Biodiversity and producivity indicators of Forest Health Monitoring as a valuation method on natural capital of Indonesian's community forest program

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ABSTRACT

Community forest program has been issued by Indonesian government since 1995 to rehabilitate protection forest, develope local government and jack up local community participation in state forest management. Sustainable Livelihood Framework (SLF) and Forest Health Monitoring (FHM) were used in this study to evaluate natural capital in the process of community forest management in Lampung's protection forest. Data were collected by interviewing respondents purposivelly selected from Beringin Jaya forest farmers groups located around protection forest in Tanggamus District, Lampung Province. A total of 71 households from Beringin Jaya forest farmers group representing 12,5 % of the members were randomly selected. Data were also collected from government officers in village, forest management unit (*Kesatuan Pengelolaan Hutan*), province and national level. 5 cluster plots were used and Biodiversity and productivity indicator of FHM were selected to know a natural capital of forest farmer group livelihood condition. The data were analyzed using SPSS. The result showed that the forest health status of natural capital of Beringin Jaya forest farmer group is enough good. Coffee plant is a dominant cultivation plant in protection forest. To improve the state forest condition, local government must assign forest farmer group to do rich planting in cultivation area.

Key words: community forest, forest health monitoring, natural capital, protection forest, sustainable livelihoods.

INTRODUCTION

The policy of state forest management in Indonesia have change many times. In Soeharto era, state forest was managed centralized. Management of state forest of Indonesia consentrated to forest companies. The poor people living in and around forest were not included by Indonesian government in state forest management. This resulted recurrent conflict and worsened local poverty, whereas the state forest land itself continued to be degraded (Suyanto, et.al., 2007). After the reformation, the government empowered the community in the management of state forests.

Community Forest (CF) Program (*Hutan Kemasyarakatan*), one of the aforementioned community forestry program, has established since 1995 after the central government issued Ministry of Forestry Decree no. 622/Kpts-II/1995 that focused on involving community around forest in the rehabilitation of degraded protection and production state forestland (Campbell 2002; Fay and de Foresta. 1998). Local communities merely as workers in forest rehabilitation activities and did not allow enter the forest and furthermore could not manage the forest. After financial crisis in 1998, management forest by participation of community got more attention that before (Arifin et al. 2009). Communities by established CF farmer groups, were given the opportunity by the government to obtain rights to manage state forests.

However, implementation of CF in the field is still encountering many obstacles, especially relating to farmers and local governance. There are several studies that have been done with regard to CF program in Indonesia. Arifin et al (2009) reported that attention against farmer's biggest concern in the community forest for forest protection is a long term contract, although the limitations of land use and the number and types of crops grown. Also farmers can expect to harvest timber on the land even though they now know not to cut them down (Kaskoyo et al. 2014). Another study conducted by Pender et al (2008), reported that the CF program in protection forests in West Lampung, reduced deforestation since farmers CF planted enrichment plant that could serve as the main crop plants (coffee) shade. Mahdi et al (2007) reported that watershed management program related to CF program in protection forest has greater changed the lost of forest cover, decreasing water, and increasing soil erosion. Despite already implemented international publications related to the effects of farmers' livelihood program to attendees CF especially in protection forests are still rarely found.

This paper used a comprehensive livelihood analyses based on a sustainable livelihood (SL) framework to access the performance the forest user group to manage the protection forest. In order to address the aim, we analyze the livelihood of

CF farmers in protection forest of Lampung, Indonesia by measuring access to livelihood capitals. Additionally FHM was used to evaluate the natural capital of CF farmer.

MATERIALS AND METHODS

Study area

This study was conducted in a CF farmer group area, i.e. Beringin Jaya farmer group its areas was located on Kota Agung Utara Forest Management Unit in Tanggamus District, Lampung Province. Beringin Jaya farmer groups was purposivelly selected for the award 1st winner of the national of sustainable forest (Wana Lestari) for CF farmer group from the Ministry of Environment and Forestry in 2016. According to Patton (1990), Cochran and Radiansyah (1991) and Iskandar (2008), purposive sampling is a deliberate sampling technique based on subjective assessment of researchers on the basis of certain characteristics considered to be related to previously known population characteristics. The research site is listed in Figure 1. Research was done on February- April 2018.

