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# Where to put community-based forestry?: Reconciling conservation and livelihood in Lampung, Indonesia ☆

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ABSTRACT

Community-based forestry (CBF) has been promoted as a potential win-win solution for improving forest conservation and livelihood outcomes. Incorporating location-specific factors from participants' perspectives in the design and implementation of CBF has been noted as an important prerequisite for ensuring positive outcomes. This study investigates benefits and challenges of CBF perceived by participating farmers in two Community Forests (HKM – *Hutan Kemasyarakatan*) in Lampung, Indonesia. Two sites were chosen systematically based on their distinct biophysical characteristics. Through qualitative assessments using interviews and focus group discussions with the farmers, we found that securing land tenure is the most important motivation for them to participate in CBF and abide by the government-imposed rules and regulations. Participants in both sites have experienced increased income, as well as other benefits, such as reduced fire incidents and illegal activities. However, benefits and challenges that the two HKMs face differ and are affected by their biophysical features, such as elevation, slope, proximity to village and roads. Participants, especially in the remote HKM in high elevation, perceive long-term and poorly monitored goals, such as reforestation, unrealistic. Site-specific and targeted technical supports are needed to identify overstory tree species that can also provide livelihood benefits. We argue for explicit considerations of biophysical features for CBF site designations and technical supports that meet site specific needs. This study provides a practical pathway to ensure economic benefits of CBF, which is an important factor for promoting CBF's success.

## 1. Introduction

Community-based forestry (CBF)[1] where local communities have the central role in planning, decision-making, and managing forest resources has been touted as a way to balance conservation and livelihood goals (Gilmour, 2016; Pokharel and Tiwari, 2013). The promises of CBF are many. Allowing local community to manage and utilize forests can: 1) create incentives for them to invest in the long-term sustainability of forests (Agrawal, 2001; Agrawal and Ostrom, 2001; Ostrom et al., 1999); 2) improve rural livelihood and alleviate poverty (Sunderlin et al., 2005; Sunderlin et al., 2003; Wunder, 2001); 3) promote equitable sharing of forest resources and benefits (Higgins et al., 2018); 4) provide multiple ecosystem services from local to global scale (Paudyal et al., 2019; Paudyal et al., 2017). However, CBF by itself offers no guarantee for such outcomes. Some studies have shown positive ecological outcomes of CBF, especially in reducing deforestation rate (Blackman et al., 2017; Galvin et al., 2018; Nelson and Chomitz, 2011; Putraditama et al., 2019; Porter-Bolland et al., 2012; Robinson et al., 2014; Stickler et al., 2017; Santika et al., 2017). However, others have found no or negative associations between CBF and forest condition (Busch and Ferretti-Gallon, 2017; Buntaine et al., 2015; Kamoto et al., 2013). Social outcomes of CBF are even more mixed with limited impacts on poverty alleviation and intensified internal conflicts (Anderson et al., 2015; Galvin et al., 2018; Kamoto et al., 2013; Marudi and Krott, 2012). Despite the mixed outcomes, forest areas either owned by or managed under CBF are increasing and account for up to 15% of total forest area

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[1] We use Community-based forestry (CBF) as an umbrella term interchangeable with 'community forestry', "participatory forestry' or 'social forestry'. "Community" here refers to place-based groups, rather than interest based alliances (Oja et al. 2016).

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worldwide (513 million hectares) (RRI, 2014). Thus, the important question to ask now is how to design policy instruments, including site designation, to promote its success, rather than the dichotomous choice of whether or not to allow CBF.

Although general factors that promote CBF success have been studied (Baynes et al., 2015; Chhatre and Agrawal, 2009; Pagdee et al., 2006), there is a significant data gap for linking location-specific variations to environmental and social outcomes of CBF (Hajjar et al., 2016; Yin et al., 2016). CBF schemes exist in a continuous spectrum of rights and responsibilities granted to local communities (Gilmour, 2016). On one end of the CBF spectrum, local communities may have little or no authority to make forest management decisions and very few rights to access and use forest products. In this case, involvement of local communities is limited to participation in government-led programs. CBF schemes on the other end can grant local communities' access and use of forest products with significant or full rights to manage forests under limited government authority and oversight. In this case, CBF schemes may even resemble full land ownership by communities (Gilmour, 2016; Paudyal et al., 2017; 2018). However, *de facto* practices may be very different than how CBF are defined *de jure*. Actual strengths of rights, participation, and empowerment of local communities are practical indicators of CBF effectiveness (Galvin et al., 2018; Strickler et al., 2017). Thus, incorporating location-specific factors from participants' perspectives in the design and implementation of CBF is important to ensure positive outcomes (Kamoto et al., 2013). In this study, we drew our analytical foci for CBF policy design from previous studies on the general factors of CBF success, especially from Baynes et al (2015) and Gilmour (2016) to improve CBF policy design and implementation in Indonesia.

