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Turning Back Rice Farming on Dayak Meratus Tribe in South Kalimantan – Indonesia: An Environmental and Economic Assessment

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ABSTRACT

We report here the evaluation of ecological performance and economic status of turning back farming practiced by indigenous people of Dayak Meratus. The scoring based on LEISA (Low External Input and Sustainable Agriculture) was applied to determine whether the ecological performance is at the level of high, medium, or low. Afterward, the economic performance also assessed by implementing revenue-cost ratio (RCR). Dayak Meratus community implement an indigenous farming system called turning back farming. They move their farming area to another area each year, and then return to the first area after years. Their farming practice is rich with ritual in each stage; and has to accordance with the customary law which respect nature, forest and ancestor. We found that the ecological level of the turning back rice farming were in the medium level because some of some ideal farming practice are neglected and the use of chemical substance. The economic performance was not feasible as the RCR value was below 1.00. We suggest that the farmers follow the customary law and conducted social control. Government encouragement and support is needed to educate people in using of natural pesticide and organic fertilizer, and crop rotation in the corridor of customary law.

Keywords: farming practice, indigenous people, rice, ecology

INTRODUCTION

Green Revolution has created a double edge knife for human life and environment. Green revolution has increased food provision in more than ten folds as well as created green jobs ([4], [16], [5]). On the other hand, it caused environmental problems in term of soil degradation, chemical pollution, and bio-diversity lost which lead to the decline of food production ([16], [22]). [22] added that the green revolution creates farmer dependency on modern seed, fertilizer, pesticide, and irrigated field. Therefore, the sustainability of food production is questionable.

As a result, there has been a strong push to get back to nature, like agricultural technique which conserves soil and nature to ensure the sustainability in agriculture [17]. Sustainable agriculture refers to the development of agriculture technology and practices that: (i) do not harm the ecology, (ii) accessible to the farmer, (iii) improve food productivity as well as the environment. It incorporates the capacity to buffer shock and continue over a long period ([18]; [19]; [15]). This sustainability farmer is incorporated to the back to nature farming practice and it is related to the traditional farming practice conducted by various indigenous people [11].

In addition, Indonesia has vast yet diverse cultural heritage account more than 300 ethnic groups with different farming practice. Ethnic groups in Kalimantan (Indonesian part of Borneo Island) have a long experienced indigenous farming practice. Most of traditional agricultural systems in Kalimantan are based on swidden agriculture ([8], [23]). Paddy rice and rice grown in swiddens (slash and burn agriculture) in hilly areas provides subsistence for the majority of the population [23].

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Kalimantan's coverage area is 54 million hectares. In 2002, approximately 50% of this area was under forest, but this has been suffered from massive deforestation [7]. Most of deforestation is caused by the logging and forest conversion to plantation, mining, agriculture, and urban area. However, this swidden farming has been accused as the major cause and environmentally destructive farming. The fact is the forest of Indonesia and their resources have been managed by indigenous groups for ages using traditional knowledge and customary laws [23]. For agricultural purpose the indigenous community apply controlled slash and burn, while most of the deforestation occurred on industrial forest and land tenure area. The indigenous farmers of *Dayak Meratus* use controlled swiddens by making fire barriers before burning. They implement turning back farming practice where they move their farming area to another area each year and then return to their first area after years.

Because of population increase and the depletion of forest area, the indigenous farming practice encounter problems. Landholding per family is getting narrower as the forest cover is reduced. The turning-back period becomes shorter over time, which lead to the shortening of soil recovery. As a result, the yield is decreasing over time and some farmers are tempted to apply modern farming, i.e.: applying chemical fertilizer and pesticide.

Based on aforementioned facts, some question emerges. To what extent that the farmers of *Dayak Meratus* apply the principal of nature farming in this changing era? What is the economic feasibility of their rice farming? Do they capable to feed their family member?

On the other hand, the previous studies of *Dayak* communities were more focused on cultural aspects related to ecology (see [9] and [23]). Besides, the anthropological approach can be found on [12]. However, none of those studies quantify the ecological aspect in the micro level (farm household). Meanwhile, the studies related to economic value and resource management can be found in [13], but it only covers the qualitative issues.

