**Regular Article**
pISSN: 2288-9744, eISSN: 2288-9752
Journal of Forest and Environmental Science
Vol. 35, No. 2, pp. 102-114, June, 2019
https://doi.org/10.7747/JFES.2019.35.2.102

JFES
Journal of Forest and Environmental Science

# The Impact of Community-Based Forest Management on Local People around the Forest: Case Study in Forest Management Unit Bogor, Indonesia

Nugraha Cahya Fajar and Joon Soon Kim*
*Department of Forest Management, Kangwon National University, Chuncheon 24341, Republic of Korea*

## Abstract

The issue of sustainable forest management (SFM) continues to emerge as part of the REDD+ mechanism mitigation efforts. Especially for some developing countries, such as Indonesia, forest management is required to provide benefits to the welfare of local communities in addition to forest conservation efforts. This study aims to identify the economic, social, and environmental impacts of community-based forest management (CBFM) implementation activities, which is one of the implementations of SFM at field level. The primary objectives were to find out the impacts of CBFM activities based on local people's perceptions and to identify what factors need to be considered to increase local people's satisfaction on CBFM activities. The data from 6 sub-villages was derived through surveys with local people involved in CBFM activities, interviews with a key informant, and supported by secondary data. The results of the study state that CBFM activities have increased the local people's income as well as their welfare, strengthening the local institution, and help to resolve conflicts in the study area. CBFM has also been successful in protecting forests by rehabilitating unproductive lands and increase forest cover area. By using binary logistic regression analysis, it found that income, business development opportunities, access to forests, conflict resolution, institutional strengthening, and forest rehabilitation variable significantly affected the local people's satisfaction of CBFM activities.

**Key Words:** sustainable forest management, community based forest management, local people, economic impact, social impact, ecological impact

## Introduction

Deforestation not only contributes substantially to global greenhouse-gas emissions and degrade vital ecosystem services, such as carbon storage in biomass and soils (Foley et al. 2007; Miles and Kapos 2008; Harris et al. 2012) but also results in a loss for those peoples who live around the forest. However, according to Sobrevila (2008), forest-dependents communities can cope with the negative effects of global climate change through Sustainable Forest Management (SFM). One of SFM implementation is Community-based Forest Management (CBFM). CBFM allows the use of such local resources as indigenous knowledge and institutions in promoting Sustainable Forest Management (Guiang et al. 2001).

After introduced in the late 1970s, CBFM has proven a successful model for forest conservation, reforestation, afforestation, and diversifying economic opportunities in ru-

Received: February 28, 2019. Revised: June 12, 2019. Accepted: June 18, 2019.

Corresponding author: Joon Soon Kim
Department of Forest Management, Kangwon National University, Chuncheon 24341, Republic of Korea
Tel: 82-33-250-8338, Fax: 82-33-243-2901, E-mail: jskim@kangwon.ac.kr

ral communities (Ellis and Porter-Bolland 2008; Nath et al. 2016). CBFM advocates a need to empower and involve communities or local peoples in forest management planning activities, so forest protection and sustainable use can be more effectively achieved when local peoples implement by themselves because they are therefore among the most vulnerable peoples to global climate change (Guiang et al. 2001; Macchi et al. 2008). According to Angelsen et al. (2009), CBFM also called in many different and specific form, such as community forest management (CFM), participatory forest management (PFM), and some other forms.

Several studies analyze the impact of CBFM in the context of economic, social, and ecological impact. The purpose of CBFM activities is to prosper the people who live around the forest, one of which is through increasing their income. According to Ranjit (2012), Rai et al. (2016), community forests have provided income and employment opportunities directly or indirectly to the user groups to enhance their welfare. Economic improvements caused by CBFM also improve the social conditions of communities around the forest. CBFM provides rights and access to utilize forest resources and establishes infrastructures development for their livelihood (Carig 2012; Ceballos 2016). However, the primary purpose of community involvement in forest management is to reduce conflicts between communities and forests, because legal ambiguity over land and natural resources has resulted in tenure insecurity, impacting livelihoods and perpetuating conflict (Riggs et al. 2016).

According to Santika et al. (2017), CBFM has successfully achieved avoided deforestation. Intensively managed forests gave better results than the forest that was not managed intensively, in terms of the number of trees, diversity of tree species, and benefits that could be taken by farmers in the short term (Winata and Yuliana 2014). Community forest management has been identified as a win-win option for reducing deforestation while improving the welfare of rural communities in developing countries. Since the proliferation of deforestation in Indonesia, this study tries to find a positive relationship between socio-economic and ecological aspects, and find out whether economic and social benefits are in line with improving environmental quality.

Issues about forest management involving communities around the forest have existed in Indonesia since two decades ago. However, lately, the issue has strengthened with the rise of conflicts between communities and forests. The latest issue, the Indonesian Ministry of Environment and Forestry through Ministerial Regulation No. 83 of 2016, created a Social Forestry program aimed at improving community welfare, environmental balance, and socio-cultural dynamics, which is in line with the aim of CBFM in detail and Sustainable Forest Management in general. In the 2015-2019 period, the Government allocated 12.7 million hectares for this Social Forestry program.

Perum Perhutani, an Indonesian state-owned forestry company, has implemented another CBFM form, called the Pengelolaan Hutan Bersama Masyarakat (PHBM). Through the Directors Decree No. 682 of 2009, the Perum Perhutani aims to improve empowerment and the role of the community and or interested stakeholders, in managing forest resources. According to Perum Perhutani (2018), PHBM program can absorb 6,304,467 people with a value of IDR 2,705.71 billion (USD=IDR 14,000), and the benefit-sharing realization for timber and non-timber production reached IDR 252.34 billion.

