

Development of *bio-rights* incentive scheme for participatory restoration and conservation of mangrove resources

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Abstract. Suharti S. 2017. *Development of bio-rights incentive scheme for participatory restoration and conservation of mangrove resources. Biodiversitas 18: 121-128.* *Bio-rights* incentive scheme is one strategy to accommodate efforts to increase economic benefits with efforts to prevent counterproductive activities to the environment (through restoration and conservation of natural resources). This study aims to assess the implementation of *bio-rights* incentive schemes, its achievements, and challenges in its implementation. The research was done by using survey method in Pesantren Village, Ulu Jami Sub-district, Pemalang, Central Java, Indonesia, which is the location of the pilot project established by Wetland International Indonesia (WII). The research was done in August to December 2014. The results showed that *bio-rights* incentives scheme could encourage the community to participate actively in restoration and conservation of mangrove resources. Implementation of *bio-rights* scheme was done through the provision of micro-credits to the community groups to develop activities that can generate sustainable income. Loan repayments and its interest was not in cash, but in the form of conservation service activities such as reforestation, habitat protection and the prevention of unsustainable land use. Through the *bio-rights* scheme, besides gaining financial benefits, villagers in Pesantren also received other benefits such as improvement of environmental conditions (widespread mangrove plantation, improvement in land productivity and the intensity of mangrove aquaculture).

Keywords: *Bio-rights*, conservation, mangrove, participatory, restoration

INTRODUCTION

Mangrove ecosystem in coastal areas has invaluable benefits for the community and its surrounding environment. This region generates public revenue from the production of aquatic biota, mineral resources, transportation routes and area for pollution neutralizer resulted from human activity (Giesen et al. 2007; Walters et al. 2008; Kusmana 2010). Numerous benefits contained in the coastal ecosystem leading to higher pressures and increase in demands to provide and to fulfill human needs (food, housing, services) both for now and in the future. Therefore, in the utilization of natural resources including mangrove, it should be able to accommodate the demands of the economy on one side with ecological principles on the other side.

However, some evidence shows that significant role of mangrove forest is not supported by the efforts to maintain its sustainability. It is estimated that among 3.7 million hectares of mangrove areas in Indonesia, 1.8 million hectares is now badly damaged due to deforestation. In assessing the value of an ecosystem including mangrove, there are different perspectives between the decision makers and profit-oriented parties on one side with the environmentalists on the other side. The first parties concern more about investment and economic development, whereas the second see the forest ecosystem from the perspective of ecology and environment (Giri et al. 2008; Soedomo 2013; Kildow and Guo 2014). In this situation, the second often are forced to be defeated due to

economic pressure and the need for area development (Din et al. 2008; Sena 2009; Ramdani et al. 2015). Some evidence shows mangrove destruction occurred massively and converted into ponds and for other uses in many parts of Indonesia (Giesen et al. 2007; Kusmana 2012; Samad et al. 2013). Therefore, in designing forest ecosystem management, it requires a thorough consideration, assessment, and analysis hence it would not adversely affect its surrounding area (Karminarsih 2007; Samad et al. 2013). A balance between social economic and ecological needs should be taken into account in the planning of mangrove forest management.

Various attempts have been made to ameliorate the degraded forest ecosystem through restoration and conservation activities, but until now the achievements are still lacking. The main reasons of the low success of restoration and conservation efforts is the competition between the interests of economic objectives with ecological objectives (Baderan 2013; Brown 2007; Nakagaki 2011). In mangrove management, a rational approach is needed to accommodate economic interests in one hand with ecological interests on the other hand amicably through direct community engagement. Amri (2005) reveals that in establishing a program for sustainable mangrove management, the economic benefit that would be obtained by the local people from the planted mangroves would determine the active participation of the people and the sustainable of the program. Another crucial factor determining the success of sustainable management of mangrove is common awareness of the community on

the importance and scarcity of the resources (Sudtongkong and Webb 2008). Moreover Datta et al (2012) argued that ensuring active participation of subsistence based users in decision making and resource sharing have been recognized as a prime determinant for sustainable mangrove management.

