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Promoting community forestry to reduce deforestation surrounding Gunung Rinjani National Park in Central Lombok, Indonesia

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Abstract. Illegal logging and encroachment are the main drivers of deforestation in Lombok Island. However, recent increases in the frequency of floods and landslides has enhanced local awareness of ecosystem restoration. This study confirms that community participation is an important factor for protecting forests, among others through involvement in ecotourism activities at Gunung Rinjani National Park and participation in agroforestry program in the park's buffer zone. Since 2010, Community Forestry Program in Central Lombok has been integrated with a scheme of reducing emission from deforestation and forest degradation (REDD). Although Community Forestry has been successfully implemented in several areas of production forests and protection forests, this scheme is a newly introduced government policy for reforming the management of conservation areas in Indonesia. Through this scheme, local communities have a bundle of rights to manage a parcel of forestland around Gunung Rinjani National Park. In addition to giving access to manage forestland, this scheme also supports the empowerment of local communities to manage forests in more sustainable ways, e.g. through the utilization of non-timber forest products, the cultivation of crops on land under the forest stand, and the rehabilitation of degraded forest lands. This study investigates the trajectories of deforestation, identifies direct and underlying causes of deforestation, and describes the role of Community Forestry to reduce deforestation in Central Lombok.

1. Introduction

Lombok Island is acknowledged as one of the prime tourist destination amongst the Indonesian archipelago. This beautiful island also contains the highest point within the Province of West Nusa Tenggara (NTB), on the Mountain of Rinjani [1]. NTB comprises a total forest area of 1.02 million hectares, about half of them are protected forests [2]. The dynamic changes in national and local government policies aiming to improve economic conditions have affected the rate of deforestation, and thus the ecologies and livelihoods, on Lombok Island. Since the impacts of the regional economic crisis



of 1997, the rates of deforestation and land degradation have increased significantly due to the increasing forest land cleared to meet local needs for land-based income alternatives [3]; [4]; [5]. Persistent socio-economic and political issues influencing deforestation in Indonesia include the transition from a centralized to decentralized system of governance caused forestland conversion for other land uses, illegal logging and extensive forest encroachment largely for agriculture or estate crop development – usually started with burning for land preparation (see [6]; [7]; [8]). [9] reports that approximately 58,000 ha of forests in West Nusa Tenggara has been deforested annually in a decade after the political reform 1998. Mitigation and adaptation strategies to anticipate the impacts of deforestation must be formulated and implemented simultaneously [10].

Deforestation and forest degradation are the result of a complex confluence factors of actors, interests, and circumstances. These factors are driven by many different causes, which affect the demand for timber, non-timber, and agricultural products to meet the needs of local communities [11]; [12]; [13]. The actors engaged in deforestation and forest degradation vary from region to region, from one location to another [4]; [14]. The driving factors behind deforestation and forest degradation have become progressively more complex [15]. The impact of previous country's economic crisis on natural forest cover was significant as there was a broad practice for more extraction of forest resources, including timber, to increase income [16]; [6]. Increased exploitation of timber was motivated by economic constraints as well as the decreased presence of forest rangers. Land clearing increased dramatically in 2000, following the economic crisis in Indonesia, and was mainly associated with the aim of establishing export tree crops for economic return. Besides profit attractiveness, [3] reported that forest degradation occurred due to inconsistent policies. The changing of decentralization law and influencing of international forest regime, for instance, affected discontinuity and/or ambiguity of some policies related to forest management and forest products [16]; [18], such as forest rehabilitation, community-based forest management, and operation of Forest Management Units. The risk for deforestation is high because of "open access" of forest areas that lead to encroachment and illegal logging practices (see [19]).

Nature conservation policy requires a fundamental change to achieve sustainable forest management. This change will require strong political-will from both central and local government concerning technical, financial, and human resources, as well as increasing community participation in forest management. Large forests are susceptible to encroachment and are also vulnerable to the activities of illegal loggers. Thus, community participation in forest management is very important [20]. Restoring forests will generate opportunities to long-term beneficially impact not only for local livelihoods, but also government earnings [21]. The scale of opportunity for restoration will depend on the current use of the forest land, and it must be in line with the management goals [22]. To prevent further destruction of forests in Lombok Island, it is essential to identify the causes of deforestation and forest degradation. Although Community Forestry has been practiced in Indonesia since 1980s, the integration of Community Forestry in managing nature conservation areas, particularly in and around Gunung Rinjani National Park in Lombok Island, is a new approach. This approach not only addresses ecological concerns but also considers social, economy, regulation, administration, information and technology, as well as safety and health in order to achieve sustainable forest management (see [23];[24]). This study aims to investigate the trajectories of deforestation, to identify direct and underlying causes of deforestation, and to describe how Community Forestry contributes to reduce deforestation.