Focus on the CBFM application in Forest Management Unit Bogor Indonesia as one of Perum Perhutani working area, especially in Tugu Utara village, the objectives of this study were: 1) to find out the community-based forest management impact on local people who lived around the forest area, and 2) to find out the factors that affect local community satisfaction on the impacts of CBFM previously mentioned. The study area which is a conservation area makes this study tries to determine the impact of CBFM economically, socially and ecologically, and find out whether there is a trade-off relationship or not between socio-economic and environmental conditions as mentioned in several previous studies due to open access (Guiang et al. 2001; Lasco and Pulhin 2006).

## Materials and Methods

### *Study site description*

This study was conducted in Forest Management Unit Bogor as one of Perum Perhutani working area, which located in Bogor Regency, West Java Province, Indonesia. In

this area, the forest areas and tea plantation areas are located directly adjacent to residential areas (Fig. 1). This site was selected as a representative research location based on some considerations. This area is one of the successful CBFM implementations in Indonesia and located as a multifunctional area (as a tourism spot and also a conservation area). According to Hidayat et al. (2017), coffee is one of the intercropping activities products in this area that planted between forest stands, and in 2016, Robusta coffee produced from this area had won the National Specialties Coffee Contest. Based on Indonesian Presidential Decree Number 144 of 1999, this area is a conservation area that has a function as a carbon reserve and water catchment area. However, according to Nerustia et al. (2015), uncontrolled utilization of this conservation area (by tourist activities) makes it threatened by degradation due to poor spatial planning.

## *Data collection and analysis*

### Data collection

The study was carried out from February to August 2018. The preliminary observation was conducted to get a general picture of the CBFM implementation in the research sites. Data was collected using open-ended and semi-structured questionnaire interview, direct observation, as well as document and archival reviews. The open-ended interview was conducted with purposefully selected key informants from the farmer, community institution member, CBFM staff, and forest management unit staff as a representative from Perum Perhutani as the landowner and policymaker. The discussion was conducted with them to collect data on the process of implementation of CBFM and challenges faced.

The individual face-to-face interviews were conducted through a semi-structured questionnaire involving forest-dependent people who involved in CBFM activities from a sample of 6 sub-villages; 105 from 110 respondents providing valid answers were selected. The population in this study is a forest-dependent community that is directly involved in CBFM activities. One hundred five respondents were determined through a purposive sampling technique

**Table 1.** Descriptive statistics of socio-economic characteristics

| Variables | % | Mean | Std. Dev. |
|---|---|---|---|
| Location | | | |
| Sub-village 1 | 17.14 | | |
| Sub-village 2 | 6.67 | | |
| Sub-village 3 | 10.48 | | |
| Sub-village 4 | 27.62 | | |
| Sub-village 5 | 21.90 | | |
| Sub-village 6 | 16.19 | | |
| Gender | | 1.90 | 0.31 |
| 1=Male | 94.90 | | |
| 2=Female | 11.10 | | |
| Age | | 2.44 | 1.07 |
| 1=<30 | 24.23 | | |
| 2=31-40 | 31.30 | | |
| 3=41-50 | 3.31 | | |
| 4=51-60 | 14.13 | | |
| 5=>60 | 3.3 | | |
| Last education | | 1.42 | 0.77 |
| 1=Elementary school | 77.73 | | |
| 2=Junior high school | 14.13 | | |
| 3=Senior high school | 12.12 | | |
| 4=>diploma | 3.2 | | |

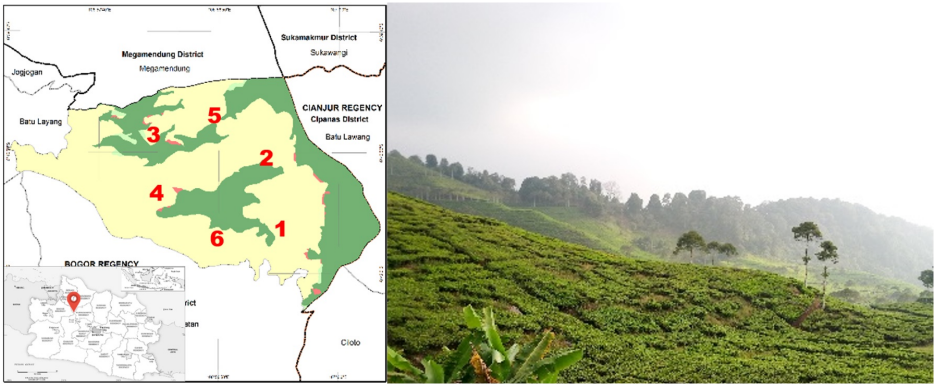


**Fig. 1.** Study site and overview.

based on a list provided by CBFM staff. The author has selected respondents who are considered to have benefited directly from CBFM activities and are considered to represent six sub-villages, which are the study areas. The differences in respondents proportion are different in each sub-village is due to differences in the number of residents in the sub-village (Table 1). The gender of the respondents (94 male and 11 female) was assumed not to affect the results of the study because based on the data, most of the local people involved in CBFM activities were male.

The questionnaire was comprised of the following three sections:

(1) Socio-economic and Demographic data: This section included demographic and socioeconomic questions such as the respondent's age, education, gender, CBFM and non-CBFM household income, household size, and land ownership.

(2) Perception Data: This part included questions on local people' perception of CBFM impact and to be measured on a five-point Likert scale. The author asked respondents about their agreement on statements which aimed to assess CBFM impact on their socio-economic life. Data was also collected on the local peoples' perception of the ecological impact of CBFM activities.

(3) Satisfaction Data: at the end of the interview, the author asked respondents overall satisfaction about CBFM activities based on the impacts they had experienced. Respondents' answers are summarized dichotomous (satisfied and non-satisfied).

The secondary sources of data covered information such as forest cover area, land utilization, population, and study area maps were collected from the Forest Management Unit Bogor and the Research Center and Planning for Regional Development (P4W IPB).