Bio-rights incentive scheme that is implemented through funding mechanisms is one strategy to accommodate efforts to increase economic benefits of mangrove resources and the attempt to prevent counterproductive activities to the environment through restoration and conservation actions. Research carried out in The Philippines also reveals that awareness on potential alternative livelihood that can be achieved by group based micro development scheme such as *bio-rights* could promote sustainable mangrove resource utilization (Chowdhury and Maiti 2014). *Bio-rights* induces people to be actively involved in restoration and conservation of mangrove ecosystems in the surrounding areas. In the scheme, if the conservation efforts demonstrate the success (according to the contract agreed between the initiator and the community receiving microcredit), the credit will be transformed into an ample grant (Eijk and Kumar 2008). The study aims to assess the implementation of *bio-rights* incentive schemes, achievement, and challenges in its implementation.

MATERIALS AND METHODS

Area of study

The research was conducted in the community participating in the development of *bio-rights* pilot project scheme developed by Wetland International Indonesia (WII) in Pesantren Village, Ulu Jami Sub-district, Pemalang District, Central Java, Indonesia (Figure 1) (Eijk and Kumar 2008). The study was carried out from August to December 2014 by using a survey method.

Methods

A total of 30 respondents were selected purposively to be interviewed about their involvement in the implementation of *bio-rights*, their perception, achievements, and challenges in its implementation. Selection of respondents are based on their active participation in the *bio-rights* scheme. To get more information about *bio-rights* scheme, in-depth interviews were also carried out with 12 key informants who are determined by using the snowball method.

Data analysis

Data obtained from the research results is analyzed by using descriptive analysis (qualitative and quantitative).

