Village forest management for mitigation of climate change and contribution to community social-economic resilience

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Abstract. Indonesia has the potential of forest resources with an area of 120.7 million hectares. The government has established various forest area management mechanisms to create livelihoods, environmental services, and climate change mitigation efforts. This study aims to determine the contribution of village forests to the creation of livelihoods for the community through physical observation, social observation, and in-depth interviews. The Village Forest in the study location has advantages because it consists of terrestrial and aquatic ecosystems, so the biodiversity richness is very high. The strength of the village forest system is that it can be managed by local communities as a source of livelihood for 59.9% of respondents, but it is not yet optimal in its management as a source of income with the majority of respondents earning less than one million rupiahs (70% of respondents). Although, the majority of the 148 respondents (37.4%) are considered that the forest areas contributed to new types of work as a source of income. The potential for exploitation and degradation of forest areas needs to be considered because of the high frequency of people entering forest areas and opening access. The existence of village forests in the region directly or indirectly contributes to efforts to mitigate global climate change. It can be conserved and protected as a carbon pool and a carbon sink. The existence of various types of new jobs and potential economic opportunities from this can reduce the rate of forest conversion and exploitation by the community which is generally done to earn income.

1. Introduction
Indonesia, with its strategic geographic location on the equator, has an area of forest reaching 187.9 million hectares or the equivalent of 63.42 percent of the existing land area [1]. The existence of forest areas in Indonesia, which dominates the land area, provides a major contribution to society and the national economy. In the years 1992-1997, the forestry sector provides a national foreign exchange of US $ 16.0 billion, or about 3.5 percent of the national Gross Domestic Product (GDP) [2]. The contribution of the forestry sector to GDP decreased from 4.3 percent in 1993 to 2.3 percent in 2003. However, a decrease in percentage does not automatically reduce the nominal revenue, because its value has increased from IDR 14.1 trillion to 36.2 trillion rupiahs [3]. The increase in value was driven by the forestry product market mechanism and the post-1998 economic crisis recovery [4]. Therefore, it must be recognized that the forestry sector makes an important contribution to national economic growth.

The forestry sector does not only contribute to the economic sector indirectly, the forestry sector provides opportunities and jobs [5]. It's getting bigger managed forest areas increasing employment opportunities, so that in 2000 there were 3,092,470 people involved in a series of processes in the
upstream-downstream forestry sector. Currently, one-third of the rural population depends on the forestry sector, for example, the availability of fuelwood, medicinal plants, food, organic fertilizers from forest litter, which are also a source of income [6]. Forest management must be strengthened to provide a more decent livelihood for the community, especially those who live around forest areas.

Strengthening forest management and involvement of local communities very important to do because it will foster a sense of belonging and will keep it as good as possible [7]. Apart from being a source of livelihood management forest monitoring is one of the strategic efforts to realize commitments Indonesia to achieve Paris Agreement commitment and Nationally Determined Contribution (NDC) to reduce emission 29% or 41% with international assistance [8]. Forestry sector and function transfer and become a contributor to emissions the largest for Indonesia, reaching 47.8%. This happens because the forest area continues to be cleared to be used as plantation land and timber is taken to fulfill economic needs [9]. With the village forest program that is managed by the local community to increase labor-intensive activities, it can contribute to income, so that the community does not need to venture out primary forest cover. Through this mechanism, the community does not only rely on the agricultural and land sectors, but there are several options work which is a source of livelihood so that the rate of forest clearing and land conversion can be reduced. This research aims to analyze the new livelihood to increased climate change mitigation.

2. Method

This study uses a qualitative approach with a combined method. Qualitative methods were conducted through interviews with respondents to gather information and data regarding the social conditions of village forest institutions. Quantitative methods were carried out by researchers through questionnaires and physical observations in the village forest area to obtain data on economic conditions and the village forest ecosystem. The research location is in the village forest in the Batu Ampar sub-district, Kubu Raya Regency, West Kalimantan Province. This location was chosen because it is unique in that the village forest area consists of a terrestrial ecosystem and an aquatic ecosystem. There is also a mangrove ecosystem which is an advantage as well as a supporting sector for people's livelihoods. The sample of this research consisted of 148 out of 3.848 population that happen to live in the village forest area in Batu Ampar, using the sampling technique of Slovin’s formula, with 5% of margin error.