### Data analysis

The collected data were analyzed using qualitative and quantitative analysis and divided based on the purposes of the study:

CBFM impact on local people living around the forest: This study looked at the impact of CBFM implementation based on the perceptions of local people who were directly involved in CBFM activities and received several benefits during their involvement. To examine the local people perceptions on CBFM impact (economic, social, and ecological impact), ten indicators were measured through the Likert scale and were analyzed using Summated Rating Scales. According to Shukla and Sharma (2017), Summated Rating Scale is designed to produce scores indicating the intensity and direction of a person's feelings about an object, or in this case of study, was a CBFM impact. The CBFM impact measured in this analysis divided into the economy, social, and ecological impact. Each impact consists of several indicators collected from various studies on the impact of CBFM activities. Then the author categorized those indicators based on economic, social, and ecological aspects Table 2.

To support the results of the Summated Rating Scale analysis, some additional simple analysis was carried out. These analyses aim to look at the impact of CBFM implementation, based on the three aspects (economy, social, and ecology), in real terms.

**Table 2.** Aspects and indicators

| Aspect | Indicator | Source |
|---|---|---|
| Economy | 1. CBFM provide employment opportunity | Ranjit 2012; Rai et al. 2016 |
| | 2. CBFM support local people's business development | Camacho et al. 2007 |
| Social | 3. CBFM give an easiest access to the forests | Carig 2012 |
| | 4. CBFM support facilities and infrastructure development | Ceballos 2016 |
| | 5. CBFM provides some trainings | Ceballos 2016; Farouque et al. 2017 |
| | 6. CBFM assists to resolve a forest conflict | Bullock and Hanna 2008; Riggs et al. 2016 |
| | 7. CBFM support local institutional strengthening | Takahashi 2008 |
| | 8. CBFM applies fair management | Agarwal 2009; Duguma et al. 2018 |
| Ecology | 9. CBFM support forest rehabilitation activities | Winata and Yuliana 2014; Santika et al. 2017 |
| | 10. CBFM support forest disaster prevention | Gurung et al. 2013 |

**Economic impact:** To measure the economic impact, income comparison (income from CBFM activities and non-CBFM activities) was conducted to figure out CBFM income contribution on respondents' total income in one year. Income from CBFM. Income from CBFM activities derived from coffee cultivation, ecotourism activities, and some types of minor/indirectly occupation related to CBFM activities such as parking or food stall providers in tourist areas, and so on. While income from non-CBFM obtained from other jobs such as salary as a tea farmer, livestock business, and so on.

**Social impact:** For social impact, the author collects information from key informants about the most conflicts that occur in the study area, how to resolve the conflict, and how the conflict progresses. These kinds of data and information were collected through an in-depth interview with some influential local community, and several related stakeholders, such as village head and CBFM staff. These data were analyzed using descriptive analysis.

**Ecological impact:** To figuring out the ecological impact, the data of land cover change has been compared using a table. The land cover is consist of forest land and non-forest land. These data were collected from the Research Center and Planning for Regional Development (P4W IPB). The land cover when the CBFM just implemented in 2008 has been compared with the land cover when the research was conducted in 2018. After compared in the table, these data were analyzed using descriptive analysis.

**Factors that affect local people satisfaction on CBFM implementation:** For this part, the binary logistic regression analysis was conducted to figure out overall local people satisfaction on CBFM impact based on their perception and incomes that generated from CBFM activities. The dependent variable in this model is local people's overall satisfaction on CBFM activities (both economically, socially, and ecologically), which is assessed dichotomously (0=not-satisfied, 1=satisfied). While the independent variables are ten indicators on previous objectives, include income generated from CBFM as the 11th independent variable (Table 3). For examine the result, binary logistic regression was conducted to find out which independent variable that affects local people satisfaction on CBFM

**Table 3.** Descriptive statistics of the independent variables

| Variable | Description | Unit | Mean | SD |
|---|---|---|---|---|
| Income | Respondent's income that only generated form CBFM activities | 100.000 IDR (USD 1= IDR 14,000) | 100.47 | 133.91 |
| Employment | Respondent's perception on employment opportunity in CBFM activities | 1=Strongly disagree 2=Disagree | 3.99 | 0.51 |
| Business | Respondent's perception on business development opportunity in CBFM activities | 3=Neutral 4=Agree | 3.66 | 0.60 |
| Access | Respondent's perception on access to the forests after CBFM activities | 5=Strongly agree | 3.91 | 0.55 |
| Fair | Respondent's perception on fair management application in CBFM activities | | 3.58 | 0.81 |
| Trainings | Respondent's perception on training provision during CBFM activities | | 2.72 | 1.02 |
| Facilities | Respondent's perception on facilities and infrastructure improvements after CBFM activities | | 3.29 | 0.93 |
| Institution | Respondent's perception on local institutional strengthening after CBFM activities | | 3.59 | 0.78 |
| Conflict | Respondent's perception on forest conflict resolution after CBFM activities | | 3.39 | 1.00 |
| Rehabilitation | Respondent's perception on forest rehabilitation after CBFM activities | | 3.62 | 0.74 |
| Prevention | Respondent's perception on disaster prevention after CBFM activities | | 3.31 | 0.62 |

activities. For eliminate the non-significant independent variables, a stepwise analysis (with 5% and 10% significance level) was carried out to produce a new model containing only variables that significantly affected respondents' satisfaction on CBFM activities. All analyses in this study were performed using IBM SPSS Statistic 23 software.

## Results

### *Community-based forest management implementation in study area*

In the study area, the forest areas and tea plantation areas are located directly adjacent to residential areas (Fig. 1), so the possibility of the local people carrying out illegal forest utilization to meet their daily needs is very high. Therefore, CBFM implementation in this area cannot use the production of timber products as a solution to increase community income, but through sustainable utilization that can improve community welfare without destroying forest stands such as non-timber forest products, intercropping between forest stands and ecotourism activities.