2. Methodology

2.1. Research site and approaches

This study evaluates Community Forestry Programs, which are concentrated within the Rinjani Mountain forests of Central Lombok. The area of the Community Forestry inside and surrounding this mountain includes 1,809.5 ha, managed by 3,559 community members. We conducted Focus Group Discussions (FGDs) and interviewed stakeholders representing institutions related to forestry, in both NTB Province and Central Lombok Regency. We conducted household interviews in nine villages

located in three districts within the regency. Field surveys were carried out in two phases. The first phase of research was conducted by field survey, household interviews, and FGDs prior to the implementation of REDD+ project in August to October 2010 and the second phase was field survey and FGD carried out in December 2014 to January 2015 after the project has been completed. We combined a review of the literature and the dissemination of a field survey to identify the causes and drivers of deforestation and forest degradation throughout Central Lombok as well as to evaluate the acceptability of REDD+ project in the community level before and after project implementation. The fieldwork for this study was designed to provide contextual detail of deforestation and forest degradation, in order to validate the arguments and findings of the secondary data analyses. Specifically, fieldwork in this study sought to lend insight into the various social aspects surrounding land use and land use change. These social aspects include motives and perceptions of stakeholders, resources and capacities of stakeholders to undertake local forest management, the nature of social arrangements, and the macro-economy and political factors that influence deforestation and forest degradation in Central Lombok. By combining site-specific context on land use change and the trends associated with secondary data analysis, this mixed-methods approach provides more reliable conclusions and thus enables more relevant recommendations.

2.2. Data collection

Primary data were gathered from interviews with key informants and households. Two questionnaire forms were used to gather data. First, a semi-structured questionnaire, was disseminated to key informants including relevant stakeholders and decision makers. Second, we used a structured questionnaire for household surveys. The household survey provided information about the socio-economic conditions and perceptions of the rural community in the research site towards forest utilization, deforestation, and forest degradation. The key informant interviews were conducted using purposive sampling, in which different stakeholders or target groups represented, and combined with a “snowball method”. According to [25], a snowball method refers to sample selection upon which additional respondents are selected by considering the recommendations of previous respondents. A quota control is used to limit the number of key informants at the same institutions. In this technique, it is important to ensure that each important stakeholder is represented, though the final choice respondent is left to the interviewer’s judgment. [26]) hold that, to design a quota sample the researcher must know at least approximately the conditions of the target group according to the research objectives. In snowball sampling, in addition to considering the recommendation of previous respondents, the selection of institutions and key informants in which and with whom the interviews are conducted is based on the relevance to the research topic and the principle of the representativeness. Thus, interviews were selected to represent a diversity of institutional affiliations (Table 1).

Household interviews were conducted through purposive sampling in Central Lombok Regency (n=69). Most respondents were interviewed in the North Batukliang district, consist of the villages of Teratak (7 respondents), Tanah Beak (9), Aik Berik (12), Karangsidemen (4), Lantan (7), and Setiling (13). Besides North Batukliang District, the interviews were also conducted with respondents who representing a household located in the villages of Kopang Rembiga (2) and Wajagesang (9). The third district was chosen for household’s interviews is Praya, where 6 respondents there has been interviewed.

The pre-project FGDs was conducted in Mataram and Central Lombok. In total, 32 participants attended the province level FGD in Mataram City, representing 28 different institutions, included: University of Mataram, NGOs, Technical Implementation Unit (UPT) of the Ministry of Forestry in Mataram, Regency Forestry and Estate Services, community leaders, Regional Environmental Agency (BLHD) of the West Nusa Tenggara Province, Forestry Research Agency of Mataram and Gunung Rinjani National Park management (BTN GRNP). We held also FGDs at regency level in Central Lombok prior to the project started and evaluation at the end of project that were attended by community leaders from villages around the forests. Secondary data complements the primary data and was used to support analytical arguments. The main sources of secondary data were government policies related to forest management, forest utilization and land use as determined by laws and regulations (national and

regional), collected from relevant institutions. Other important sources of secondary data include statistical geographic and demographic data obtained from the province forest service and center for statistical board. Finally, secondary data were gathered from reports and results of previous studies. The combination of this mixed-methodology analysis seeks to answer the questions of what and who are the causes of deforestation and forest degradation; and where, when, why, and how has deforestation and forest degradation occurred in Lombok.