The contemporary development of Indonesia's forest management presents an important opportunity to examine CBF. In 2014, then-presidential candidate Joko Widodo ran a campaign based on progressive forest-related agendas (Seymour, 2014), which include a campaign promise of redistributing State forest estate to local communities. Indonesia recognized local people's rights to participate in formal forest management decisions as early as 1995 in the form of Ministerial Decree on Community Forestry and Forest Village Community Development (Lindayati, 2002). However, CBF in Indonesia has never been the centerpiece of a high-profile presidential campaign or had the cross-ministerial supports, which are realized with the election (2014) and re-election (2019) of Joko Widodo. Soon after he took the oath of the Presidential office, his campaign promises were incorporated into the Presidential Regulation No. 2 of 2015 on National Medium-Term Development Plan. Within it, the government declared an ambitious target to significantly increase community-managed forest estate from less than 1%[2] to 10% of total State forest estate (up to 12.7 million ha) by 2019 under the umbrella of 'Social Forestry' (*perhutanan sosial*) program (MoEF, 2015; 2016). Although the progress has been slower than promised, the area under the Social Forestry program has more than doubled (2.7 million ha as of 2019) during the first term of the Jokowi Administration, and the trend is expected to continue in his second term (2019–2024) (MoEF 2019). Social Forestry initiative is a massive undertaking to decentralize forest management down to community-level. It offers an opportunity to improve the livelihood of 16.31 million poor rural population that resides within and around forest area in Indonesia (Badan Pusat Statistik, 2018). However, this policy is also being undertaken while Indonesia's forests is experiencing one of the largest losses in the world (Hansen et al., 2013) due to massive illegal logging, lack of management, and rapid expansion of monoculture oil palm and acacia plantations in the last decade (Wijaya et al., 2015). External economic pressure for expanding plantations of cash crops combined with internal issues of weak forest governance has contributed to the loss of 15.8 million hectares of forests between 2000-2012, of which 6 million hectares was primary forests with high carbon and biodiversity values (Margono et al., 2014).

The stated goal of Social Forestry is to alleviate poverty and reduce unemployment and disparity of access to forest resources by granting legal access for local communities so they can manage the forests for their welfare sustainably (MoEF 2016). This regulation formally recognizes six schemes of CBF in Indonesia with various degree of management rights and responsibilities. They are (1) Community Forests (HKM – *Hutan Kemasyarakatan*), (2) Village Forests (HD – *Hutan Desa*), (3) Community Plantation Forests (HTR – *Hutan Tanaman Rakyat*), (4) Customary Forests (HA – *Hutan Adat*), (5) Forest Partnership (KK-*Kemitraan Kehutanan*), and (6) People's Forests (HR – *Hutan Rakyat*). Each of these six schemes corresponds to different spectrum of CBF types in terms of rights and responsibilities. CBF schemes, such as HR and HA, imply inherent land ownership representing one end of CBF spectrum where communities have rights to use timber and non-timber forest products and assume management responsibilities. HD and HKM schemes are partly devolved CBF type where usufruct rights of communities tend to be highly prescribed and limited to non-timber forest products, although communities can acquire a relatively long-term lease (35 years) of the State forest estate. While any community groups can apply for HKM permits, HD permits can only be submitted by a village entity recognized by the local government. These two types of CBF account for about 80% of the newly designated Social Forestry areas (56% HD and 23% HKM out of total 2.26 million ha CBF designated from 11/2014 to 06/2019) (Fisher et al., 2019) MoEF, 2019. Indonesia's ambitious CBF expansion plan is unfolding as partial and limited devolution of forest governance, in the form of HD and HKM schemes.

To accelerate the process of increasing the areas under Social Forestry, Indonesian government developed several maps, such as the Indicative Map for Social Forestry Areas (PIAPS- *Peta Indikatif Areal Perhutanan Sosial*), where communities can prepare proposals for social forestry. Other mechanisms include the release of State forest estate areas for agrarian reform designation (TORA- *Tanah Obyek Reforma Agraria*) or to indigenous communities following a constitutional court ruling (Directorate General of Social Forestry and Environmental Partnership, 2015; Fisher et al., 2019; Myers et al., 2017). However, these formal efforts to identify social forestry areas by the government have received limited input from local communities and did not take into account biophysical characteristics of the area (Fisher et al., 2018, 2019) . Understanding the role of biophysical features on CBF success would help the zoning effort and setting an realistic expectation for CBF success. There have been numerous studies on CBF practices in Indonesia on the process of forest rights devolution through (e.g. Colfer and Resosudarmo, 2002; Fisher et al. 2018; Ojha et al., 2016), the social and legal challenges of securing communities' rights (e.g. Moeliono et al., 2015; Moeliono et al., 2017; Safitri, 2010), as well as on counter-productive outcomes of the decentralization process in Indonesia after the fall of the New Order regime (around 1998) (e.g. Djogo and Syaf, 2004; Resosudarmo, 2004). However, studies that examined the biophysical conditions of the CBF managed forests are seriously lacking (Bong et al., 2019). Although the studies that examined social equity, participation and local factors affecting the future of CBF in Indonesia are also lacking (Bong et al., 2019), there have been several studies in Lampung province, where the first HKMs in Indonesia were established. These studies found positive social and environmental outcomes (Kaskoyo et al. 2017; Suyanto et al. 2005), contract length as the most important consideration for farmers in their community forest contracts (Arifin et al. 2009), positive impacts of the facilitation programs that promoted social learning (Wulandari and Inoue, 2018; Wulandari and Kurniasih, 2019), as well as importance of providing technical assistance and financial opportunities (Kaskoyo et al. 2014).

[2] According to the data from FAO (2015), CBF area in Indonesia was estimated to be around 0.84 million ha (Gilmour 2016). The existing CBF area was announced to be around 1.4 million ha at the time of the Social Forestry Initiative declaration (MoEF, 2015). The official government data as of November 2017 places the figure under 1.1 million ha (Fisher et al. 2018).