Based on this research gap, this study evaluates the nature farming practiced by indigenous people of *Dayak Meratus* and to seek out their rice farming feasibility. This study is important as a first step in managing and treating the indigenous people in South Kalimantan.

RESEARCH METHODOLOGY

The study was conducted in South Kalimantan, an Indonesian province located in the southern part of Kalimantan (Borneo) Island. It is located between 114°19'13" – 116°33'28" East Longitude and 1°21'49" – 4°10'14" South Latitude. South Kalimantan has coverage area of 37,530.52 sq km (6.98% of Kalimantan Island) consisted of low land and highland. Most of highland is covered by protected tropical forest. South Kalimantan has a tropical climate with temperature ranged between 21.6°C – 34.3°C, the humidity is between 51.2% - 99.1% monthly, and the precipitation accounted 30.1 – 1641.9 mm [3]. In South Kalimantan, the *Dayak* are commonly lives along the river basin (among others are *Dayak Bakumpai* and *Dayak Ngaju*), and the mountainous area (for example: *Dayak Lawangan* and *Dayak Meratus*/*Bukit*/*Buket*). The study is focused on *Dayak Meratus* community in Haratai Village, Hulu Sungai Selatan District.

The study involved 23 household head, or 10% of the village population, as respondents. The experts and the tribe chief were involved as key informants. The data were analysed through descriptive statistics and then continue to ecological and economic performance assessment.

The ecological performance was accessed by adopting LEISA (Low External Input and Sustainable Agriculture) criteria as proposed by [19]. The indicators included: land condition, land treatment, plant diversity, farming practice, fallowed period and its land treatment, and chemical substance use. We constructed questionnaire with the main focus in scoring their farming activities. Then we determine their score by following formula:

$$Ecological\ Level\ (EL) = \frac{SrO}{SrI} * 100 \quad (1)$$

Where: *SrO* is observed score, and *SrI* is ideal score. We divided EL into three interval, i.e.: high (>77.77%), medium (55.54 – 77.76%%) and low (<55.54%).

Afterward, RCR (revenue-cost ratio) is used to determine financial feasibility by following formula:

$$RCR = \frac{Revenue}{Cost} \quad (2)$$

The farming is feasible if RCR is more than 1, and vice versa.

RESULT AND DISCUSSION

Dayak Meratus in a Glance

The *Dayak* refers to the tribe groups of indigenous people of Borneo Island who lived in the hinterland. They collected valuable forest product for their daily live and traded to the cities or the mouth of the river [8]. [1] estimated that roughly 3 million of people were classified as *Dayak*, or less than a third of the Borneo Island's population. They scattered in the territory of Indonesia (Kalimantan), Malaysia (Sabah and Sarawak), and Brunei Darussalam. In a 2010 census, this number was doubled into 7.09 million people, where more than half was live in the Indonesian territory of Kalimantan ([2], [10]). The *Dayak* group in Kalimantan can be classified into six clusters of tribes, i.e.: *Klemantan, Iban, Apokayan, Murut, Ot Danum-Ngaju*, and *Punan* [14]. Linguistically, they can be divided into 5 family languages, namely: *Barito Raya, Dayak Darat, Borneo Utara*, *Sulawesi Selatan*, and *Melayik* [6]. Overall, the *Dayak* group is comprised of 405 sub-tribes [14].

Dayak Meratus is incorporated to *Punan* cluster [21], but [20] include them into the *Ngaju*. Linguistically, *Dayak Meratus* belong to the *Melayik* language group [6]. They live in the hinterland of hills and mountainous area of Meratus in South Kalimantan. They are also known as *Dayak Bukit/Buket* which literally means "origin". In a 2000 census, the population accounted 35,838 persons [2].

They are subsistence farmer, who cultivate rice, groundnut, banana, corn, sugar cane, and chilli. They also gather non-timber product and hunting. Some of them cultivate native rubber plants, candlenut, and cinnamon, to sustain their livelihood. Based on their customary land use, they only use the land designated for agricultural use, while protected and sacred forest are strictly forbidden.