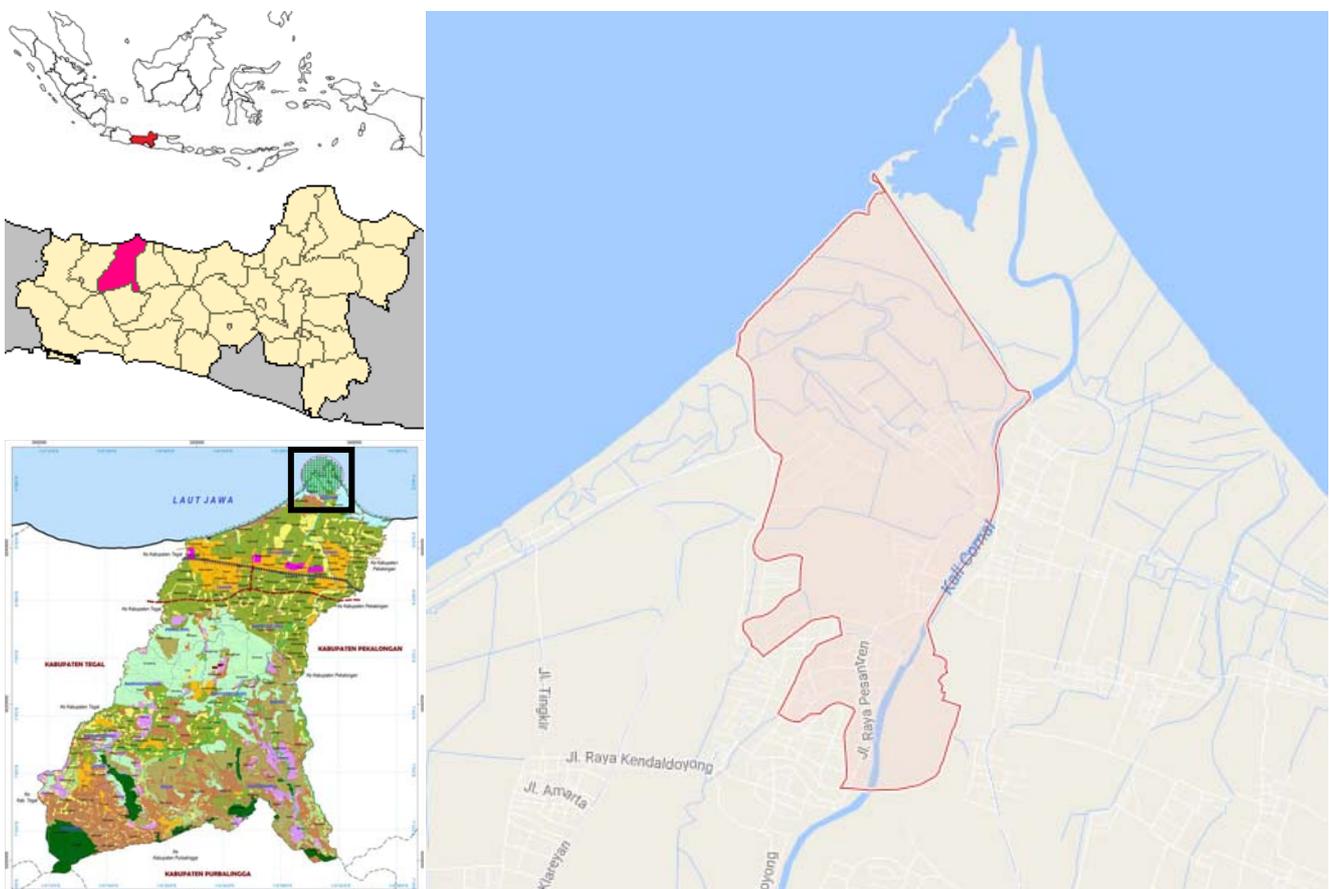


Figure 1. Research location at Pesantren Village, Pemalang, Central Java, Indonesia

RESULTS AND DISCUSSION

Bio-rights incentive scheme

Bio-rights incentive scheme was first developed by Wetlands International, Alterra Green World Research and a number of related organizations in the late 1990s. This approach was developed as a response to various social problems, an economical and highly complex environmental issues that are difficult to overcome with conventional natural resources management approach (Eijk and Kumar 2008). *Bio-rights* scheme as an alternative solution to the problem is intended to coalesce poverty alleviation and environmental conservation.

Implementation of *bio-rights* scheme was done through the provision of micro-credits to the community groups to develop activities that can generate sustainable income. Microcredit in many cases is the only alternative approach that can be developed to help people get rid of poverty like what has been mentioned by Brown (2010): “Microcredit-the extension of small loans-gives people who would otherwise not have access to credit the opportunity to begin or expand businesses or to pursue job-specific training. These borrowers lack the income, credit history, assets, or security to borrow from other sources”. However, in developing countries many people doubt about the ability of micro credit in poverty alleviation, although it is so popular and growing in the United States and Canada to overcome the hurdles to self-sufficiency (Brown 2010).

Similar to another micro-credit scheme, *bio-rights* is also “pro-poor” approach and support activities that often have a low return and low market demand (Khandker 2005) such as rehabilitation and conservation of natural resources. Khandker (2005) mentioned that there is an assumption stated that aggregate poverty impact of microfinance is modest or even nonexistent implying that poverty impact at the participant level represents either income redistribution or short-run income generation from the microfinance intervention. Study on microfinance and poverty in Bangladesh done by Khandker (2005) found that access to microfinance contributes to poverty reduction, especially for female participants, and to overall poverty reduction at the village level. Microfinance thus helps not only poor participants but also the local economy. Most microcredit is offered by non-profit social enterprises; as the loans are repaid, the money is invested into other loans, bringing the benefits of microcredit to an ever-expanding pool of entrepreneurs. Loan repayments and its interest was not in cash, but in the form of conservation service activities such as reforestation, habitat protection and the prevention of unsustainable land use.