Table 1. List of interviewed key informants related to forests in Central Lombok

Level	Institution	Total number of respondent	Scope of work (number of respondent)
NTB Province	Province Forest Service	4	Forest product distribution (1) Forest planning (1) Forestry program (1) Forestry budget (1)
	Local NGO	1	Natural resource management & community empowerment (1)
	WWF	2	Natural resource & biodiversity conservation (2)
Central Lombok Regency	Forest & Estate Service	8	Forest administration (1) Reforestation & land rehabilitation (3) Forest planning (4)
	Gunung Rinjani National Park Management	2	Forest rangers (2)
Total		17	

3. Results and Discussions

3.1. History of land cover changes in Central Lombok

Deforestation and forest degradation in Lombok could be categorized into four periods that are 1960's, 1980's, 1990-2002 and after 2002. In the 1960's deforestation happens because of a failure of reforestation programs due to lacking participation of local people. Throughout the 1980's, a policy of granting permit for local people to utilize small amount of timber resulted in deforestation because of over-exploitation and insufficient replanting. Throughout 1990-2002, the Forestry Service appointed a private company to monopolize timber production, bypassing local involvement. In reaction, local populations harvested timber illegally. During the movement for political reform throughout 1998-2002, illegal logging was widely practiced in Lombok. From 2002 to the present, the overall situation of deforestation has been declining after the implementation of the Community Forestry Program. However, extraction of firewood continues in some areas to result in pockets of deforestation (table 2).

Farming is the most common means of livelihood of local people in Central Lombok. Thus, linkages between agriculture and forestry are common. However, in some ways, these linkages demonstrate a trade-off in terms of land use, time, and monetary resources. Land in forest areas can be used in multiple, simultaneous ways through activities such as intercropping. One land use that has become foundational for many forest communities is the Community Forestry. The designation of a Community Forest refers to those areas that are jointly managed by forest service and forest farmer group, and harvested for timber or non-timber forest products. These jointly owned forests ensure rural community's continued access to participating in and utilizing the resources from forest areas.

Tabel 2. Chronology of land cover changes in Central Lombok, NTB Province

Time	Chronology
1960	Reforestation programs were initiated in Setiling village, mostly by planting <i>Sengon</i> (<i>Paraserianthes falcataria</i>). Local people were not interested in this program because of low price of <i>sengon</i> .
1970	Local people in Lantan village were involved in illegal logging. During this period, the characteristics of the deforestation were very similar to those in Setiling and Aik Berik Villages. (1970-2002)
1975	Conflicts between Forestry Service and local people due to over utilization of timber permit, and then, people encroached forests in and surrounding Aik Berik village (1975-1989)
1975	Reforestation programs through several schemes, e.g. agroforestry (intercropping), green belt, and <i>Gerhan</i> were conducted in Lombok. (1975-1997)
1980	A private company was granted permission from the Forestry Service to harvest timber of <i>sengon</i> in and surrounding Setiling village.
1983	Local people were invited to participate in reforestation through agroforestry scheme (intercropping), particularly in Setiling village. In 1985, this scheme was stopped. (1983-1985)
1995	Massive illegal logging and forest encroachment occurred in Lombok, particularly in Praya Barat Daya district. About 600 ha of secondary forests were logged during this period. (1995-2000)
1997	A larger forest encroachment for agriculture in and surrounding Aik Berik village (1997-2002)
1997	Local government granted a private company to log small amount of timber, including less commercial small-woods. This triggered local people to participate in illegal logging, particularly in Karangsidemen village. (1997-2007)
1999	Local government granted permit for a private company to log, particularly less commercial woods, by involving local people in Telon Ambon Hamlet.
2000	Forestry Service granted permit for private companies to utilize timber without involvement of local people and then, people logged timber illegally.
2000	Deforestation was continuing in Praya Barat Daya district covering the area of more than 200 ha. (2000-2005)
2002	Local government granted Community Forestry for an Islamic Boarding School. However, less capacity of the school to manage Community Forestry resulting for a decreased forest area in and surrounding Aik Berik village (2002-2003)
2002	Local people were involved in establishing Community Forestry through agroforestry and took advantage of open space to plant crops. (2002-2005)
2004	Bamboos were planted in the buffer zone of Gunung Rinjani National Park
2005	No deforestation occurs in Praya Barat Daya district during this period. Local government proposed 900 ha of forest for HTR (People Forest Plantation) in order to rehabilitate degraded forests and improve community welfare. The MoFor allocated 895 ha of forests for HTR and the Bupati has granted HTR in two villages (Pandan Indah and Mangkung).
2007	Illegal logging decreases overall in Lombok, but continues in several spots.