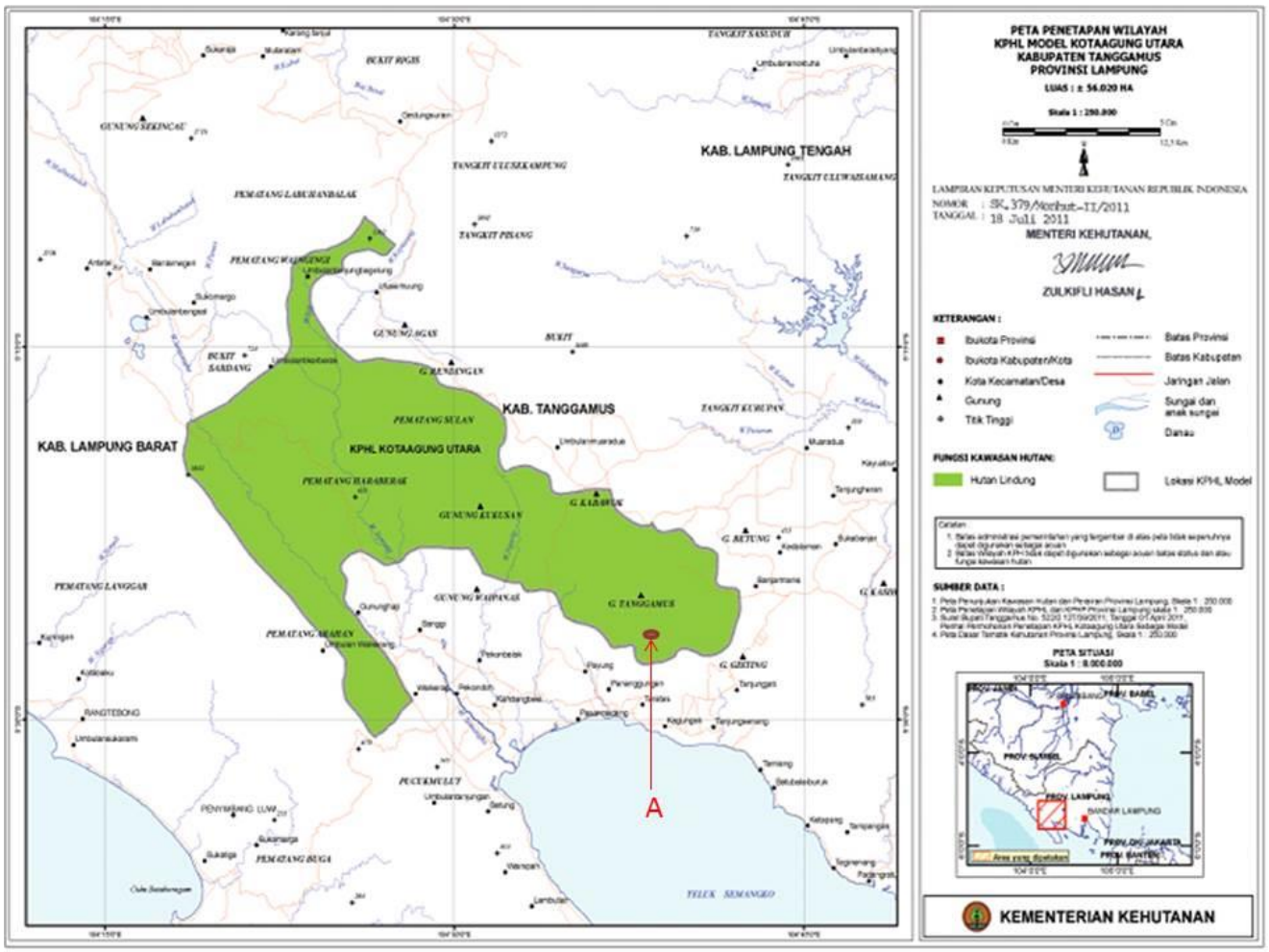

Figure 1. Location of research site (A).

A total of 71 households from Beringin Jaya forest farmers group representing 12,5 % of the members were randomly selected. Data were also purposivelly collected from government officers in village, forest management unit (*Kesatuan Pengelolaan Hutan*), province and national level. Five employees of each government officers were interviewed to support the data related to CF program.