Bio-rights is an incentive scheme that is almost similar to the system of Payments for Environmental Services (PES). In its establishment, there are three main stages of *bio-rights* scheme that emphasize community involvement (Eijk and Kumar 2008). Phase 1 is the funding allocation in the form of micro-credit loans for its participants which could be used to develop income generating activities on an ongoing basis. Stage 2 is the refund of the loan and its interest which is not in cash, but in the form of

environmental conservation services, such as reforestation activities, habitat protection, and sustainable land use. Step 3, if the activities related to environmental conservation efforts (phase 2) performs well, then the loan funds (microcredit) will be converted into pure grant which would then be rolled out to other members of society for sustainable development

Historical development of *bio-rights* in Pesantren Village

Pemalang District is one of the districts in Central Java Province, Indonesia located on the northern coast of Java. The astronomical Pemalang lies between 1 090 17 '30 "-1090 40' 30" E and 80 52 '30'-70 20 '11 "latitude (Pemalang District Government 2014). Pemalang District lying from the East to the West has about 34.6 km long beach (Eijk and Kumar 2008). Along the coastline of Pemalang, there are mangrove forests that function as protection from the waves, the wind and sea water intrusion. In the early of 1980s, the development of aquaculture (ponds) extends significantly to the coastal areas of Southeast Asia, including Indonesia to meet the high demand for tropical shrimp continuous to increase worldwide. Consequently, conversion of mangrove to shrimp farms occurred massively in Pemalang. Development of shrimp farms managed intensively has caused high pollution from waste production of fertilizers, pesticides and antibiotics used. Being unaware on the value and importance of mangroves as a life supporting ecosystem, society abuzz rent their land for shrimp cultivation to external investors. As a result, mangrove forests in Pemalang lost for several years. Investors rented land to build open pond system with very low-cost land rental and cheap daily wages. In the first years, cultivation of tiger shrimp (*Penaeus monodon*) gave huge advantage, but only a small fraction that was given to the local community.

A few years later, shrimp diseases such as white spot syndrome virus outbreak in Pemalang resulting in the decrease of shrimp production almost to the point of zero. Consequently, investors left the region, leaving poverty in the community with no capital or financial at all for repairing the damage of natural resources. Mangrove destruction also lead to severe erosion and flooding that always came during storms and high tides. This had hampered the continuing effort of the community to cultivate shrimp and fish pond that has been damaged so that further enhance the public poverty.

Considering the very poor conditions of the people in Pemalang, in 1998 Wetland International Indonesia initiated to develop the *bio-rights* scheme in the area to conduct a re-greening effort of degraded community land. The first step was begun by establishing cooperation with local NGOs in Central Java to integrate conservation objectives and local development without neglecting the needs and aspirations of local communities.

Implementation of *bio-rights* scheme

Bio-rights scheme was not implemented on an individual basis, but it was developed for a group of the

community. At the initial phase, all groups involved agreed to focus on the activities of restoration and conservation of mangroves and coastal plants. This was the results of intensive discussions between the community and with relevant stakeholders. Mangrove species planted included *Rhizophora mucronata*, *Rhizophora apiculata*, *Avicennia* sp. and several coastal plants such as *Hibiscus tiliaceus*, *Terminalia catappa*, *Calophyllum inophyllum* and *Casuarina maritima*.

In order to keep the function of pond aquaculture system as well as to meet the economic needs of the people, mangroves was not planted on the whole pond area, but it was cultivated by using silvofishery cultivation pattern. Mangrove planting was aimed to combine the function of pond cultivation with ecosystem services provided by mangroves replantation. This farming technique actually is a strategy to assure that its participant would gain economic benefits by involving in the program which eventually would increase their active participation and high achievement of the program. This is in accordance with research results done by Amri (2005) in South Sulawesi and literature review done by Datta et al. (2012) which proves that economic benefits seem to be necessary to guarantee the sustainability of mangrove management program establishment. Subsequently, plans were made further to restore beaches that formed a protected area (green belt) for the ponds from the threat of erosion and storm damage. Mangrove was lined grown on sandy soil along the coastline with a thickness of 50-100 m width. Selection of activities by taking into account the aspirations of the people was meant as payoff of the conservation service provided.