3. Results and discussion

Based on the results of the study there are 77.8% men and 22.2% women with very diverse ages ranging from less than 30 years to more than 60 years. The majority of respondents were aged 31-39 years (31.8%), 40-49 years (29.7%), 50-59 years (20.3%), less than 30 years (17.6%), and more than 60 years (0.7%). Meanwhile, in terms of education level, the majority of respondents are elementary school graduates (54.7%), junior high school graduates (19.6%), high school graduates (18.9%), bachelor graduates (3.4%), not attending school (2.7%), and others (0.7%). The majority of respondents in this study were active in LPHD organizations (48.8%), KUPS (28.9%), village government (18.1%), non-governmental organizations (0.6%), and others (3.6%). The respondents have diverse type of work as shown in Figure 1.

The types of work that are mostly occupied by the community can be categorized into sectors that rely on forestry, trade, and manufacturing which is community directly adjacent to the forest area. This condition encourages people to use the forest, so that there are many types of work-related to forestry, for example, forest business, farmers, manual labor in agriculture and plantations, and breeders [10]. Forest as a stable ecosystem provides a very large contribution to the social and economic life of the community particularly creating job opportunities and opportunities as well as potential income in it [11]. Forest to play a role as a source of food because provide carbohydrates, protein, fat, vitamins, and various other nutrients from the diversity of organisms contained therein [12].
The diversity of organisms found in forest areas become a determining factor for the intensity and income of the community. In general, forest ecosystems provide ecological, economic, hydrological, pharmacological, area protection, and aesthetic [13]. These benefits become an attraction for the community to enter the forest and explore and exploit [14]. However, the various benefits provided by forest ecosystems are ultimately managed by humans for economic benefits [15]. This mechanism causes the forest ecosystem to tend to degrade that made worse by the minimum employment Opportunity for some people so that only the forest open for chance work for anyone for the sake of obtaining income [16].

When viewed in terms of the income of the people who live in Forest research location generally has income below the regional average minimum wage (UMR). The majority of people (49.7 percent) have an income of fewer than 2 million rupiahs per month, while people who have high enough income or more than 3.5 million rupiahs per month only 3 percent. It is understood that the limitations of technology and knowledge are the main barrier to income for the community. This can be seen from the
types of commodities obtained from forest areas and the added value they provide. In detail, the average community income can be seen in Figure 2.

The community in everyday life is closely related to forests and forest ecosystems. Intensive interaction between the community and forest areas has been going on for several centuries and provides mutually beneficial relationships [10]. Proof of relationship that Mutual benefit can be seen from the sustainability of life between forest areas with the local community [17]. In the beginning, the people considered the forest as their ancestor who kept them safe from all forms of life's challenges, for example, from hunger (food scarcity), health, to natural disasters [18][19].

The various functions of forests on protecting the surrounding ecosystem are commonly referred to as sustainable environmental services that exist if its sustainability is well maintained [20]. If people are capable of comprehending and understanding sustainable environmental issues, they will logically preserve the sustainability of the forest because forests will maintain the stability of their life through the environmental services provided [21]. Environmental services are given by the forest ecosystem stability, among others availability of tree-based food, understorey-based food, mushrooms, water availability, emission absorber, oxygen production, holding disaster risk, and health resilience through ethnobotany [15][22][23]. Generally, not all of these aspects can be finalized, so that the community only lists real income and does not include other values earned [24].

The optimization of environmental services from forest ecosystems can be enhanced through strengthening the local-community knowledge capacity [25]. Based on the research results it is known that several livelihood sectors have increased in the forest area. In detail sectors that have increased are shown in Figure 3.

Figure 3 shows that the ecosystem forests play an important role provide job opportunities to the community. Various types of additional jobs can be created through this knowledge capacity building activity. This means that the community can understand forests more comprehensively and proportionally so that potential new types of work emerge, provide a livelihood for the community [26]. People have done management, but with the boost of capacity building, they are introduced to a variety of forest management patterns that have two benefits at the same time (1) conserving forest and (2) providing livelihoods or income.

![Figure 3. Number of the employment sector in forest areas. Source: primary research data, 2019.](image-url)
Previously, Forest as a source of livelihood was only managed to obtain raw products and the most dominant was timber forest products, although non-timber forest products were well known and tend to be sold without efforts to provide added value. This results in a selling price of forest products low and has implications for the amount of income earned [6]. Therefore, there needs some intervention from the government to increase capacity knowledge and technology in the area, thus encouraging the community added value [27]. Increased human resource capacity is the most important thing for the sake of realization of economic resilience for the surrounding communities' forest monitoring, which will encourage efforts to conserve the forest itself [19][28]. Economic resilience becomes the leverage for environmental conservation efforts, as the concept adaptation of Miller and Spoolman [29] that poverty to be one factor that encourages exploitation and environmental damage.