The Sustainable Livelihood Framework (SLF) approach is used to identify the expected levels of life in groups by looking at the activities undertaken by each community using capacity capability and asset ownership.. Livelihood is understood as the capitals, activities and access to the capitals, which are mediated by institutional and social relations that together determine the living gained by individual or household (Ellis, 2000). A livelihood is the set of capabilities, capitals and activities, that furnish the means for people to meet their basic needs and support their well-being (Chambers

and Conway, 1992). The SLF has been developed by DFID and was used to know the change of condition before and after existence of community empowerment program through CF. Livelihood capitals are the resources on which people draw in order to carry out their livelihood strategies (Farrington, Ramasut and Walker, 2002). Capitals are not just a thing that go into a production process but also a basis for power to act and ultimately to bring about change in society (Morse and McNamara, 2013). These asset types are human, natural, financial, physical, and social capital.This analysis involves the analysis of capitals owned by local communities around protection forests in the form of natural capitals only.

Five cluster plots were used and biodiversity as well as productivity indicator of FHM were selected to know a natural capital of forest farmer group livelihood condition. Supriyanto et al. (2001) states that ecological indicators of forest health may include biodiversity, productivity, vitality and site quality. In this paper we used biodiversity and producivity as indicators of FHM. In forest health assessments, the parameter that can be used for biodiversity indicators is the index of species diversity that can be calculated using the Shannon-Weiner Index. Trees growth as measured by the increment of basal. areas in each cluster plot can be used to calculate forest productivity. Basal. areas data retrieval was performed on all plants in the tree phase. The weighted value used as a reference is based on Putra (2004) and Safe'i et al.(2015) ie, the weighted value for biodiversiy of 0.077 and for productivity of 0.28. To determine the final value of forest health conditions, Putra (2004) stated the result of multiplication between the scores of each parameter with the weighted value of each parameter or can be formulated as follows: Forest Health Value = Weighted Value x Score Value. Score of forest health indicators is obtained through the transformation of the value of each parameter representing a forest health indicator. Score values are given at 0-10 intervals with the criteria as in Table 1. The higher the score indicates the higher the health level.The data were analyzed using SPSS.

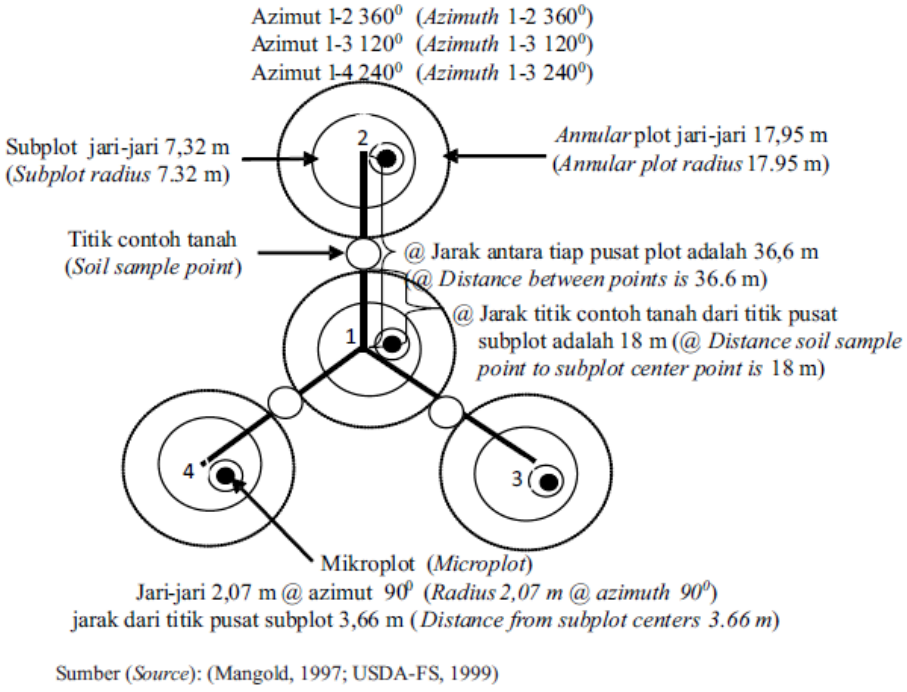

Figure 2. A Cluster Plot of FHM.

Table 1. Category of forest health based on score of indicators.