The head of community group which is one of key informants told that at the beginning of the implementation, the contract was agreed for 2-3 years, but later it was extended after project intervention showed high achievement. Since conservation activities focused more on coastal restoration, the indicators selected for success attainment was survival rate percentage of the seedlings planted. The agreement was if the survival rate reached $\geq 75\%$ until the period of the contract was completed (after three years), then the community acquire reward where the status of micro-credit was changed to become pure aid (grants). Conversely, if the survival rate was lower than the target, it would lead to the repayment of micro-credit either the whole or in part, depending on the contract.

Characteristics of participants involved in *bio-rights* scheme in Pesantren Village

Pesantren Village communities are participating in the *bio-rights* scheme mostly were owner or worker of the land left by the shrimp investors in the past. Cultivation pattern developed ranging from monoculture milkfish cultivation, milkfish-shrimp-tilapia cultivation, and milkfish-shrimp-seaweed cultivation. Silvofishery cropping pattern was commonly found in fishpond cultivation, where mangroves were planted in the middle of the ponds or in bands around the pond. Description of the farmers participating in the *bio-rights* scheme in Pesantren Village are presented in Table 1.

Table 1. Characteristics of respondents participating in *bio-rights* scheme in Pesantren Village, Pemalang, Central Java, Indonesia

Criteria	Percentage
Average age (years)	41.5
Percentage of respondents (%)	
Male	74
Female	26
Average number of family members (persons)	4
Distribution of main occupation (%)	
Farmers	74
Merchant	3.7
Others	22.3
Distribution of education level (%)	
Illiterate	3.7
Elementary	77.7
Junior high	11.11
Senior	3.7
University	3.7
Average cultivated land (ha)	1.2
Status of cultivated land (%)	
Owner	51.85
Rent	29.63
Profit sharing system	7.4
Wage labor	11.11
Mangrove species cultivated	<i>Rh. mucronata</i> . <i>Rh. apiculata</i> . <i>C. maritima</i>
Main reason to select the species planted (%)	
Easy to grow	33.33
Benefits	37.03
Grow fast	11.11
Seedling was easy to get	7.4
Others	11.11
Cropping pattern of mangrove (%)	
Monoculture	85.18
Polyculture	14.81
Number of mangrove trees/ha	1200-1600 ph/ha
Frequency of ponds maintenance (%)	
Once a year	55.55
Twice a year	33.33
Three times a year	7.4
Four times a year	3.7
Kinds of fish cultivated (%)	
Milkfish	85.19
Milkfish-shrimp-tilapia	3.7
Milkfish-shrimp-seaweed	3.7

Table 1 showed that majority of respondents only have basic education level (elementary school), and even only 3.7% of them are illiterate. Abdullah et al. (2014) found that there is a correlation between educational attainment with a willingness to participate in one program. The case in Pesantren Village present different findings as participants who involved in *bio-rights* program have different level of education from the lowest level (illiterate) until the highest level (university) and even most of the participants have only elementary level of education. Of all respondents, only 51.85% who were landowners, while others were fish pond workers. Main considerations in selecting tree species are easy to grow and various benefits that can be obtained from it. From field observation, it was

found that mangroves were planted with a density of between 1200-1600 trees/ha. The average land size was 1.2 ha.

