, in which water supply adequate to support intensive agricultural activity. The rice field surrounding Bukit Retap area are not influenced by dry periods. Informant point out that the success of agricultural activity was also supported by the application of chemical fertilizer and pesticides.

In Ensaid Panjang, there are strong tendency of the spread of intensive farming system, especially rice farming in rice fields. Informant point out that the average crops yield per unit of lands area tends to increase, especially in land with chemical fertilizer application. Some people, however, continuing cultivates crops and many fruit trees under agroforestry system in limited number. It is especially continued by households without rice field, lack of capitals and labor, or people who wish to continues traditional system. Some people argues to continuous traditional farming because it is related to the tradition of Nyelapat Taon.

Rice fields have been viewed as an effective and efficient methods to produce rice. Compared to the wet rice field, upland agricultural practices provides opportunities to cultivate numerous crops. The upland agriculture, however, viewed as complicated agricultural practices with many steps of works. There are some reasons for people to involve in the intensive agriculture farming in rice field. Firstly, upland farming is complicated and it is very long time to get economical benefits from upland farming. Secondly, this practice need high cost. Rice field has been viewed as an effective agricultural activity with significant economical benefits. Development of alternative farming system to replace traditional farming system can often reduce landscapes ecological and household's economical aspects in Ensaid Panjang. In the perspective of landscape ecology, it is crucial to manage rapid development of agricultural sector following the land and space capacity [30] [31].

National and local government has implemented program to maintain and increase rice productivity. Intensification of agriculture mechanism to produce high yield crops alter the sustainable farming practices. Recently, most of the farmer in Ensaid Panjang use more chemical fertilizer and pesticides as part of the methods to increase crops yield. The labor is another problems related to social issues. Through the intensive agricultural system, the culture to manage agricultural lands following community and family member togetherness was decrease.

2. From native rubber to rubber with superior traits variety

Rubber Hevea brasiliensis is one of the important commodity of Ensaid Panjang. Informant point out that rubber generates sufficient revenue to support household's income. It is especially important in the economics of recent Dayak Desa community in Ensaid Panjang where traditional farming activity through slash-and-burn were gradually decreased. Traditionally, rubber is the part of the agroforestry system among Dayaks community in Kalimantan [32] [33]. The local variety of rubber previously common in traditional garden, especially in agroforestry ecosystem. Informant notes that the rubber often has specific characters, including trunk diameter ± 50 cm, plant height 8 meter with plant age can reach about 60 years. This rubber species can be tapped in 8-10 years after planting. Most of these rubber population are origins from the Dutch colonial era, and

as far there are genetic characteristic studies to described the superiority of the rubber tree. It can be said that the cultivation of rubber not intensive. Rubber was grown under the agroforestry system together with other fruit. The decision by farmer to changes native rubber to rubber with genetic superiority traits is made within the frame of economical issues. As many area in the world, the driving force for the changes of native rubber to rubber with superiority traits is economical motives [34].

Changes in rubber cultivation system within Ensaid Panjang area itself, however, will affect other parts of indigenous landscapes in Ensaid Panjang. Scholar point out that changes of landscapes crucial problems. One of the main challenges facing local community in Ensaid Panjang is that of managing its fast agro-ecosystem resources on sustainable basis. In the perspectives of local community in Ensaid Panjang, rubber commodity provides significant benefits in households economical earning. Economical benefits potentially increase when intensive rubber farming was implemented through the application of chemical fertilizer, pesticides, herbicides and other poisonous chemical to minimize pest and herbs. Another potential source of income is to cultivate superior rubber tree in monoculture techniques. Desire to have large superior rubber plantation has been stimulate the changes of old rubber plantation under agroforestry system into monoculture rubber with superior traits. The assistance of funding institution such as Credit Union has been reported important to accelerate changes of rubber population in Ensaid Panjang. Such institution provides credit facility to accelerate monoculture rubber plantation development.

Recent rubber cultivation has thus changed land use pattern, degraded agroforestry pattern, degraded traditional knowledge in farming system, and potentially depleted biodiversity. Rubber agroforestry decline and monoculture rubber plantation grows very fast. Recently, the socio-cultural aspect of traditional rubber plantation are often neglected. The economical consideration in rubber plantation management are often the driving force for the disturbance of socio-cultural value of rubber plantation. There are some ecological risk associated with recent monoculture rubber, including soil degradation. The intensive use of pesticides and herbicide potentially contribute to the soil pollution [11].

Socio-economical impact of monoculture rubber cultivation has been identified important. Land management based on labor increase significantly and replace the traditional system (i.e. gotong royong, bedurug). In rubber cultivation system, the sharing benefit after rubber harvest become common in Ensaid Panjang. Among the crucial problem is the rubber price was controlled by market. In the low price of rubber, there was no optional strategy among local farmer to replace rubber with other commodity. This leads farmer in hard economical situations. The ownership of rubber orchards also creates the domination of particular person and loss of togetherness culture in orchards management. Dominancy often locally defined and related to the lands ownership and ability to pay labor. Overall, monoculture rubber orchards has changes the sosio-economical aspect of local people in Ensaid Panjang.

IV. Conclusion

Clearly, survival prospects for sustainable traditional slash-and-burn in Ensaid Panjang are not good. The traditional practices of slash-and-burn is presently threatened mainly by modernization, economic and agriculture intensification. In response to the limited area for swidden agriculture and prohibition to exploit forest resources, local community has adopted and established intensive farming techniques. This approach believed provide effective farming mechanism for the implementation of agricultural sector development. It is especially relevant with the issues of land availability for traditional farming. The existing lands for agriculture is not adequate to respond to increased population pressures.

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