Their farming fields belong to the individual within the community. A household head is entitled to 7 – 10 parcels of land which the acreage is based on the necessity or the number of family members. Their location is usually scattered and far from another. It may need a day to a week by foot from the village. These parcels can be passed down to their children by customary approval. A farmer uses one parcel to cultivate rice in a year. Then, they will move to the next parcel while the previous parcel is fallowed. This step is continued until all parcels were used and the farmer goes back to the first parcel after years. By implementing this, the land has appropriate time to recover.

Rice farming is considered as sacred activity and it is a religious obligatory. Each stage of its farming practices, from land clearing to post-harvesting, must be associated to sacred ritual and accordance to the *Balian. Balian* is an old religion which emphasizes the ritual on daily lives, especially the farming practice, to respect the environment, forest and ancestors.

As aforementioned, all farming steps are initially started by ritual leaded by a shaman. It is initiated with area selection by observing some physical and botanical properties, for example: soil colour, bush density, plant diversification, etc. After shaman approval in a ritual, the land clearing stage is begun by making fire border around the field, slashing bushes with some trees are leaved, collecting plant remain in the middle, and burning the plant remains. The burning activity is usually carried out early in the morning to reduce heat and uncontrolled fire. After days, the ash and burnt remains are dispersed in cleared land and the planting is begun. They cultivate around 5 – 8 rice varieties in a field intercropped with corn, sugar cane, banana, and perennial trees. Rice can be harvested after 9 months. As rice selling is strictly forbidden, unhusked rice is kept in a handmade tube-like (known as *lulung*). Then, it is stored in the family granary which has certain features to ensure rice quality last longer. Each family has several tubes from each 4 – 5 year harvest. By implementing *first in first out* for their daily rice consumption, they ensure their food security as well as the quality.

Socio-Economic Characteristic of Respondent

The socio-economic characteristic of respondent is presented in the Table 1. As presented, all farmers are in the productive age and most of farmers in the middle age (60.87%). They have a large number of dependent family members (21.17%). This implies that they see that family member is the main source of labour in the future for agriculture and other activities.

Almost half of them land holding of 3 – 4 hectare. This number was estimated value since they have less knowledge about common unit of land area. They only know about *lembar* which literally mean as *a parcel of land*. The opened acreage of each *lembar* depends on their labour capacity.

Table1. *Socio-economic characteristic of the respondents (N=23)*

Variables	Frequency	Amount	Percentage of total respondents
Age (year)	< 30	5	21.74
	30 – 50	14	60.87
	>50	4	17.39
Family dependents (person)	2 – 4	11	47.83
	5 - 8	12	52.17
Land holding (ha)*	1 – 2	13	56.52
	3 – 4	10	43.48
Farming experience (year)	0 – 10	6	26.09
	10 – 20	8	34.78
	>20	7	30.43
Formal education	Uneducated	14	60.87
	Basic school	6	26.09
	Middle school	3	13.04

**) Estimated value*

They are experienced farmer which span from less than 10 years (26.09%) to more than 10 years (65.21%). However, this long experience inversely to their formal education. Around 60.87% of farmers are never attended a formal school. In addition, all of them did not have access to extension service and farmer group.

Ecological Assessment

According to the customary law, all farming stages must consider the nature perspective. The farming practices have been passed down from generations. The farming is started with the parcel selection. The farmers usually choose a parcel which has been fallowed for 5 – 10 years. It usually has trees with 20 – 30 cm of diameter as a sign that the soil fertility is relatively high. This selection also considers the vegetation features such as grass/bush density and plant diversity.

Slash and burning is quite common for land clearing. This is often accused as the cause of fire forest and environmental destruction. In facts, the farmer applied strict controlled burning. First, they made a fire barrier by slashing vegetation in 5 – 7 m width around their parcel. Then, the bushes and plant remain are burned step by step in the morning to avoid extra heat and uncontrolled fire. Main trees and bamboo trees are leaved to ensure good soil condition and prevent soil erosion. Then, the ashes and burnt remain are dispersed along the land and used as ameliorant. According to LEISA, slashing and burning is not encouraged because if may pollute air and decrease soil fertility in the long term.