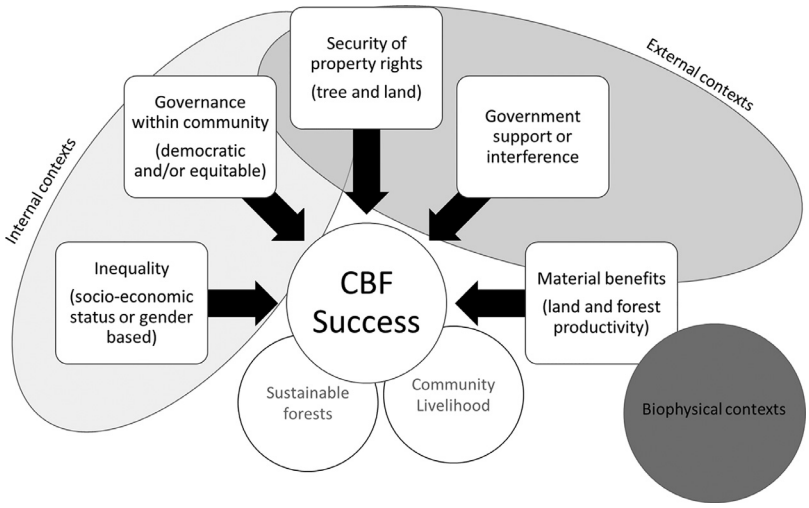


**Fig. 1.** A diagram of the relationship between factors influencing the success of CBF practices. We adapted the causal diagram from Baynes et. al (2015) and simplied to draw our analytical focus.

In this study, we examine the factors promoting CBF success in Indonesia focusing on the effects of biophysical features. We systematically selected two community forests (HKMs) in Lampung province of Indonesia where early evidence of community forestry outcomes exists to contrast the factors affecting CBF outcomes. We present opportunities and challenges of achieving the win-win potential of CBF from the community members' perspective. We conclude with the policy recommendations and future research needs.

## 2. Conceptual framework

Baynes et al. (2015) identified five main interconnected factors that are likely to affect the success of a CBF practice, broadly defined as positive outcomes both social and environmental. These are (1) inequality based on socio-economic status or gender, (2) security of property rights, (3) governance within community forestry groups, (4) government support or interference to community forest groups, and (5) material benefits to community members (See Fig. 1 adapted from Baynes et al. 2015).

The types of CBF schemes determining rights and responsibilities of communities, as well as the configurations of communities and existing non-governmental supports, would affect the state of these five factors and the likelihood of CBF success (Ojha et al. 2016). However, material benefits from CBF are additionally affected by macro-economic conditions and access to technology and markets, as well as biophysical factors of CBF locations, such as elevation, slopes, climate conditions, soil types. Forests at higher elevation and steeper slope are less likely to be deforested, while fertile lands with better accessibility to roads, labor and markets are more likely to experience deforestation. One worldwide meta-study (Ferretti-Gallon and Busch, 2014) showed that among twenty most commonly studied meta-variables associated with deforestation, biophysical factors of location and proximity of built infrastructure and population centers are those most consistently associated with deforestation (Table 1). These variables represent one of the fundamental dilemmas of CBF for reconciling conservation and livelihood needs. Infrastructure development, such as road building, is often critical to improve living conditions and to diversify livelihood options in rural areas, especially for poor forest-margin communities (Wunder, 2001). However, it is one of the major direct drivers of deforestation, along with agricultural expansion and wood extraction (Lambin et al. 2001; Geist and Lambin 2002). Thus, to move CBF beyond granting the rights of only economically marginal forest products (Anderson et al. 2015), CBF policies must explicitly consider how biophysical and spatial features of CBF affect its ability to achieve the dual mandates of conservation and livelihood.

## 3. Methods

The earliest CBF management in Indonesia was in the form of HKM concessions, especially in Lampung province, where HKM were first established by the Ministry of Forestry in 2001 with temporary licensing of 3–5 years (Safitri, 2010). Agroforestry system established through HKM provided many benefits, in terms of higher discharge to the local dam in the watershed (Verbist et al., 2005), improving forest productivity and biophysical condition through fire risk reduction (Suyanto et al., 2005), as well as livelihood benefits (Kaskoyo et al. 2017; Pender et al., 2008). Another study showed that farmers would be willing to follow more restrictive rules if they were given longer contract period (Arifin et al., 2009). However, many earlier programs with temporary licenses were not extended due to alleged malpractices. CBF program stagnated until the second wave of HKM concessions was granted with a longer license period of 35 years under the new Ministry of Forestry Regulation No. P.37 of 2007 (Safitri, 2010).

We investigated community perspectives on HKM practices in the study areas using qualitative approach using series of interviews and focus group discussions with community members and local stakeholders relevant to the implementation of HKM schemes in Lampung province. The study locations were systematically selected through a combination of GIS exercise and multi-criteria selection. We selected HKMs that are: (1) older than 5 years to ensure that the community members have experiences of managing an HKM, (2) part of the same Forest Management Unit[3] that has been recognized by both the Ministry of Environment & Forestry (MoEF) and the provincial government, (3) located within the same functional designation of "Protection Forest"[4]. We found eight units of HKM that met these three criteria within Batutegi Forest Management Unit (FMU), at Tanggamus district, Lam-

[3] Forest Management Unit (FMU) is a public service provider legally established by the Ministry of Environment and Forestry, and registered with local government with clearly demarcated forest boundary as an operational unit of forest management with manageable size. Each FMU is responsible to develop forest planning document, managing and monitoring forest resources, as well as engaging with stakeholders. There are three types of FMU recognized by the Ministry; these are (1) Conservation FMU with the primary function of conserving plant and wildlife biodiversity, (2) Protection FMU with the primary function of protecting ecosystem services to regulate water, prevent flooding, control erosion, prevent seawater intrusion, and maintain soil fertility, and (3) Production FMU with the primary function of producing forest products (FORCLIME 2015). Conservation FMU is considered as the extension of central government, while Production & Protection FMUs are considered local governments' agencies.