The success of *bio-rights* scheme

Monitoring and evaluation on the grow of mangrove cultivation carried out both by *bio-rights* participants and the WII found that the survival rate of seedlings planted achieving $\geq 75\%$ in the period of the contract (Eijk and Kumar 2008). There are a lot of factors contributing to the success of *bio-rights* establishment in Pesantren Village including awareness on the importance of mangrove, calculation about threat of risk if mangrove does not exist (Sudtongkong and Webb 2008), recognition of potential benefits that would be obtained (Farley et al. 2010) and support from all related stakeholder (Carter et al. 2015). This success had made a change in the status of micro-credit into pure grant which then can be utilized for developing further income generating activities. Although *bio-rights* scheme had been completed several years ago in the area, but the impact of the success of the activities still clearly can be seen and recognized today. Aquaculture in Pesantren Village, which was formerly barren now, has become productive. From field observation, it can be seen that mangrove trees grow well with an average height of 6-10 meters. Coastal plants planted even grow to more than 12 meters. Growing areas along the beach has now become dense forest followed by naturally regenerated seedlings. System silvofishery is also well developed.

In addition, mangroves planted in bands around the ponds provide shade for pedestrians while mangrove leaves falling into the water become nutrients for the ponds. Another benefit obtained from mangrove cultivation is the availability of animal feed ingredients (goat) of the trimmed mangrove leaves. Within a few years, the coastal areas of Pesantren Village have gained significant benefits from improved ecosystem conditions. The number and species of fish that can be caught around the river/canal embankment has now increased. Similarly, shrimp and crab populations rebounded after nearly extinct. This success is in line with Darusman (2012) who argued that the appropriate forestry development for the benefit of the economy, the environment, and the sovereignty of the nation should be multi-products and based on community participation, either individually or in groups. Furthermore, the establishment of *bio-rights* incentive scheme has facilitated the development of forward linkages for its participants i.e. development of food stalls (warung makan), fishing activities and fish product processing to increase its added value.

Another factor which also contributes to the success of *bio-rights* incentive scheme developed in Pesantren Village is active participation of the community and also related stakeholder in mangrove management in Pemalang District. This has been enlightened before by Agrawal (2000); Memon and Chandio (2011); Datta et al. (2012) and Febryano et al. (2014) who revealed that involving communities and other stakeholders having close relationship and high dependence on the existence of mangrove resources would be the important key to carry

out collective action in management of mangrove ecosystem in one area. Subsequently Datta et al. (2012) explains that sustainable management of mangrove ecosystems will eventually rely on the cooperation among governmental bodies and local stakeholders (including local community) struggling for a common goal i.e., the protection and conservation of mangrove ecosystem.

Economic impact of *bio-rights* scheme

Berhane and Gardebroek (2011) argued that there is limited information about long-term impacts of microfinance credit that can show evidence about the success of the scheme. Another study in Bangladesh also tried to evaluate the impact of microfinance programs on multidimensional poverty due to several claims, doubts and skepticism on the program (Nawaz 2010). The positive impact of *bio-rights* establishment in Pesantren Village could be one example of clear evidence on the success of microfinance scheme. Although the contract of *bio-rights* officially ended in 2005, the restoration project continues to run. Society still meets every week to discuss new restoration activities.

In 2008, 120 hectares of unproductive ponds planted for restoration and maintenance activities expansion mangrove belt (green belt). The community also maintains collaboration in development activities by registering them into a cooperative group. This allows for effective cooperation in cultivation, production, post-harvest and marketing of products with other parties (Eijk and Kumar 2008).

The success of *bio-rights* scheme developed in Pesantren Village also confirms research done by Brown (2010) who argued that microcredit has proven itself as a strong stimulant to economic development. People who received loan has the capability to pay it back support themselves through their increased income, as well as employing others and even increased tax income. Like already elaborated before, most microcredit is offered by non-profit social enterprises; as the loans are repaid, the money is invested into other loans, bringing the benefits of microcredit to an ever-expanding pool of entrepreneurs. Research done by Rahman (2012) confirmed the importance of micro credit scheme developed in Bangladesh in increasing the socioeconomic condition of its beneficiaries.