They implement non-tillage without terracing, as they believe that terracing will disturb the soil structure. They leave some vegetation (wooden trees and bamboo) and perennial crop to minimize soil erosion. On the other hand, LEISA encourages terracing in the steep area and introduce plant to prevent soil erosion.

They cultivate local varieties of rice (from 46 variety of local rice available) which quite resistant to pest and disease, and fit to the ecological feature. On average, they cultivate 6.65 varieties in a parcel. [19] opines that this diversity will assure the sustainability of genetic diversity of rice. Intercropped with rice, they also plant banana, groundnut, sugarcane, pulses, and flower. This application is accordance with LEISA suggestion, as diversifying will help in maintaining biodiversity and ensure farmer food security.

Table2. *Indicators of ecological performance*

Indicators	Respondent (people)	Percentage of total respondents (%)
Land Slope		
Flat (0^0–15^0)	2	8.69
Steepy (15^0–30^0)	17	73.91
Steep (>30^0)	4	17.39
Initial land condition		
Bush	1	4.34
Trees	22	95.65
Forest	0	0
Fallowed land treatment		
Legume planting	0	0.00
Converted to perennial crop	18	78.26
No treatment	5	21.73
Fallow period		
> 8 year	13	56.52
5–7 year	9	39.13
<5 year	1	4.34
Land rotation		
3 year	0	0
2 year	2	8.69
1 year	21	91.30
Fertilizer use		
Never	21	91.30
Sometime	2	8.69
Always	0	0
Rice plant resistance		
Very resistant	3	13.04
Resistant	4	17.39
Not resistant	16	69.56
Level of combination to woody plant		
Yes	10	43.47
A little	12	52.17
No	1	4.34
Pesticide use		
Never	2	8.69
Sometime	13	56.52
Always	8	34.78
Number tree in the cultivated land		
Many	5	21.73
Around 1-25%	16	69.56
No tree	2	8.69

Commonly, they do not use additional fertilizer; except for only 2 farmers who use it rarely. Most of them believe that the soil fertility is high and the use of chemical fertilizer may harm soil structure and create a dependency to chemical substance in the future. In addition, 52.17% of respondents use pesticide rarely, and 34.78% use it more frequently. Beside charm and enchanting, the community have local knowledge to deal with the pest attack by smoke (by burning a part of *enau* (*Arecaceae*) tree). The use of anorganic fertilizer and pesticide is not recommended by LEISA, but the use of organic fertilizer and natural pesticide are highly recommended. Therefore, farmer should be encouraged to make their own fertilizer and pesticide by using any organic materials around. The participation of extension service with customary law approaches will have a great impact in changing their mind set.

After harvesting, 78.26% respondents plant native rubber plant on their land, while others fallow it to be secondary forest. About 39.13% respondents fallow their land for more than 8 years. This no-treatment behaviour on fallowed land is not recommended by LEISA. LEISA suggest to plant leguminous vegetation which as ability to fixate nitrogen from air. It will help the soil recover faster.

They do not sell their rice and it is strictly forbidden by the customary law. This law is implemented to avoid food scarcity if harvest failure is occurred. The granary is established 100 – 170 cm above the ground. The unhusked rice is kept in a tube-like storing known as *Lulung* (sized 150 - 200 cm in diameter, and 150 cm height). They use the oldest rice for consumption to assure rice quality. Each family at least has unhusked rice worth of 3 – 5 year harvest.

Observing the farming practice used, we compare to the principle of green farming proposed by [19] as the ideal green farming. We use score of each farming indicator to determine whether turning back rice cultivation meets green farming requirement in ideal form, medium, or low.

We found that the Ecological Level (EL) of turning back farming was 61.59% and it was on the medium level (55.54 – 77.76%). The reason is all respondents did not apply ameliorant and did not diversify with herbs. Furthermore, 86.95% of respondent did not use natural pest control and their land only can be cultivated during a year. Around 34.78% of respondent used pesticide and most of farmer did not treat their fallowed land. The absence of extension service and farmer group also contributed to this status.