[4] State forests in Indonesia are classified into three designated functional categories: 'Production Forest' for providing forest products; 'Protection Forest' for

**Table 1**
Twenty most commonly studied meta-variables associated with deforestation.

| | Ferretti-Gallon and Busch, 2014 | Angelsen and Kaimowitz, 1999 | Geist and Lambin, 2002 | Rudel, 2009 |
|---|---|---|---|---|
| Number of CBF cases | 117 | 140 | 152 | 268 |
| **Biophysical** | | | | |
| **Elevation** | | - | | - |
| **Proximity to water** | | ? | + | |
| **Slope** | | - | | - |
| **Soil suitability** | | + | + | + |
| **Wetness** | | - | | |
| **Built infrastructure** | | | | |
| **Proximity to cleared land** | + | + | + | |
| **Proximity to road** | + | + | + | + |
| **Proximity to urban area** | + | + | + | |
| Agriculture and Timber | | | | |
| Agricultural activity | + | + | + | + |
| Agricultural price | + | + | + | |
| **Proximity to agriculture** | + | + | + | |
| Timber activity | ? | ? | + | + |
| Timber price | ? | ? | + | |
| Socioeconomic | | | | |
| Indigenous peoples | - | | | |
| Population | + | + | ? | + |
| Poverty | - | ? | + | |
| Rural income support | + | | + | |
| Institutional | | | | |
| Community forestry | ? | | | |
| Land tenure security | ? | ? | ? | |
| Protected areas | - | | | - |

(Source: Ferretti-Gallon and Busch 2014). Bold are those associated with biophysical factors of CBF location and their proximity to infrastructure, labor and markets.

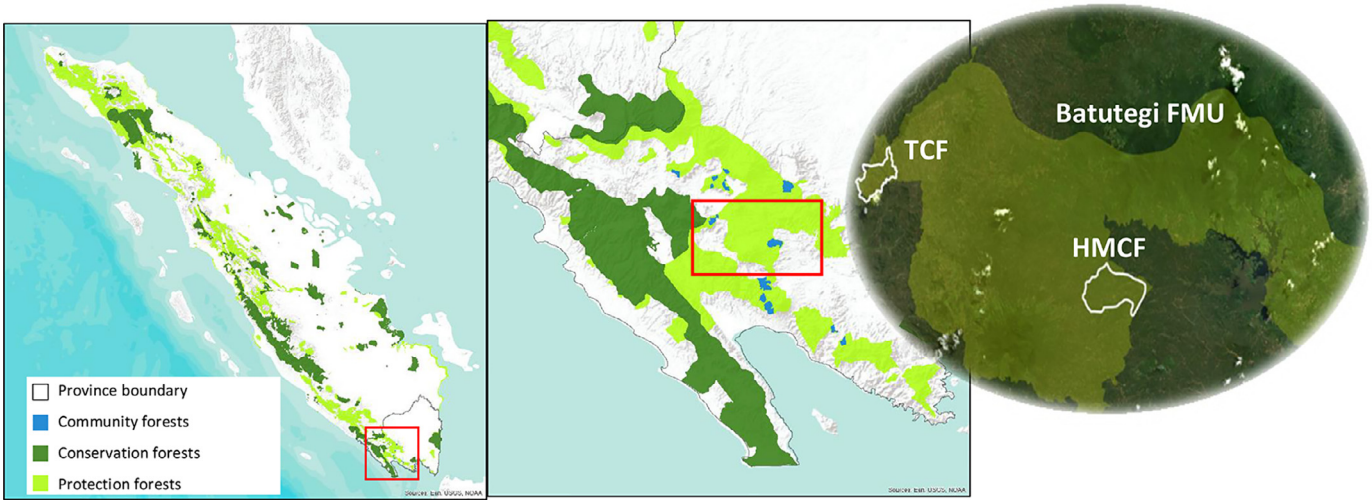


**Fig. 2.** Locations of the selected HKM units in Lampung province of the Sumatra Island in Indonesia

pung province (Fig. 2). Batutegi Protection FMU was established in 2010 and is currently responsible to manage 58,174 hectares of Protection Forest area in Tanggamus district. Topographically, Batutegi FMU is dominated by hilly area with more than 45% of the area classified as steep slope. Batutegi FMU serves critical role to protect a watershed which consists of three main river systems. The watershed is a catchment area for Batutegi dam that is designed to produce 24 mw of electricity and supplies 90,000 hectares of irrigated rice fields on the eastern and central Lampung plains (Kusworo, 2014).

Among those that met the three criteria, we selected two HKM units with different biophysical characteristics. By selecting the two HKM units with similar property rights, intra-governance and external support, we can highlight the impact of different biophysical characteristics on the performance of each HKM unit. The first HKM unit, *Tribuana Community Forest* (hereafter referred to as TCF), was licensed in 2007 and located on the northern part of Batutegi FMU. With the size of 1,507 hectare, TCF consists of 500 household members. The second HKM unit, *Hijau Makmur Community Forest* (hereafter referred to as HMCF), was licensed in 2009 and located near the center of Batutegi FMU. It is slightly smaller in size with 1,190 hectares and 434 household members. TCF and HMCF present different biophysical features, in terms of elevation, slope and accessibility. HMCF is easier to access and closer with population centers, which is about 3-hour drive directly from Bandar Lampung (the capital of Lampung province) with relatively good road condition. The site is located at low elevation (415 meters above the sea level), and the surrounding landscape is relatively flatter compared to TCF. In contrast, TCF has no access road for cars and can be reached by 40 minutes

ecosystem protection, such as watershed and soil conservation; and 'Conservation Forest' for protecting biodiversity and ecosystem conservation.