This area has some different potential to implement CBFM activities. This study was divided into six sub-villages that have their potential and character. Sub-village 1 (Cibulao), Sub-village 2 (Cikoneng), Sub-village 3 (Rawa Gede) and Sub-village 5 (LC) are located in the middle of tea plantation that owned by a private company, so most of the population in these villages work as tea farmer. Meanwhile, Sub-village 4 (Cisuren) and Sub-village 6 (Pondok Rawa) are located close to the main road, and most people work as an assistant in a private-owned villa, micro-shop seller or entrepreneur. Sub-village 1 has a mountain bike track, Sub-village 4 has a waterfall attraction, Sub-village 5 has beautiful hills, and Sub-village 6 has a camping ground as a tourism destination. Now the local people and local government continue to explore and develop a tourism potential and other potentials in other Sub-villages to improve the local people welfare without damaging the forest stands. The potentials of each sub-village summarized in Table 4.

### *Community-based forest management impact*

In this study, local people perceptions as the main actors in CBFM were fundamental, because the perceptions they felt during the implementation of CBFM were used as benchmarks to determine the impact of CBFM activities. Table 5 presents the analysis results of Summated Rating Scale, which contains local people's perceptions of each indicator and their overall perception of CBFM activities. The different potentials in each sub-village (Table 4) affect the results of this analysis.

#### Economic impact

Based on Table 5, the local people show agreed perceptions for all indicators in the economic aspect. The local people agreed that CBFM has absorbed many labors or has provided many employment opportunities to communities around the forest, either directly (CBFM staff, coffee farmers, tourism managers), or indirectly (open places to eat, lodging, parking lots, security or stores around the tourism place). The local people also agreed that CBFM supported people around the forest to develop their businesses, generally through capital loans for their business, providing

**Table 4.** A potential summary of each sub-village

| Sub-village | Location | Dominant occupation | Current CBFM activities |
|---|---|---|---|
| Sub-village 1 | In the middle of tea plantation, but near to main road | Tea farmer | Tourism: bike track<br>Intercropping : coffee plantation |
| Sub-village 2 | In the middle of tea plantation | Tea farmer | Intercropping: coffee plantation |
| Sub-village 3 | In the middle of tea plantation | Tea farmer | Intercropping: vegetable plantation |
| Sub-village 4 | Near to main road | Entrepreneur, Tourist service provider | Tourism: waterfall attractions |
| Sub-village 5 | Between tea plantation and forest area (farthest from main road) | Tourist service provider | Tourism: mountain and hills attractions |
| Sub-village 6 | Near to main road | Entrepreneur, Tourist service provider | Tourism: camping ground attractions |

**Table 5.** Results of the summated rating scale

| Aspect | Indicator | SD | D | N | A | SA | Total score | Indicator score | Perception |
|---|---|---|---|---|---|---|---|---|---|
| Economy | 1. Employment opportunity | 0 | 2 | 8 | 84 | 11 | 419 | 3.990 | AGREE |
| | 2. Business development opportunity | 0 | 3 | 34 | 64 | 4 | 384 | 3.657 | AGREE |
| Social | 3. Access to the forests | 0 | 4 | 9 | 84 | 8 | 411 | 3.914 | AGREE |
| | 4. Conflict resolution | 1 | 10 | 30 | 55 | 9 | 376 | 3.581 | AGREE |
| | 5. Trainings provision | 6 | 55 | 6 | 38 | 0 | 286 | 2.724 | NEUTRAL |
| | 6. Facilities and infrastructure | 2 | 27 | 17 | 57 | 2 | 345 | 3.286 | NEUTRAL |
| | 7. Institutional strengthening | 1 | 10 | 26 | 62 | 6 | 377 | 3.590 | AGREE |
| | 8. Fair management | 3 | 20 | 26 | 45 | 11 | 356 | 3.390 | NEUTRAL |
| Ecology | 9. Forest rehabilitation | 0 | 5 | 41 | 48 | 11 | 380 | 3.619 | AGREE |
| | 10. Disaster prevention | 0 | 9 | 54 | 42 | 0 | 348 | 3.314 | NEUTRAL |
| Total | | | | | | | 3,682 | AGREE | |

SD, strongly disagree; D, disagree; N, neutral; A, agree; SA, strongly agree.

**Table 6.** Income contribution in one year

| Sub-village | Income CBFM in one year | | | Income Non-CBFM in one year | | | Increased income (%) |
|---|---|---|---|---|---|---|---|
| | ∑ Income (IDR) | Average (IDR) | Contribution (%) | ∑ Income (IDR) | Average (IDR) | Contribution (%) | |
| Sub-village 1 | 201,960,000 | 11,880,000 | 45.40 | 242,908,900 | 14,288,759 | 54.60 | 83.14 |
| Sub-village 2 | 138,710,000 | 6,030,870 | 30.64 | 313,980,000 | 13,651,304 | 69.36 | 44.18 |
| Sub-village 3 | 179,230,000 | 6,180,345 | 36.42 | 312,918,000 | 10,790,276 | 63.58 | 57.28 |
| Sub-village 4 | 220,000,000 | 20,000,000 | 57.14 | 165,000,000 | 15,000,000 | 42.86 | 133.33 |
| Sub-village 5 | 82,800,000 | 11,828,571 | 62.96 | 48,720,000 | 6,960,000 | 37.04 | 169.95 |
| Sub-village 6 | 232,240,000 | 12,902,222 | 59.64 | 157,174,000 | 8,731,889 | 40.36 | 147.76 |
| Total | 1,054,940,000 | 10,047,048 | 45.95 | 1,240,700,900 | 11,816,199 | 54.05 | 85.03 |

USD 1= IDR 14,000.

land rent for their plantation, assistance to market their products (coffee products, tourism spot, or other local people product from the forest), as well as conducting several pieces of training related to business development.