3.2. Situation before the implementation of Community Forestry Program

Before the implementation of Community Forestry program, there were many logging practices in many villages both for household purposes and for sale. People received orders of illegal timber, mostly to supply firewood for households, tobacco industry, and furniture production. Besides illegal logging, encroachment, as well as the extraction of grasses and non-timber forest products from protected areas were also practiced in many villages. Reforestation program in Lombok was carried out in 1960es. This program failed because local people were not involved. In 1980, people participated in reforestation program by planting mahogany under contract. At that time, people were allowed to intercrop the mahogany with banana and tobacco. However, after the termination of the contract, the Forestry & Estate Service demolished the crops and prohibited people from entering the forest. In the 1990's, the Forestry Service & Estate Service permitted a private company to harvest sengon (*Paraseriates falcata*) without involving local people. This resulted in illegally logged timber and encroachment onto state forest areas. Deforestation continues due to practices of collusive officers who back illegal logging and illegal trading through practices of underwrite, oversee, or simply permit profitable logging or forest conversion. According to the key informant and household interviews, field observations, and analysis of Landsat satellite data, the following areas have been identified as locations that demonstrate a strong relation to deforestation and/or forest degradation in Central Lombok (figure 1).

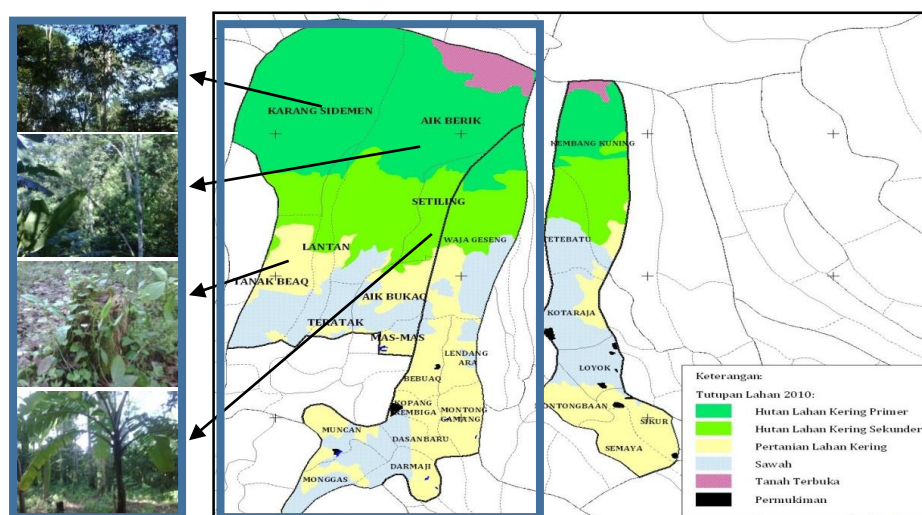


Figure 1 Description of land cover in Central Lombok

3.3. Deforestation in North Batukliang District

Villagers in Aik Berik were mostly composed of subsistence farmers who produced agricultural commodities including bananas, rice, and livestock. Community members most commonly access forests for the collection of firewood and food supplies. Previously—between 1980 and 2002—people encroached onto forest land to convert it to dry field and settlement. Forest surrounding the Village of Aik Berik suffered severe damages due to illegal logging and forest encroachment to dryfield. Moreover, people also gathered firewood in large volumes to be sold into the market. Although currently encroachment is decreasing, local pheasant continues to endanger forest resources. The worst deforestation case occurred in the Protection Forest of Tambingkeke and Elar Bongko, and were caused by the entrance of private company to harvest timber. Conflict ensued between forestry officials and local people concerning the management of timber. Deforestation within the village boundaries has been dominated by the economic incentive to harvest timber for sale to the market at Teratak Village. Raw material needed for firewood, furniture, and construction timber in Selong, Praya and Mataram, a practice that continues today. Additionally, people entered the state forest to carry out intercropping. Encroachment occurred continuously due to the imbalance between the number of households and

available agricultural land area. The agricultural land is only 658 hectares, used by 389 households, thus the agricultural land density is 0.59 ha/household.