Besides several indirect benefits (intangible) generated from the existence of mangrove ecosystem including protection for Pesantren Village from erosion, waves brunt and wind blows, improvements on the environment and mangrove habitat, it also provides direct benefits (tangible) which can be experienced by the people by the increase in their socio-economic conditions. This is reflected by the growing number of business alternatives that could be developed as a positive impact on the success of farming. Revenue earned from fishpond cultivation and its related activities (the processing of fish, shrimp, seaweed) provides the largest proportion (82.82%) compared to other sources of income. This high income helps the people to get rid of poverty which they previously experienced. If compared with the poverty line set by BAPPENAS (Agency for National Development and Planning) and the

World Bank for Indonesia, the average income of the people in Perantren Village was higher (Central Bureau of Statistics 2014) (Table 2). Study on factors affecting Fisher's perception of benefits and participation in Pak Phanang Bay, Thailand reveals that monthly income was identified as an important factor for participation (Jumnongsong et al. 2015). The case in Pesantren Village is dissimilar with the situation in Pak Phanang Bay, Thailand because at the initial stage of *bio-rights* establishment, most of its candidate of participants are in poor condition, hence willingness to participate in the scheme was not influenced at all by level of their monthly income.

Table 2 describes that *bio-rights* scheme developed in Pesantren Village obviously could help its participants to increase their income significantly. This success is in accordance with research done by Brown (2010) who found that microcredit has proven itself as a strong stimulant to economic development. People who received loan has the capability to pay it back support themselves through their increased income, as well as employing others and generating business for their supply chain. On the other side, Governments benefit through decreased social assistance costs and even increased tax income.

Perception on the *bio-rights* scheme

Bio-rights scheme has provided an opportunity for the people to actively participate in the restoration and conservation of mangrove. Learning from experience in Pesantren Village, people now understand the value and importance of mangroves as life supporting system. *Bio-rights* scheme also indirectly induced other stakeholders to engage in restoration and conservation of mangrove. The result of interviews with selected respondents reveals their positive perceptions towards the existence and benefits of mangrove forest. Respondents' perceptions on *bio-rights* scheme is presented in Table 3.

The result showed that *bio-rights* incentive scheme could encourage the people to actively participate in restoration and conservation of mangrove. Besides receiving financial benefits, villagers in Pesantren Village also attained other benefits such as improvement in environmental conditions (expansion of mangrove plantation, increase in land productivity and intensity of mangrove aquaculture) and increased in capacity to develop mangrove based business alternatives. This evidences showed that Government assistance to the poor does not always create people dependency and disincentives that make things not better but worse, like what has been argued by Morduch (1999) and Kutir and Odoom (2009).

In general, *bio-rights* participants in Pesantren Village express their positive perceptions and satisfaction about this scheme. The main aim of the program to restore and rehabilitate mangrove ecosystem perform its sustainability until now. The achievement of *bio-rights* scheme in Pesantren Village is different from research results from Rahman (2012) who reminded that in many cases the effectiveness of the micro-credit program tends to decrease due to lack of sufficient loan and provision of training

Table 2. Average income of respondents in Pesantren Village, Pemalang, Central Java, Indonesia

Criteria	Income (Rp/ha/th)
Fish pond cultivation	42,101,008
Dry land farming (rice field cultivation, garden, dry land cultivation)	2,621,559
Others	6,446,703
Total Income	51,169,270
Contribution of fish pond cultivation (%)	82.28
Number of family members	4
Income/capita/month	1,066,026
Poverty line BPS th 2014	277,802
Poverty line WB \$2/cap/hr	730,260

Table 3. Perceptions of respondents on *bio-rights* scheme at Pesantren Village, Pemalang, Central Java, Indonesia