Based on Table 6, the contribution of income from CBFM activities per year is different in each Sub-village. The income contribution differences depend on the potential of each Sub-village, as explained before in Table 1. The potential of each village is different due to the differences in each sub-village location. The Sub-villages that does not have tourism potential yet tend to have lower income from CBFM. Most of the respondents still have a main job as a farmer in a tea plantation owned by a private company (Sub-villages 2 and 3). Meanwhile, the Sub-villages that have tourism potential have more significant income from CBFM activities, because most of the respondents choose to offer tourism services as main jobs (Sub-villages 1,4, 5 and 6). The CBFM in these Sub-villages have contributions above 50% because the lakes, hills and camping ground that they manage have become one of the favorite tourist attractions so that most of the local peoples' income in these sub-villages generated from ecotourism activities. Overall, CBFM activities contribute 45.95% of the total income of local people per year, or in other words their income increase by 85.03% when compared to total income without the income from CBFM activities.

### Social impact

For social aspects, six indicators assess the impact of CBFM activities on local communities around the forest.

Based on the results, respondents agreed that through CBFM activities, they had more easy access to enter the forest or to utilize and manage forest resources. After the CBFM, the community was permitted to plant coffee plants in the forest area and carry out forest utilization activities in the form of ecotourism management. Respondents also agreed that local people involvement in CBFM activities had reduced any conflict in forest area, which is generally caused by land ownership issues that could trigger the illegal logging activities. CBFM activities also have helped strengthen the local institutions through the farmer group formation. Therefore, respondents agreed that CBFM activities had helped strengthen local institutions in their area.

However, not all indicators were approved by respondents as a positive impact of CBFM activities. Respondents chose to be neutral or hesitant when they asked about their perceptions about the availability of training and the facilities and infrastructure development during CBFM implementation. Currently, the provision of training and infrastructure development is still centered in Sub-village 1, 4, and 6 because of its location close to the main road. Sub-village 1 has a coffee development center that is already national level, while Sub-village 4 and 6 is located near the center of the village administration. Respondents also answered neutrally when asked whether the implementation of CBFM activities had implemented fair management practice. This result is related to the previous indicator. Residents in sub-villages 2, 3, and 5 consider the CBFM management not yet fair because the development is still concentrated in the sub-villages close to the main road. The uneven development of CBFM activities in all rural areas was suspected to be the reason why respondents chose to answer neutral for these three indicators. The local people hope that the infrastructure development, as well as capacity building training, can be more evenly distributed throughout the sub-villages.in the future.

The condition of the community who lived around the forest is mostly less capable and does not have private land. It makes the forest encroachment as the most frequently encountered conflict in the study area. Communities carried out illegal planting and illegal logging activities to fulfill their daily needs. According to Fig. 2, around 2000, farmers were encroaching forests and planting them with vegetables, which are the main crops of farmers, such as tomatoes, carrots, cabbage, and broccoli. If calculations are made, the benefits of farmers from growing vegetables are not sufficient for them, because they sell their harvested vegetables to middlemen or dealers, so the price is far below the market price. This condition is endangering the condition of the forest because if left unchecked, the forest encroachment will continue to expand in line with the needs of the farmers. In 2008, Perum Perhutani helped the community to create local forest community institutions and make work plans for implementing CBFM programs to improve forest community welfare without destroying forest ecosystems. CBFM offers to change vegetables into coffee plants because it can be planted between tree stands and can be harvested twice a year. CBFM also provides training related to marketing coffee products harvested by the community. According to Firdaus (2017), the number of conflicts related to forest encroachment has continued to decline since the CBFM implementation.

### Ecological impact

For ecological aspects, respondents agreed that CBFM activities had a positive effect on the forest rehabilitation process. Based on respondent information in the study area, about 100 ha unproductive land was re-planted during

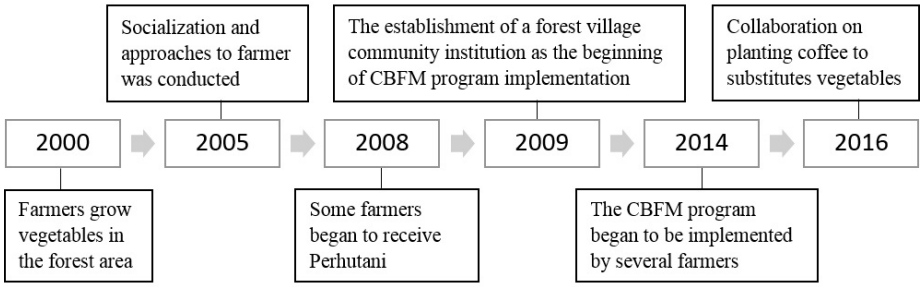


**Fig. 2.** Chronology of community and forest conflicts related to the vegetable plantation.

CBFM with Multi Purposes Tree Species (MTPS), such as jackfruit, mango, and several other types. These rehabilitation activities funded by various funding sources such as the central government, NGOs, and corporate social responsibility from several private companies that care about the environment. However, the respondents chose to answer neutral when they asked whether CBFM activities had an effect on natural disaster prevention in the forest, especially erosion, landslide, and flood. Although forest rehabilitation activities continue during CBFM, natural disasters continue to occur every year. The natural disaster prevention system needs to be improved.

This data was processed by the Research Center and Planning for Regional Development (P4W IPB). Table 7 showed changes in land cover when CBFM was just implemented (2008), and when this research was conducted (2018). The result showed a change in the total forest area about 254.91 hectares after ten years of implementation. These results indicate that during CBFM activities, the forest rehabilitation process was well implemented. Forest rehabilitation aims to prevent natural disasters, maintain forest ecosystems, even as a source of consumption and production of local people around the forest. This result would be better if it could show the ecological changes of each sub-village and present them year after year. However, due to limited data and time, this study can only obtain data on land cover changes for the entire village before and after CBFM implementation.