Besides the amount the additional income, the intensity of the community in obtaining income is also very important [30]. This is related to the economy and the capability of money-saving. If the community gets an active income, they will tend to consistently work relate to the forestry sector and hence they will guard the forest from forest exploitation. Table 1 about the relation between intensity activity in the forest and the income

Table 1 shows that the existence of forest areas is very supportive of the realization of community economic resilience. Economic resilience achieved through various forest management mechanisms can generate monthly income for local communities (50.4%), quarterly income (36.3%), six-month income (5.9%), and annual income (7.4%). It can be seen explicitly that the people in this area manage forest areas intensively to obtain forest products that are harvested every month. Meanwhile, a small proportion of others utilize the forest area for the cultivation of certain types that can be harvested seasonally, whether for 3 months, 6 months, or annually. This system implies that the community should be given increased capacity for knowledge and skills optimally [31]. Intensification of forest area management, if done inappropriately, has the potential to cause degradation of ecosystem quality [32].

Community intensification in managing forest areas can also be seen from the activities undertaken to enter the area. Of course, it cannot be separated between the pattern of forest area management and the community's intensity in entering the forest area [33]. People in this area tend to have open access to natural forests, which is reflected in their frequent entry into forest areas. This matter can be seen in Table 1 that there is a synchronous pattern between the intensity of the community obtaining income and the intensity of the community entering the forest area. It can be ascertained that the community enters the forest area to obtain timber forest products or non-timber forest products for their consumption or on sale [34]. With the forest village, forest ecosystem utilization patterns become more promising in terms of sustainability and economic acceptance of the community. In Figure 4, a change in the pattern of forest ecosystem utilization is shown: village forest.

| No. | Activity                                      | Period   |
|-----|-----------------------------------------------|----------|
| 1   | The intensity of the community in obtaining income | Monthly 50.4% Quarter 36.3% Semester 5.9% Annual 7.4% |
| 2   | The intensity of the community in entering the forest area | Monthly 56.5% Quarter 15.3% Semester 9.4% Annual 18.8% |

**Figure 4.** New patterns of forest management through village forests. Source: primary research data, 2019-2020.
Figure 4 shows that prior to the existence of the village forest, the community was more concerned with maximizing economic benefits without considering the sustainability of the forest. If this is continued, it will pose a risk of damage to the environment and decreasing environmental services [35]. Since the implementation of the village forest mechanism, various interventions from the government and the private sector, and non-governmental organizations have had a positive impact because the community uses the forest no longer based on exploitation but ecologically friendly and sustainable management. This pattern evokes a passion for conservation as well as giving more income than before [20].

New use patterns also provide enormous potential for climate change mitigation. If the pattern is applied, there will be new jobs intensively and the community is no longer extensively land-clearing and forest conversion. This scheme will be better conserve to become a carbon sink in mitigating climate change. The community will no longer exploit the forest cover and convert it to monoculture plants which cause huge emissions [24]. Utilization based on agroforestry is very appropriate because it is ecologically friendly and has the potential to absorb more carbon in the form of plant biomass [25]. The monoculture pattern has also been changed with silvopasture which provides more income in nominal terms frequency due to variations in the type of commodity. This is a strategic effort to mitigate climate change considering the pattern of monocultures increases the emission contribution which is quite large, especially in terms of land preparation and control of plant pests [26]. With the village forest, the community has more varied job opportunities and opportunities, higher income, increasing conservation efforts, and climate change mitigation [22]. Especially if carbon trading is implemented, the community will get greater benefits and be in tune with environmental conservation efforts [36].

4. Conclusions
The majority of respondents have jobs that are directly related to forest resources in the upstream sector, namely farmers, forest business workers, and unskilled laborers with an average income of below IDR 2,000,000 per month. Some of the community (37.4%) considered that the forest area affected the addition of productive work as a source of income, which entirely still depended on the land-based sector. With the village forest, people have more open employment opportunities and opportunities, and the income potential will increase. Village forests present ideal benefits in the context of community livelihoods and environmental preservation. Environmental conservation efforts also contribute greatly to climate change mitigation because the community no longer clears forests for the cultivation of monocultures and switch to climate-friendly cultivation according to ecological characteristics.

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