This medium level mean that the turning back farming meets some green farming indicators, while also neglected other ecological value. The meet indicators includes the use of natural fertility, non-tillage application, diversify the cultivated plant, and mixing with woody plant. While the neglected ones are: pesticide and chemical fertilizer use, the use of high slope land which fragile to soil erosion, and improper irrigation.

Economic of Rice Farming Status

Rice is considered as sacred commodity and selling is forbidden. Despite of that, we tried to monetize the rice harvest as well as labour cost and input cost (except for pesticide and chemical fertilizer). We use the prices prevailed in the nearest village as the proxy of farm gate prices. By this approach, we calculate the harvest value and total cost of rice farming. The total harvest was converted from local unit (*gantang*) to kilogram. The farming costs include family labour, hired labour (*gotong royong*), ritual cost, own seed, tools depreciation, fertilizer and pesticide.

Table3. *Cost items of turning back farming practice*

Cost item	Value (IDR*)	%
Implicit costs		
a. Own seed	19,934.78	0.17
b. Family labor	3,868,260.87	32. 23
Explicit cost		
a. Hired labour *(gotong royong)*	1,000.000.00	8.59
b. Pesticide	179,130.43	1.53
c. Tools depreciation	691,097.39	5.94
d. Ritual (3 times)	6,000,000.00	51.55
Total cost	11,758,423.48	100.00

**) IDR = Indonesian currency (US$ 1.00 = IDR 12,177.70 in 2013)*

In average, they produced approximately 1939.79 kg of husked rice and it was worth of IDR 7,852,170.00 (US$ 644.79) per household. However, total cost was higher that the revenue which lead to the RCR value was less than 1.00 (RCR = 0.45). This result indicates that rice farming was financially not feasible. Even if the ritual cost was neglected, the RCR would be 0.94. However, the farmer still cultivates rice as it is obligatory farming. This is why they rely on perennial crops to sustain their livelihood. The ritual cost is also paid from perennial crops.

Reducing cost by abandoning ritual and reducing hired labour are not a good option because both cost items represent their traditional and cultural value and it against customary law. Hired labour cost is related to cost for community self-help (*gotong-royong*) where the neighbourhood help each other in farming activity, especially during planting and harvesting. This cost is assigned for food and beverage for the helpers during planting and harvesting. This mutual assistance is a part of tradition and a symbol of togetherness. Therefore, an increase of harvest might be the solution if they seek farming profit/surplus.

Farmer claimed that with existed yield, they can feed their family during a whole year. If they experience harvest failure, they can use their rice stock to survive for another 3 – 5 year in rows.

According to the customary law, keeping the harvest in traditional granary ensures their food security during bad year.

CONCLUSION AND RECOMMENDATION

The turning back farming follows continuous step arranged by customary law and started by rituals. It has local wisdom to harmonize farming activity to nature conservation. These local wisdoms also accommodate conservation, food security, and local culture.

The ecological level of turning back farming is in medium level as they neglected some ecological value, i.e.: no organic addition, no herb mixing, no animal-plant interaction use, no eco-friendly pest control, land only suitable for a year, use steep land, and no treatment for fallowed land. In economic point of view, the farming is not feasible as the total cost is higher that revenue. Most of the total costs are for rituals.

We suggest that the farmers follow customary law and conduct social control. Government support to use natural pesticide and organic fertilizer, and crop rotation is advised as well as appropriate extension service. We also recommend do more holistic study on household economic behaviour which include food production and gathering, food consumption, household expenditure, and family labour use.

REFERENCES

[1] Ave, J. B. and V. T. King. 1986. People of the weeping forest: Tradition and change in Borneo. National Museum of Ethnology, Leiden.

[2] CBS. 2010. "Kewarganegaraan, Suku Bangsa, Agama, dan Bahasa Sehari-Hari Penduduk Indonesia" (Citizenship, Ethnic Group, Religion, and Daily Language of Indonesian Population). Central Bureau of Statistic, Jakarta.