**Table 7.** Land cover change in the last 10 years

| Before CBFM (2008) | After CBFM (2018) |
|---|---|
| Forest area : 487.37 Ha | Forest area : 722.28 Ha |
| Non-forest area : 1201.87 Ha | Non-forest area : 966.96 Ha |
| Forest cover : 28.85% | Forest cover : 42.76% |

### *Local people satisfaction on CBFM impact*

After figured out the impact of CBFM activities based on the perceptions of the local people involved, we should know how local people perceive or satisfy CBFM as overall activities. Their perceptions based on the ten indicators in the previous analysis, coupled with income generated from CBFM activities, are used to measure the total level of satisfaction of CBFM activities using binary logistic regression analysis. At the beginning of its planning, this study was expected to use ordered logistic regression. However, due to insufficient data available, so the analysis was replaced using binary logistic regression. The results of the analysis briefly summarized in Table 8.

Table 8 is the result of the binary logistic regression analysis after running the first model. From Table 8, based on the value of t-Value (Sig.), we can find out which independent variable (from 11 independent variables) that significantly affects the dependent variable. The income

**Table 8.** Results of the binary logistic regression analysis

| Variables in the equation | B | SE | Wald | df | Sig. | Exp (B) |
|---|---|---|---|---|---|---|
| (Constant) | -31.690 | 7.551 | 17.612 | 1 | 0.000 | 0.000 |
| Income | 0.009 | 0.004 | 5.130 | 1 | 0.024* | 1.009 |
| Employment opportunity | 0.594 | 1.406 | 0.178 | 1 | 0.673 | 1.811 |
| Business development opportunity | 2.176 | 0.656 | 11.013 | 1 | 0.001* | 8.815 |
| Access to the forests | 2.423 | 1.459 | 2.758 | 1 | 0.097** | 11.280 |
| Fair management practice | -0.613 | 0.660 | 0.862 | 1 | 0.353 | 0.542 |
| Training provision | 0.145 | 0.486 | 0.089 | 1 | 0.765 | 1.156 |
| Facilities and infrastructure dev. | 0.093 | 0.508 | 0.033 | 1 | 0.855 | 1.097 |
| Conflict resolution | 0.470 | 0.393 | 1.429 | 1 | 0.232 | 1.600 |
| Institutional strengthening | 1.523 | 0.749 | 4.135 | 1 | 0.042* | 4.584 |
| Forest rehabilitation | 1.723 | 0.551 | 9.764 | 1 | 0.002* | 5.600 |
| Disaster prevention | -0.158 | 0.601 | 0.069 | 1 | 0.793 | 0.854 |

N = 105, Chi-square = 77.587, df=11, Sig. = 0.000, -2 Log likelihood = 66.360, Cox & Snell R Square = 0.522, Nagelkerke R Square = 0.700, *Significant at $\alpha$ = 5%, **Significant at $\alpha$ = 10%.

generated from CBFM activities; CBFM supports for business development; access to the forests after CBFM; CBFM supports institutional strengthening; and forest rehabilitation activities during CBFM variable, are significantly affecting respondents' satisfaction on overall CBFM activities.

After figured out which independent variables significantly affect dependent variables, the author re-runs the model analysis using stepwise analysis to remove variables that do not significantly affect the dependent variable and get the new best model. Based on the results of the stepwise analysis, conflict resolution variable changes to be significant. Therefore, the independent variables that significantly affect respondents satisfaction are the income variable generated from CBFM activities; support for developing business by CBFM; access to the forest after CBFM; support institutional strengthening by CBFM; support conflict resolution by CBFM; and forest rehabilitation activities during CBFM. The results of the final model analysis summarized in Table 9.

From the Table 9, the results of the goodness of fit (-2 Log Likelihood < Chi-Square Table) indicate that after the independent variables entered, the addition of the independent variables could significantly affect the model, or in other words, the model fit on with data. All of the independent variables have a p-value that smaller than 0.10 (alpha = 10%), which indicates that all of the independent variables have a significant effect on the 10% significance level. The Nagelkerke R Square value is 0.689, so the independent variable could explain 68.9% of the dependent variable, while the rest (31.1%) explained by other variables that are not in the model. All of the independent variables are statistically significant, with positive signs. It demonstrates that the higher respondents perception on those six indicators, the higher their satisfaction on CBFM as overall activities.

## Discussion

CBFM involves communities around the forest into forest management activities. The main objective of CBFM activities is to maintain forest standing and provide socio-economic benefits to communities around the forest that are considered to have an essential role in forest conservation efforts (Nath et al. 2016). At the beginning of its planning, this study was expected to use ordered logistic regression so that the displayed analysis results can be more representative. However, due to insufficient data available and research limitation, the analysis was replaced using binary logistic regression.

Based on Table 8, "employment opportunity" variable shows not-significant results. This results due to before there was a CBFM activity, respondents already had jobs to generate their income. The existence of CBFM activities is believed to be a source of additional income. As already expected, negative coefficients are obtained for the "fair management practice" variable. These results are related to "training provision" variables and "facilities and infrastructure development", which are also not significant. Currently, the provision of training and infrastructure development is still centered in Sub-villages that located close to the main road, not been fair and equitable yet. The uneven development of CBFM activities in all rural areas was suspected to be the reason why these three indicators do not

**Table 9.** Results of the binary logistic regression analysis after stepwise analysis

| Variables in the equation | B | SE | Wald | df | Sig. | Exp (B) |
|---|---|---|---|---|---|---|
| (Constant) | -31.350 | 7.413 | 19.261 | 1 | 0.000 | 0.000 |
| Income | 0.009 | 0.004 | 6.213 | 1 | 0.013* | 1.009 |
| Business development opportunity | 2.271 | 0.632 | 12.926 | 1 | 0.000* | 9.693 |
| Access to the forests | 2.683 | 1.192 | 5.069 | 1 | 0.024* | 14.635 |
| Conflict resolution | 0.525 | 0.314 | 2.787 | 1 | 0.095** | 1.690 |
| Institutional strengthening | 1.249 | 0.523 | 5.708 | 1 | 0.017* | 3.486 |
| Forest rehabilitation | 1.571 | 0.457 | 11.815 | 1 | 0.001* | 4.811 |