**Table 2**
Summary characteristics of selected HKM units. Slope and elevation maps were calculated using digital elevation model from NASA Shuttle Radar Topography Mission 1-arc second global dataset (U.S. Geological Survey 2015). Cost distance to village were calculated using path distance tool on ArcGIS 10.6 that calculates the least accumulative cost distance while accounting for surface distance along with horizontal and vertical cost factors (elevation and slope). Tree cover in the year 2007 is masked from global annual tree cover loss dataset (Hansen et al. 2013).Points of villages were obtained from Indonesia's Basic Geospatial Information dataset published by Indonesia Geospatial Agency (Geospatial Information Agency 2016).

| Variables | | Tribuana (TCF) | Hijau Makmur(HMCF) |
|---|---|---|---|
| Licensed | | 2007 | 2009 |
| Area (hectare) | | 1,507 | 1,190 |
| # of Households | | 500 | 434 |
| Male FGD participants | | 13 | 11 |
| Female FGD participants | | 6 | 7 |
| Elevation (MASL) | Min | 918 | 341 |
| | Mean | 1,060 | 501 |
| | Max | 1,238 | 706 |
| Slope (%) | Min | 0 | 0 |
| | Mean | 11.48 | 12.76 |
| | Max | 43 | 38 |
| % tree cover (2007) | Min | 0 | 0 |
| | Mean | 52 | 82 |
| | Max | 100 | 100 |
| Cost distance to village | Min | 2,764 | 1,042 |
| | Mean | 4,269 | 2,941 |
| | Max | 5,518 | 4,764 |

on a trail motorbike after 5 h drive from the provincial capital. Due to its high elevation at 1,090 meters above the sea level and lack of paved road near the site, it is significantly harder to reach the site (Table 2).

We seek community consent to participate in the study before focus group discussions at the selected HKM units for each gender (May-August 2017). At TCF, we managed to conduct two focus group discussions, with 13 male participants and 6 female participants, respectively. At HMCF, we had two focus group discussions with 11 male participants and 7 female participants, respectively. Each focus group discussion was limited to 10 participants to maintain a manageable size for a group discussion. Participants were invited to join the focus group discussion through an open invitation announcement by the head of each group. A summary of the research questions and goals, resume of the principal researcher, consent forms, and brief on the role of participants in the focus group discussions were delivered along with an invitation.

To examine the factors affecting the outcomes of HKM management, the focus group discussions were designed to understand the following four aspects: (1) historical aspect of the units' land use and how their HKM came into play, (2) current forest uses, (3) benefits of HKM from the perspective of community members, and (4) challenges of managing HKM. All interviews and focus group discussions were recorded, transcribed, and coded in Bahasa Indonesia to retain any nuance presents within the interviews and discussions. The transcripts were analyzed manually to identify recurring themes.

## 4. Results

### 4.1. Land use history and licensing process

Both selected units experienced similar land use problems before the formal licensing of HKM. The land use at both locations before HKM was agroforestry with coffee being the majority crop. The forests were already degraded, with TCF being more degraded than HMCF (percent of tree cover in year 2007 were 52% and 82% respectively). According to the participants at TCF, the area has been severely degraded due to massive timber logging practices in the 1950s, which then followed by land use conversion to agroforestry by the local communities. In the early 1980s, the government started the nation-wide process of developing forest inventory and delineate forest boundary with little to no input from the local stakeholders and launched a reforestation program to some of the most heavily degraded forests in the country. This step was followed by massive eviction of local communities from the forest area, including the communities at TCF, in an effort to clear the encroached forest area under the "*translok*" (local transmigration) program. The communities at TCF were relocated to a government designated settlement area at the lowland area on the eastern part of the province.

Despite this massive effort from the government, most of the evicted population came back to the site around the mid-1990s due to lack of livelihood options at the settlement area, and started to reopen the area in Tanggamus forests sporadically. However, only after the big fires in 1997 that the community were able to reenter and occupy the forests in large scale, mostly due to the large patches of open areas created by the fires as well as the vacuum of power in the government following the fall of New Order regime in 1998. Due to the severe forest degradation in the 1950s, the participants recall that it was hard to find large tree stumps when they reopened the area after they resettled in the mid-1990s. The area was covered by shrubs, reeds, and ferns.

During this period, the government started to see CBF as one management option for what they deemed as *'abandoned land'* (forests area with no management). The local forest agency at that time agreed to provide the local communities at TCF access to manage the land with intercropping form of agroforestry, but there was no clear licensing or management guidelines. As a result, there were still a lot of differing opinions on the legality of communities residing within the boundary of Protection Forest. By the mid-2000s, the community at TCF was already starting to form farmer groups in the hope of securing a more permanent and legal land tenure from the government. With the help of one local non-governmental organization (NGO), they started the process of writing a proposal to acquire a HKM license and formalize a forest plan to be submitted to the central government[5]. In 2007 with a new regulation in place (MoEF Regulation No. P.37), the government granted their HKM license with a clear boundary and management rights for 35 years.