Score	Category of forest health
0-1	Very bad
2-3	Bad
4-5	Medium
6-7	Good
8-10	Very good

Source: Putra 2004

RESULTS AND DISCUSSION

Obstacles of CF program implementation

Implementation of CF program in Lampung Province has been running well. This is because the CF program has been socialized since 1998 and has many CF groups established and licensed CF in Lampung Province. Tanggamus Regency is one of the districts in Lampung Province which already has 5 CF groups that have been licensed to manage CF in 2008 (Kagungan, 2012). The successful implementation of CF in Tanggamus District is due to the support from the government (central, provincial and district), companions (NGOs and universities) and the community/group.

Although the implementation of CF program in Tanggamus Regency has been running well but there are still some obstacles in the implementation of CF program, among others: the lack of escort personnel especially after the CF management permit is given (especially related to the making of management plans, reporting activities, processing of crops and payment restribusi of CF crops). Implementation problems CF program appears also due to the many changes that occur in CF policy. Dwiprabowo dkk (2013) and Kaskoyo et al (2014) stated that there has been 9 times changes in CF policy in the period 1998 to 2011. In 2014 there is another regulation change related CF. In 2016 Community Forest (CF) is incorporated in or as part of the Social Forestry program.

Natural Capital and Its Changes

Natural capitals analyzed include: the area of arable land in protection forest, the size of the land owned, the number of coffee trees, the number of rubber trees, the number of timber trees in the owned land and the sense of security in managing the land and trees (Table1). Many things are natural capitals that change significantly. Cultivated area in protection forest increased significantly. The additional arable land is usually obtained by making a purchase (the term in the field is a compensation) to the farmer who moved the residence or need a cost to their daily life. The money of respondent used for the compensation is obtained from the sale of cultivated crops in the cultivated fields in the form of coffee, cocoa and rubber. There are also respondents who get the results from the labor of the farm laborers although only a few of them.

The area of land owned by farmers purchased outside state forest areas also increased significantly. Respondents are aware that managing land areas is only temporary so that they purchase land that can be managed much longer than land claimed. The land is generally located not far from where the respondent lived and planted timber trees as a savings that will be used when harvested / harvested. This is done by the respondents because the timber crops that exist in the arable land in the protection forest should not be felled. The forest provision is a provision of the government to keep the function of protection forest can run continuously. It also encourages the number of timber trees in the property to increase significantly. Safety in managing cultivated land and crops at the CF site also increased significantly. This is because the legality / permission granted to manage the arable land in protection forest has been provided by the government. Respondents felt that the management of the cultivated land had been so that if any other party would use or seize the land they would be protected by the government. Prior to the CF permit, respondents were often asked for some of their harvest by irresponsible people and this was similar to the results of research Kaskoyo et al. (2017).

Table 1. Changes in Natural Capital.

No	Natural Capital	Mean of Natural Capital	
		Before	After
1	Cultivated area inside protection forest (ha)	1,1*	1,65*
2	Private landholding outside protection forest (ha)	0,8*	1,6*
3	Amount of coffee trees (no.)	X	5395
4	Amount of rubber trees (no.)	X	118
5	Amount of wood trees inside protection forest (no.)	X	125
6	Amount of wood trees in private landholding outside protection forest (no.)	12*	26*
7	Security of cultivate land and trees (%)	30*	100*

Note: * Significant difference between before and after ($p < 0,05$)

Forest Health Status of Natural Capitals

The productivity of protection forests is actually measured by the productivity of forests in generating non-timber forest products in the cultivation and protection areas. However, with regard to the function of protection forests, productivity can also be approximated by the increment of basal area. The value of basal area is shown in Table 2.

Table 2. Value of Basal Area (m^2) in each cluster plot.

Cluster Plot	Basal Area (m^2)
1	8.28
2	11.57
3	9.92
4	2.37
5	5.45

Note: Compiled and analyzed from field data

Biodiversity is important in the management of protected forests. Plant planting in protected forest management should use an agroforestry system. The species diversity index is calculated using the Shannon-Weiner Index formulation. The value of biodiversity is shown in Table 3.

Table 3. Value of Biodiversity in each cluster plot.

Cluster Plot	Biodiversity
1	2.27
2	1.45
3	2.24
4	0.66
5	1.13

Note: Compiled and analyzed from field data

Forest health can be used to evaluate the community's success in protection forests management. The calculation of forest health on natural capitals is obtained by using the formula at above. The score and status of forest health could be seen in Table 4.

Table 4. Value of Biodiversity in each cluster plot.