N = 105, Chi-square = 75.837, df = 6, Sig. = 0.000, -2 Log likelihood = 68.110, Cox & Snell R Square = 0.514, Nagelkerke R Square = 0.689, *Significant at $\alpha$ = 5%, **Significant at $\alpha$ = 10%.

affect respondents' satisfaction on CBFM activities. For the "disaster prevention" variable, the high rainfall level in the study area suspected as the cause of the insignificance of this variable. Although the community and forestry staff have made efforts to plant some trees and security patrols, some natural disasters, mainly landslides, still occur, especially during the rainy season. The natural disaster prevention system needs to be improved.

Several studies have been conducted to analyze the impact of CBFM activities, both economically, socially, and ecologically. CBFM facilitates the use of forests by local people to increase their income without damaging the forest. Therefore, the local peoples utilize it by making tourist attractions around the forest and planting intercrops that have an additional value in between forest stands, such as coffee. In its implementation, these utilization activities have increased the income of local peoples who lived around the forest and even made it the primary source of income for some households. CBFM has absorbed many labors or has provided many employment opportunities to communities around the forest, either directly (CBFM staff, coffee farmers, tourism managers), or indirectly (open places to eat, lodging, parking lots, security or stores around the place tourism). CBFM scheme also provides assistance such as capital loans for their business and even assistance to market their products (coffee products, tourism spots, or other local people product from the forest). This fact is in line with Camacho et al. (2007) which states that CBFM provided economic benefits to the local people in the form of increased employment opportunity, additional income, financial support, provision of production inputs, availability of land for cultivation and funds for the people's organization, which can increase their welfare.

CBFM schemes make local people involved in forest management, utilization, and conservation activity, or indirectly, make it easier for them to access the forest, as demonstrated in CBFM implementation in the Philippines. According to Guiang et al. (2001), CBFM has improved socio-economic conditions through the promotion of social justice and equitable access to the forests. However, the problem is, forests have existed for a long time. Therefore, even though forest ownership is currently clear (state or private), there are still many local people who consider the forests around their homes to be inherited from their predecessors. So when they prohibited from using the forest or entering the forest, it will trigger a conflict over the ownership of forest land. With this CBFM activities, local peoples are given the convenience of accessing forests and indirectly reducing conflicts between communities and forests. According to Bullock and Hanna (2007), community forests can help mitigate conflict among groups by facilitating communication, challenging misconceptions about management and values, providing fair representation, and better sharing both the costs and benefits of forest management.

In its regulations, the implementation of CBFM requires a legal forest user group as a requirement. This requirement was made because the government does not want to involve community groups that are not formally incorporated in order to avoid illegal utilization activities. The obligation to form an official forest user group triggers people who use the forest to strengthen local institutions. Besides "forcing" the community to strengthen their local institutions, CBFM implementation facilitates some training to strengthen local institutions in the that area, which is in line with CBFM practice in Bangladesh which provided training of various stakeholders involved and helps improve their knowledge and skills and also change attitudes of individuals (Farouque et al. 2017). According to Pagdee et al. (2006), some of the variables with significant influence on the success of community forestry are strong leadership with the capable local organization and local authority, which makes institutional strengthening highly related to CBFM activities.

The increase in the socio-economic level mostly has a trade-off relationship with environmental sustainability. However, in developing countries, like Indonesia, besides supporting the balance of ecosystems, forests also become a source of income for the people who lived around. So it required to be able to increase the socio-economic level of forest-dependent people without destroying forest ecosystems, especially in conservation forest and protected forests areas. Tugu Utara Village is a conservation area with a high level of deforestation. There are many changes in land cover from the forest to the tourism sector due to high demand for tourism in this area. The further impact of this deforestation is that there have been several natural disasters such as floods and landslides due to the reduced number of for-

est stands. This natural disaster is very detrimental to the community, especially those who live around the forest. They were disadvantaged because they were victims of tourism development in the area. This situation encourages the local people and CBFM to carry out tree planting activities in some unproductive land. It aims to prevent natural disasters, as well as conservation of animal habitat in forest areas and as a source of consumption and production materials. They also carried out the forest monitoring and patrol activities together with the forestry staff to secure the forest stands. The results of forest rehabilitation have appeared in Table 7, which indicates that CBFM activities effectively increase the forest area. This result is in line with Takahashi and Todo (2012), who figured out after one year the establishment of the forest associations of CBFM activities in Ethiopia, the forest area increased substantially, most likely because the associations also monitor illegal logging, enabling the regeneration of open areas.

Based on the results of this study, community-based forest management was successful in providing economic, social, and ecological benefits to local peoples living around the forest. Most respondents were also satisfied with CBFM activities in their area. However, in reality, CBFM implementation encountered a variety of obstacles related to issues of conflict of interest between stakeholders, land ownership issues, issues of community development equality, environmental issues and other issues that still need to be further investigated in future studies.

## Acknowledgments

The author thanks Perum Perhutani, especially in Forest Management Unit Bogor, for giving permission to do this research in their working area. The author also thanks Puncak Lestari Forest Village Institution for giving such information and support the collecting data activities.

## References

Agarwal B. 2009. Gender and forest conservation: the impact of women's participation in community forest governance. Ecol Econ 68: 2785-2799.

Angelsen A, Brockhaus M, Kanninen M, Sills E, Sunderlin WD, Wertz-Kanounnikoff S. 2009. Realising REDD+: National strategy and policy options. Center for International Forestry Research, Bogor.