The land use dynamic at HMCF experienced the similar trajectory with the one at TCF, marked by periods of massive logging operations during the 1950s followed by community settlements afterward, and eviction by the government in the 1980s. During this period, the forest area at HMCF was reforested using exotic high value timber species, such as *sonokeling* (*Dalbergia latifolia Roxb.*) which is now part of the IUCN Red List classified as Vulnerable to extinction (IUCN. 2000). Following the fall of New Order regime in 1998, most of the evicted population came back to the area and started to encroach the forests. Some of them were after the high-value timber such as *sonokeling,* but most were smallholders opening the forest to establish coffee plantations. With no clear land tenure, the community members were aware that their activities were essentially illegal. Horizontal conflicts between farmers were common, as anyone can easily harvest their coffee crops due to uncertain land tenure. The establishment of HKM practices at HMCF was initiated with the help of a local NGO figure who later became a provincial parliament member in 2007, and the HKM application was approved in 2009. During this process, they formed farmer groups and collectively fund the process with an average contribution of Rp. 170,000 (about USD 13) from each household.

[5] ICRAF (The World Agroforestry Center) conducted an action research project called RUPES (Rewards for Use of and Shared Investment in Pro-poor Environmental Services) from 2004-2012 in Sumberjaya watershed. As part of this program, they partnered with local NGO (Watala), to help farmers apply for HKM permit, conducted soil conservation auction program, and river care program as part of a payment for ecosystem services experiment within Protection Forests (Amaruzaman et al. 2017).

### 4.2. Current forest uses

According to the regulation outlined by the MoEF Regulation No. P.88 of 2014 (Ministry of Environment & Forestry (MoEF) 2014, activities granted within HKMs in Protection Forest are limited to utilization of the forest zone, its ecosystem services, and harvesting of non-timber forest products. The license holders are responsible to manage the area sustainably, and that includes planting the area with overstory trees to improve the forest condition and restore its ability to provide ecosystem services. To improve forest condition at Tanggamus district, both HKMs were tasked with reforesting their HKM areas with at least 400 overstory trees per hectare during the duration of their land tenure of 35 years.

The majority of TCF is dominated by coffee plantations, with an intercropping of pepper and pepper pole trees in between. The average coffee crop density at this site is around 2,000–2,500 coffee trees per hectare with robusta coffee (*Coffea canephora*) as the main type that they grow. According to the farmers at TCF, their pepper production is not as good as the other sites in the lower elevation. The ratio of coffee versus pepper planting at this site is estimated at around 85%–15% respectively. They use legume tree such as *dadap* (*Erythrina variegata*), and *kapuk randu* trees (*Ceiba pentrandra*) as supporting tree to grow the pepper vines (*Piper nigrum*). The participants reported that they have tried to plant avocado trees at the site, but the fruits were too small and subpar in quality to sell despite normal growth of the tree diameter. Another experiment was rubber tree planting in the hope of being able to tap the rubber sap for additional income. It was motivated by the increasing rubber price in the last decade. Despite their best effort to find the best quality seeds, the growth of these rubber trees was subpar, and the water content of the sap were too high to be sold as a commercial product. The low productivity of rubber trees in higher elevation has been well documented, and optimum yield of rubber sap can only be achieved in elevation below 900 meters and minimum temperatures of 22.8 °C (Chen et al. 2016). The only overstory tree that grows well in this site was perceived to be what the local called *kayu afrika* (*Maesopsis eminii*). The tree is known as a fast growing timber tree that can reach 30 m in height with clear bole up to 10 m (Orwa et al. 2009). Due to restriction of harvesting any timber from the site, this particular tree species is deemed useless for them. Pepper cultivation is also considered best in land with altitude less than 1,000 m above sea level International Pepper Community (2007), thus cultivating pepper at TCF cannot produce optimum yield. It is also one of the reasons why they don't want to plant more of the trees at the site, as it will only decrease their coffee crops area with no additional benefits for them. C ommunity members in TCF rely heavily on coffee and only a small portion of the land is set aside for pepper plantation as their livelihood crops.

In contrast with TCF, pepper grows really well in HMCF. Historically, local communities near Batutegi area earn their living through coffee cultivation. FGD participants reported that after 1998, pepper price increased dramatically which eventually led them to cultivate more pepper. The current ratio between coffee and pepper was reported to be around 45% to 55%. The most common trees that they use to support the pepper vines are *dadap* (*Erythrina variegata*), and *kapuk randu* trees (*Ceiba pentrandra*), and *johar* (*Senna siamea*). The suitable microclimate condition to cultivate pepper at HMCF makes a significant difference to their motivation to plant more overstory trees. They are more willing to reduce their coffee trees, and replace it with more hardwood timber and overstory trees, as long as it can support their pepper vines.

The difference in proportion of the land used by different livelihood crops, as well as the variety of livelihood crops in these two sites show a clear link between biophysical characteristics of the land with its ability to support alternative livelihood crops for the community. This distinction can be critical in determining farmers' motivation to diversify crops and restoring the forest overstory, which are both keysto avoid the land being converted into monoculture plantation instead of a healthy agroforestry practice.

### 4.3. Benefits of community forests

When asked about the benefits of practicing community forestry and operating under the HKM scheme, participants at both sites were all in agreement that securing land tenure is their top priority. They feel that having legality over their managed land provides safety and comfort in doing their job as farmers. Before the legal HKM designation, there was little security over coffee and pepper planted as stealing forest products was a routine practice, which makes horizontal conflicts between farmers very common. Meanwhile, they were always in a state of fear of eviction or prosecution by the government. As a consequence of the uncertain legal status, they also had to pay illegal fees imposed by certain corrupt government officials to let them stay. After securing the license as HKM concessions, members of the HKM units developed their own map of individual plots, equipped with clear boundaries and detailed GPS coordinate information. The mapping process was supported by local NGOs in cooperation with the district government. The detailed plot boundary marked for each HKM member prevents conflicts among farmers, as well as giving them the legal ground to reject any illegal fees or any extortion efforts by corrupt government officials.