[3] CBS of South Kalimantan. 2012. South Kalimantan in Figures 2011. CBS of South Kalimantan, Banjarmasin.

[4] Chang, T. T. 1991. Problems of the green revolution in rice production. Conference on "Toward a Sustainable Environmental Future for the Southeast Asian Region" in Yogyakarta, Indonesia.

[5] Clark II, W. W. and G. Cooke. 2014. The Green Industrial Revolution. In: Clark, W. (ed) Global Sustainable Communities Handbook. Elsevier Inc.

[6] Etnologue (2016). Language Map of Indonesia, Kalimantan. Language of the World.

[7] Fuller, D. O., T. C. Jessup, and A. Salim (2004). Loss of forest covers in Kalimantan, Indonesia, since 1997-1998 El Nino. Conservation Biology, 18 (1): 249 – 254.

[8] Jessup, T. and A. P. Vadya (1988). Dayak and forests of interior Borneo. Expedition, 30(1): 5 – 17. www.penn.museum/documents/publications/expedition/ PDFs/30-1/Jessup.pdf. Accessed on: March 22, 2016.

[9] Joshi, L., K. Wijaya, M. Sirait, E. Mulyoutami. 2004. Indigenous systems and ecological knowledge among Dayak people in Kutai Barat, East Kalimantan – a preliminary report. ICRAF Southeast Asia Working People No. 2004_3. ICRAF Southeast Asia, Bogor.

[10] JPM (2011). "Taburan Penduduk dan Ciri Khas Demografi" (Population Dispersion and Demographic Characteristics). Jabatan Perangkaan Malaysia. Malaysia.

[11] Kalafatic, C. 2004. Indigenous peoples' sustainable livelihoods. FAO Livelihood Support Program.

[12] King, V. T. 2013. Borneo and Beyond: Reflection on Borneo Studies, Anthropology and the Social Sciences. Working Paper Series 3. Institute of Asian Studies, Universiti Brunei Darussalam.

[13] Kusuma, I, D. 2005. Economic Valuation of Natural Resource Management: A Case Study of the Benuaq Dayak Tribe in Kalimantan, Indonesia. PhD Dissertation. Louisiana State University and Agricultural and Mechanical College.

[14] Lontaan, J. U. (1975) "Sejarah, Hukum Adat dan Adat Istiadat Kalimantan Barat" (History, Customary Law, and Customs of West Kalimantan). Pemda Kalbar, Pontianak Indonesia.

[15] Perlas, N. 1993. The Seven Dimensions of Sustainable Agriculture. Center for Alternative Development Initiative.

[16] Pingali, P. L. 2012. Green Revolution: Impact, limits, and the path ahead. Proceedings of the National Academic of Sciences of the United States of America (PNAS). doi: 10.1073/pnas.0912953109.

[17] Pretty, J. 1995. Regenerating Agriculture: Policies and Practice for Sustainability and Self-Reliance. Earthscan, London.

[18] Pretty, J. 2008. Agricultural sustainability: Concepts, Principles, and Evidence. Philosophical Transaction of the Royal Society B, 363(2008): 447 – 465. DOI: 10.1098/rstb.2007.2163.

[19] Reijntjes, C, B. Haverkort, and A. Waters-Bayer. 1992. Farming for the Future: An Introduction to Low-External-Input and Sustainable Agriculture. Macmillan.

[20] Riwut, Tj. (1993). "Kalimantan Membangun Alam dan Kebudayaan" (Kalimantan Develop Nature and Culture). Tiara Wacana, Yogyakarta.

[21] Sellato, B. (1994). Nomads of the Borneo Rainforest: The Economics, Politics, and Ideology of Settling Down. University of Hawaii Press.

[22] Shiva, V. 2016. The Violence of the Green Revolution: Third World Agriculture, Ecology and Politics. University Press of Kentucky.

[23] Weihreter, E. (2014). Traditional knowledge, perceptions and forest conditions in a Dayak Mantebah community, West Kalimantan, Indonesia. CIFOR Working Paper No. 164. Center for International Forestry Research, Bogor, Indonesia.

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