Criteria	Perceptions of respondents
Mangrove condition compared with 10-15 years ago (%)	
> Better	85.2
Similar	14.8
> Worse	-
Purpose of planting mangrove (%)	
Income increasing	70.37
Prevention from natural disaster	74.07
Nature conservation	7.41
Stakeholder involved and known by the people	Wetland Int'l; Marine and Fishery Regional Office; Forestry Regional Office; NGO Sahabat Alam
Positive impact by participating in <i>bio-rights</i> scheme	Increase in income, and capacity; development of mangrove base business alternatives
Local institution could function well (%)	
Yes	90
No	10
Difficulties in mangrove utilization (%)	
High price of production	
Expensive land rent (land access)	40.74
Pest and disease attack (fish and mangrove trees)	7.41
Mangrove trees loss	22.22
	29.63
Benefits of mangrove (%)	
Fuel wood	59.26
Fodder	40.74
Habitat for fish spawning and breeding	7.7
Prevention from erosion and waves	33.33
Recommendation for better mangrove management (%)	
Stable price of production inputs	50
Increase of technical extension	11.11
Increase in partnership development	55.56
Increase in mangrove planting	5.56

Note: Selection of multiple answers

facilities. Other findings from Nawaz (2010) were also different from the success story in Pesantren Village. He argued that in many cases, only a few people (usually with better social status) who could benefit microfinance scheme and in most cases, it has not reached many of the poorest. Therefore Nawaz (2010) suggested that in order to increase microfinance effectiveness as a means for poverty reduction, microfinance program establishment should be provided by related strategies such as skills training, technological assistance and education and health support. Although the scheme has terminated several years ago and support from Wetland International Indonesia as the main stakeholder already finished, the scheme is still managed well by its participants implying that ecological and economic interests could run amicably, Active participation of surrounding forest community seems to be the prime factor determining sustainable management of mangrove ecosystem (Roy and Alam 2012).

As already elaborated above, harmonious coordination among governmental bodies and local stakeholders (including local community) struggling for a common goal i.e. the protection and conservation of mangrove ecosystem seems to be the essential factor for sustainable management of mangrove ecosystems (Carter et al. 2015). Lack of policy integration and coordination among related stakeholders and halfhearted departmental support for community participation in mangrove management is reported to become the limited success of restoration program of mangrove forest in Thailand (Memon and Chandio 2011). In addition, the certainty of benefits that would be acquired by involving in the program also become the essential factor to assure active participation of all related parties, mainly local people living in surrounding mangrove ecosystem (Amri 2005; Datta et al. 2012; Abdullah et al. 2014). Jumnongsong et al. (2015) found that the perception of potential benefits are more important for participation in mangrove management compared with the perception of threat and mangrove state. Subsequently, increasing awareness of the ecological and socio-economic importance of mangrove forests and other ecosystems, to balance these benefits against the benefits from conversion, and to change the mainstream development is extremely needed (Farley et al. 2010). Above all, a social campaign meant to change attitude and increase of public awareness, active involvement and compliance with mangrove management programs of all related stakeholders especially coastal community in valuing the importance of mangrove ecosystem must occur.

In conclusion, *bio-rights* incentive scheme that accommodates ecological interests and economic considerations is an alternative solution for the complexities of natural resources management which confront many problems and pressures for its sustainability. *Bio-rights* schemes developed through the provision of micro-credit provides people an opportunity to play an active role in restoration and conservation of mangroves. Through *bio-rights*, land which is previously unproductive, barren and face a variety of threats including erosion, waves, and the storm has turned into productive silvo fishery area and other mangrove-based business

alternatives. To assure its sustainability, mangrove-based alternative development activities need to consider the potential of resources (biophysical, capital, HR), community preferences and market access. Development of *bio-rights* scheme needs to be developed on a larger scale and more extensive by involving stakeholders related with mangrove ecosystem management. Assurance of potential benefits that would be obtained determines enthusiasm and active participation in mangrove management. To facilitate the effectiveness of microfinance as a means further for poverty reduction, microfinance scheme establishment need to be provided by related strategies such as skills training, technological assistance and education and health support.

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