Bullock R, Hanna K. 2007. Community forestry: mitigating or creating conflict in British Columbia? Soc Nat Resour 21: 77-85.

Camacho LD, Rebugio LL, Camacho SC, Carandang AP, Paras FD. 2007. Economic aspects of community-based forest management program as a strategy for forest landscape restoration in the Philippines. For Sci Technol 3: 108-116.

Carig ET. 2012. Benefits and constraints of community-based forest management in the Philippines. Int J Humanit Appl Sci 1: 73-77.

Ceballos JA. 2016. Evaluation of community-based forest management project in Ma-asin, Iloilo, Philippines. Int J Sci Res Publ 6: 673-676.

Duguma LA, Minang PA, Foundjem-Tita D, Makui P, Piabuo SM. 2018. Prioritizing enablers for effective community forestry in Cameroon. Ecol Soc 23: 1.

Ellis EA, Porter-Bolland L. 2008. Is community-based forest management more effective than protected areas?: A comparison of land use/land cover change in two neighboring study areas of the Central Yucatan Peninsula, Mexico. For Ecol Manag 256: 1971-1983.

Farouque MG, Fuyuki K, Takashino N. 2017. Attitudes of local people towards community-based forest management: A study of a Sal forest area in Bangladesh. Int J Agric Ext Rural Dev 4: 263-273.

Firdaus D. 2017. Conflict assessment of forest area in BPKH Bogor KPH Bogor Perum Perhutani Regional Division West Java and Banten. Thesis. Bogor Agricultural University, Bogor, Indonesia. (in Indonesian with English abstract)

Foley JA, Asner GP, Costa MH, Coe MT, DeFries R, Gibbs HK, Howard EA, Olson S, Patz J, Ramankutty N, Snyder P. 2007. Amazonia revealed: forest degradation and loss of ecosystem goods and services in the Amazon Basin. Front Ecol Environ 5: 25-32.

Guiang ES, Borlagdan SB, Pulhin JM. 2001. Community-Based Forest Management in the Philippines: A Preliminary Assessment. Institue of Philippine Culture, Ateneo de Manila University, Quezon City.

Gurung A, Bista R, Karki R, Shrestha S, Uprety D, Oh SE. 2013. Community-based forest management and its role in improving forest conditions in Nepal. Small Scale For 12: 377-388.

Harris NL, Brown S, Hagen SC, Saatchi SS, Petrova S, Salas W, Hansen MC, Potapov PV, Lotsch A. 2012. Baseline map of carbon emissions from deforestation in tropical regions. Science 336: 1573-1576.

Hidayat A, Dharmawan AH, Pramudita D. 2017. Feasibility of Cibulao Coffee Cultivation in Community-based Forest Management. Risalah Kebijakan Pertanian dan Lingkungan 4: 85-95. (in Indonesian)

Lasco RD, Pulhin JM. 2006. Environmental impacts of commun-

ity-based forest management in the Philippines. Int J Environ Sustain Dev 5: 46-56.

Macchi M, Oviedo G, Gotheil S, Cross K, Boedhihartono A, Wolfangel C, Howell M. 2008. Indigenous and Traditional Peoples and Climate Change. International Union for Conservation of Nature, Gland.

Miles L, Kapos V. 2008. Reducing greenhouse gas emissions from deforestation and forest degradation: global land-use implications. Science 320: 1454-1455.

Nath TK, Jashimuddin M, Inoue M. 2016. Community-based forest management (CBFM) in Bangladesh. Springer, Cham, pp 17-28.

Nerustia AN, Rahmawati R, Hernawan D. 2015. Management policy implementation of spatial region conservation and tourism. J Governansi 1: 45-54. (in Indonesian with English abstract)

Pagdee A, Kim YS, Daugherty PJ. 2006. What makes community forest management successful: a meta-study from community forests throughout the world. Soc Nat Resour 19: 33-52.

Perum Perhutani. 2018. Pengelolaan Hutan Bersama Masyarakat (PHBM). http://bumn.go.id/perhutani/halaman/159. Accessed 29 Dec 2018.

Rai RK, Neupane P, Dhakal A. 2016. Is the contribution of community forest users financially efficient? A household level benefit-cost analysis of community forest management in Nepal. Int J Common 10: 142-157.

Ranjit Y. 2012. Economic impact of people's participation in forest management (a case study of Kabhre Palanchwok, Nepal). Econ J Dev 13: 139-151.

Riggs RA, Sayer J, Margules C, Boedhihartono AK, Langston JD, Sutanto H. 2016. Forest tenure and conflict in Indonesia: Contested rights in Rempek Village, Lombok. Land Use Policy 57: 241-249.

Santika T, Meijaard E, Budiharta S, Law EA, Kusworo A, Hutabarat JA, Indrawan TP, Struebig M, Raharjo S, Huda I, Sulhani, Ekaputri AD, Trison S, Stigner M, Wilson KA. 2017. Community forest management in Indonesia: Avoided deforestation in the context of anthropogenic and climate complexities. Glob Environ Chang 46: 60-71.

Shukla N, Sharma D. 2017. A review on construction of summated rating attitude scales. Int J Innov Res Multidiscip Field 3: 230-232.

Sobrevila C. 2008. The Role of Indigenous Peoples in Biodiversity Conservation: the Natural but often Forgotten Partners. The World Bank, Washington DC.

Takahashi R, Todo Y. 2012. Impact of community-based forest management on forest protection: evidence from an aid-funded project in Ethiopia. Environ Manag 50: 396-404.

Takahashi S. 2008. Challenges for local communities and livelihoods to seek sustainable forest management in Indonesia. J Environ Dev 17: 192-211.

Winata A, Yuliana E. 2014. Forest stand potential as level of success indicator of community-based forest management. J Teknologi 15: 106-118. (in Indonesian with English abstract)