Cluster Plot	Final Value of Forest (Natural Capitals) Health in CF	Forest Health Category of Natural Capitals Conditions
1	5	Medium
2	6	Good
3	7	Good
4	3	Bad
5	5	Medium

Note: Compiled and analyzed from field data

Discussion

To achieve positive social and environmental outcomes, specially in developing nations, Decentralized forest management is one of the three major contemporary forest governance policies that is being implemented (Agrawal et al., 2008). The CF program, can improvement in the security of land-use rights as well as improved the number of woody plants inside the CF land. The CF farmers mentioned that before CF program implemented, they were reluctant to invest much in plants or many perennials as their right to the land as well as its products was not secured. They also could not remember the number of perennial trees as well as cash crops they used to plant inside the forest. The uncertainty of security of rights caused the farmers planted, nurtured, and harvested their crops in secret and quickly even for immature coffee (Kaskoyo e al. 2017).

The degree of flexibility of an ecosystem to the pressures and disturbances present in natural forests can be presented by biodiversity. Monitoring forest health through productivity assessments is used to view tree growth and growth, not just current productivity .

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REFERENCES

Agrawal, A., Chhatre, A., Hardin, R. 2008. Changing governance of the world's forest. Science, 320(5882), 1460-1462.

Arifin, B., B. Swallow, Suyanto, Richard. 2009. A Conjoint Analysis of Farmer Preference for Community Forestry contract in the Sumberjaya Watershed, Indonesia. Journal Ecological Economic 68:2040-2050.

Chambers R, Conway GR. 1992. Sustainable rural livelihoods: practical concepts for 21st century. IDS discussion paper 296, Department for International Development, London.

Cochran, W. G., Radiansyah. 1991. *Teknik penarikan sampel*. University Indonesia Press.

Dwiprabowo, H., Mulyaningrum, M., Suwarno, E. 2013. *Organisasi Belajar dan Implementasi Kebijakan Hutan Kemasyarakatan (HKm). Jurnal Penelitian Sosial dan Ekonomi Kehutanan, 10*(2), 85-98.

Ellis, F. 2000. *Rural livelihoods and diversity in developing countries*. Oxford university press.Farrington, Ramasut and Walker 2002

Fay, Chip, Hubert de Foresta. 1998. Progress Towards Increasing the Role Local Play in Forest Lands Management in Indonesia. Southeast Asia Policy Research Working Paper, No.27. International Center for Research in Agroforestry (ICRAF) Southeast Asia, Bogor, Indonesia.

Iskandar. 2008. *Metodologi Penelitian Pendidikan dan Sosial (Kuantitatif dan Kualitatif).* Jakarta: GP Press.

Kagungan, D. 2012. *Kebijakan Hutan Kemasyarakatan (HKM) Di Kabupaten Tanggamus Provinsi Lampung*. *PUBLICA*, *2*(1).

Kaskoyo, H., Mohammed, AJ., Inoue, M. 2014. Present State of Community Forestry (Hutan Kemasyarakatan/HKm) Program in Forest and Its Challenges: Case Study in Lampung Province, Indonesia. *Journal of Forest Science*, *30*(1), 15-29.

Kaskoyo, H., Mohammed, AJ, Inoue, M. 2017. Impact of community forest program in protection forest on livelihood outcomes: A case study of Lampung Province, Indonesia.*Journal of Sustainable Forestry*, *36*(3), 250-263.

Mangold, R. 1997. Forest Health Monitoring: Field Methods Guide. *Buku*. USDA Forest Service. New York. 246 p.

Morse, S., & McNamara, N. 2013. Sustainable livelihood approach: A critique of theory and practice. Springer Science & Business Media.

Patton, M. Q. 1990. Qualitative evaluation and research methods. SAGE Publications, inc.

Pender J., Suyanto, John, K., Edward, K. 2008. Impacts of the Hutan Kemasyarakatan Social Forestry Program in the Sumberjaya Watershed, West Lampung District of Sumatra, Indonesia. IFPRI Discussion Paper No. 00769.

Putra, E. I. 2004. *Pengembangan Metode Penilaian Kesehatan Hutan Alam Produksi*. Tesis. Tidak dipublikasikan. Program Pasca Sarjana. Institut Pertanian Bogor. Bogor.

Suyanto, S., Khususiyah, N., Leimona, B. 2007. Poverty and environmental services: case study in Way Besai watershed, Lampung Province, Indonesia. *Ecology and Society*,*12*(2).

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