The second most cited benefit of HKM is income from the main livelihood crops, such as coffee and pepper. On average, a hectare of coffee trees (with tree density of about 2,000–2,300 trees) can generate about 1 to 1.5 ton of coffee beans per year (TCF coffee productivity is on the lower end of this range, while HMCF is on the upper end of the range). On average, one household manages around 2 hectares of plot inside the HKM concession. With a price of Rp.20,000–Rp.25,000 per kg of coffee beans (around USD 1.5 - USD 2), the gross income from coffee sales alone can be at least Rp.40 million (around USD 3,000) per year. As for pepper, the average price per kilogram for dried black peppercorn is around Rp.100,000 (around USD 7.3). With an average density of 700 pepper vines per hectare, farmers can harvest around 1 ton of black peppercorn per year and earn gross income of about Rp.100 million (around USD 7,280) per year. As with many other agricultural commodities, these economic benefits depend on fluctuating market price and yields affected by macro economy and climate conditions. The participants at both sites complained that the year 2017 was an exceptionally bad year, with the yields of both coffee and pepper plummeting to less than 500 kilograms per hectare. This kind of drop in production is reported to be rare, and in most years, the yields of both commodities have been quite stable. As a comparison, the minimum wage of Lampung province was set by the government in 2016 as Rp.1.76 million per month, or around USD 1,630 per year (Badan Pusat Statistik 2016). The level of income generated by HKM agroforestry practices can be quite high compared to the average income level of the province, although HMCF is more affluent than TCF due to their ability to grow more lucrative crop such as pepper. The FGD participants reported that HKM farmers are able to buy lands outside of the forest estate (the local term is *tanah marga*, loosely translated as the village land) to build their homes, own motorcycles (more than one per household), and send their children to boarding schools.

When asked about any environmental benefits of HKM that they can observe, they reported lack of forest fires and air pollution in the landscape. Before the introduction of HKMs, land clearing for agriculture and agroforestry practices were often done by using fires as it is the cheapest way to open up the forests. With clear boundaries and collective awareness of HKM rules that they have to adhere to, HKM members reported that they monitor and warn others who try to open up any forests with fires.

### 4.4. Challenges of community forestry

The FGD participants at both sites stated that they understood the strict restriction of timber harvesting for HKMs within Protection Forest, as well as the reforestation target of 400 overstory trees per hectare im-

posed by the Batutegi FMU. Farmers at both sites positively evaluated current HKM regulations and practices. They understand the reasons for limiting use of the forests imposed by the government. To protect the area from illegal loggers, both HKMs haves their own community patrol. This practice also significantly reduces the occurrences of forest fires that were previously rampant as a method of land clearing for agricultural purposes. The participants also reported that their ability to retain and renew the HKM license is tied to their performance for protecting the Protection Forests. Despite taking the timber harvesting restriction very seriously, the participants at both sites were not too concerned about not being able to fulfil the reforestation target. Most of them feel that they still have plenty of time to achieve the target until the expiration date of the current license, and that the government is not monitoring this particular target very closely. While the regulation clearly stated that HKM license is not permanent and cannot be inherited, they are still hoping that the government would eventually provide them with a more permanent land tenure to secure their HKM practices to the next generation.

However, two HKMs face different challenges for abiding by the rules and responsibilities outlined by the government. The participants at TCF, relying heavily on coffee production, complained that even after they are practicing community forestry for more than a decade now, they are still unable to find overstory tree species that can provide livelihood benefits. They stated that the government target of planting at least 400 trees per hectare is unattainable if it only means less area to plant their main livelihood crops. They have asked for more support from the government to help them find multipurpose tree species that can grow well and provide livelihood benefits at their site. Local government agency (Batutegi FMU) lacks funding and capacity to provide supports for the HKM. While the limitations imposed by biophysical features prevent HKM farmers at TCF from synergizing the goals of sustainable forests management and rural livelihood, farmers at HMCF are in a better position to achieve their reforestation target. HCMF's proximity to villages and better road network means lower production costs for their agricultural products, thus adding more net profit compared to TCF in addition to more options of livelihood crops. Farmers at HMCF are more concerned with ways to improve the quality of their produces and better post-harvest handling to get higher price.

Despite these differences, the farmers at both sites expressed their hope to improve their farming practices by employing better technique, using better seeds, and experimentation with organic farming practices. Organic coffee beans are priced higher than regular beans, but the FGD participants stated that they lack the expertise to maximize coffee production with organic farming. From their limited experience, organic coffee farming produces less quantity of coffee, while demanding significantly more work and time to prepare and apply organic fertilizers. Post-harvest processing is also one area that they would like to improve, but lack technical expertise and financial access. While the farmers expressed desire to independently package and market their coffee beans to the market instead of selling them to middlemen, it is hard to acquire a loan to improve their operations. One of the reasons is that they are not legally allowed to put their HKM license as a collateral for bank loans. Both units expressed their wish to have a functioning cooperative so that they can negotiate better price with buyers, as well as generate community savings to help them improve their operations.

There are some differences in tasks and roles among genders at both sites. Men are expected to represent the household in meetings with government officials or NGOs. However, women at HMCF are the ones who mostly negotiate with the buyers for the sale of their produces. Women are perceived to be more persistent at price negotiations, but also the logistic of how the buyers collect the produce is one of the reasons why women at HMCF perform this task. At TCF, farmers collectively collect the produces and deliver them to buyers' warehouses. HMCF is closer to villages and easier to access by road, thus, most buyers collect the commodities by going to each farmer' house. Since most of the men are in the field, the women are the ones who interact with the buyers and negotiate the price. However, their perceptions of benefits and challenges of HKM did not differ significantly by gender.

## 5. Discussion

This study presented farmers' perspective on benefits and challenges of HKM practices, which are relatively consistent with other studies on HKM practices across Indonesia. For example, Arifin *et al. (2009)* concluded that (1) farmers prefer longer contract period, (2) respond positively on the hypothetical right to cut trees, and (3) relatively unconcerned about the tree density required for reforestation purposes. Assigning clear property rights with delineated boundaries that are agreed by all members was the key to eliminate social conflicts between farmers, which eventually led to better intra-community farmers group governance in our study areas. With better intra-governance among members, they are able to coordinate more effectively and take actions against potential offenders of HKM rules, thus improving the likelihood of HKM success. In general, farmers at our study sites are willing to follow the rules set out by the government for Protection Forest in exchange of securing land tenure to cultivate the area.

However, biophysical features of the sites significantly affect the ability of the CFM groups to achieve the stated conservation and economic goals of the HKM scheme. When planting more trees can only mean reducing economic benefit, there is less chance of improving forest conditions. Higher elevation sites with steeper slopes may reduce likelihood of forest degradation due to lack of access, but it also prevents farmers from having more livelihood crop options, thus reducing their motivation in restoring degraded areas. Lack of technical capacity to process and market their forest and agricultural products is also preventing HKM units from earning higher economic benefits. Currently this role is filled sporadically by a local NGO (Konsorsium Kota Agung Utara) that is funded mostly by bilateral grants[6]. Despite their best effort to empower HKM units in Tanggamus district, they do not have enough funding and staff capacity to support all HKM units in the area. Most farmers believe that the government can do more to help them meet the reforestation target. Specifically. technical assistance to select tree species for TCF is an area where the government can improve HKM implementation. This is also an important point for improving decentralized forest governance structure (Bae et al. 2014; Kim et al., 2016; Sahide et al., 2016). As the forefront of forest management at the field level, FMUs are responsible to assist implementation of HKMs within their jurisdiction (Kim et al., 2016). Batutegie Forest Management Unit is completely funded by the provincial government budget, and does not receive any funding from the central government. As of 2017, the annual budget of the FMU is Rp. 285 million (around USD 19,950) to oversee an area of 58,174 hectare (KPHL Batu Tegi 2012; MoEF2018). This budget is barely enough to pay for their own 35 staffs, let alone developing an impactful and technically sound assistance program for HKM concessions within their jurisdiction. Allocating more resources into FMUs providing day-to-day support for the implementation of HKM program can mean improving the quality of monitoring and evaluation of each HKM and increasing the ability for government to identify issues on HKM implementation early in the program. These two are keys for the decision makers to evaluate the implementation of HKM regularly, adapt, and improve policies to ensure that both conservation and economic goals can be achieved.

The political commitment of the current administration to significantly increase the area of *social forestry* is a major step in advancing CBF implementation in Indonesia. However, this ambitious target should also be followed by increased fiscal support, not only within the central government budget, but also at the implementation level

[6] An example is the Tropical Forest Conservation Action (TFCA) program, which is the project implementation of debt-for-nature framework signed between Indonesia and the United States (Prijono 2017).

through local government budget. Future iteration of the Indicative Map of Social Forestry (*Peta Indikatif Areal Perhutanan Sosial-PIAPS*) should take into account biophysical characteristics of the land to ensure, so it can support multiple objectives of forests restoration as well as livelihood improvement for rural communities. Increasing monitoring and evaluation capacity is the key to ensure that this massive experiment of redistribution of forest estate does not end in more forest degradation. From the perspective of local communities, the HKM scheme and *social forestry* program in general are seen as an opportunity to secure land tenure within the forest estate for their livelihood. This motivation led to the management pattern that prioritizes economic benefits over sustainability of the forests. Significant portions of HKM areas that we visited are dedicated for coffee plantation and multipurpose trees species, with no regards to conservation value of the forests. Planting overstory trees that can fulfill some of the government requirements for forest rehabilitation is seen as the second priority.

Future designation of HKM schemes should take into account land suitability analysis based on the land's biophysical characteristics to ensure farmers can generate enough benefit as well as multiple options of livelihood crops within their HKM areas to avoid the tendency to convert the land into monoculture plantation. Evaluation of reforestation target should be conducted more rigorously to achieve the goal of conservation and sustainable management, and not merely a populist policy to redistribute forest estate.

## 6. Conclusion

This study aims to understand the benefits and challenges of CBF from farmers' perspectives focusing on the effects of site-specific biophysical features. Although this case study is limited to two communities in one province in Indonesia, we believe that the findings of this study have broad implications for improving the process of CBF site designation. Biophysical features of potential sites can be evaluated based on remotely sensed spatial data, which is a practical pathway forward for ensuring positive CBF outcomes. Technical supports should be devised to meet site-specific needs for CBF to achieve the dual mandate of sustainable forest management and poverty alleviation.

Nevertheless, additional studies are needed to systematically assess and quantify the factors affecting CBF success on a larger scale if we are going to generalize the findings of this case study to other areas. Future research can employ experimental designs for quantifying actual cost and benefits of CBF designation and stratifying the community experiences and outcomes based on their biophysical features.

## Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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