People used forests as main area for income generation through the harvest of agroforestry products such as bananas and *empon-empon*. Additionally, people collected firewood and grass fodder from the Community Forestry area. However, the productivity of intercropping is currently threatened. As timber crops grow, food crops within the Aik Berik agroforestry system decline. Canopy cover increases as timber crops grow, which in turn increases the competition between timber and food crops, and thus lowers the yield for food crops. As these food crops decline in yield, community members' income declines as well. In addition to the increased competition between timber and food crops, the installation of water pipes was also reported as a conflict within Aik Berik. Within Aik Berik, the installation of water pipes and the presence of mineral water companies that did not involve or provide economic improvement for the community threatens forest areas. People in downstream areas using forest services, such as water, has continued to grow without compensation to upstream areas. In the absence of compensation, upstream communities such as Aik Berik began stifling and threatening to damage the forest ecosystem.

Falling crop yields and the absence of downstream-upstream compensation for forest service combine to provide additional incentive for pursuing timber-based livelihood strategies. Community members within Aik Berik thus began to trim branches or fell trees to allow re-growth of the crops. The harvested branches were then used or sold as firewood. The current policy to substitute kerosene with coal when making tobacco has lowered tobacco farmers' income; however, firewood was considered a good substitute for kerosene and did not result in declines in tobacco production. Therefore, firewood was the prime fuel for drying tobacco, and trees have been trimmed and cut in Aik Berik to meet such demands.

Setiling village, like Aik Berik, also contained high deforestation. Village members Setiling were mostly farmers and craftsmen, who have a high level of interaction with forest areas. Primary agricultural commodities in Setiling include chilies, taro, yams, and bananas that were sold through debt bondage to middlemen or directly at the market within Setiling Village. Forest-community interactions were primarily a result of commodity production, including the collection of firewood and food supplies. In total, forest covers 51% of the Setiling Village land area. In 1960, a reforestation program was initiated by cutting down mature timber, replacing this tree stock with *sengon*. Communities were involved in this project as workers and were given permission to intercrop within the reforestation project area. This policy lasted for three years. After the three-year project duration, public officers halted intercropping and prohibited community members from entering the forest. This change in policy, however, did not lead to immediate conflict. In 1980, the *sengon* trees that were planted by community members were cut down by a private company with permission from the local government. Community members were not employed through this company; instead temporary labourers were employed from outside Setiling Village. Again, there was no immediate conflict from this lack of community involvement. After harvesting *sengon*, the local forest service began improving forest productivity by using *lelesan* for unproductive trees and created a *cemplongan* plantation system. This plantation system ultimately failed from a lack of maintenance.

Local community members were asked to cooperate in re-establishing the plantation system. Setiling community members who lived adjacent to the forest were assisted by local officers to re-plant the plantation three times. However, each time the results were not satisfactory. The next forest policy in Setiling that sought to include community members in forest management permitted community members to intercrop forest areas with mahogany seedlings. The mahogany seedlings were collected from several nurseries in Telon Ambon, Janggor (Tumasir), and others at least 10 km from Setiling. Villagers with licenses for intercropping travelled to these nurseries by foot to collect the seedlings. In addition to the mahogany seedlings, rice, corn and chilli were planted as cultivation crops within forestlands. These policies resulted in the improvement of forest conditions, making Setiling Village a successful example of reforestation program. However, when the intercropping contract expired in 1983, community members were again prohibited from re-entering the forest. Despite this prohibition, there

were no conflicts between community members and governmental forestry agencies; respondents noted that this may be because of the actions of teachers and village heads to reduce tension throughout the village. Due to the success of the Setiling reforestation combined with increased land allocation in neighboring Aik Berik village led to a short-lived dispute. However, this dispute did not last long, as leaders in both villages were able to coordinate collaborative efforts between community members in Aik Berik and Setiling villages. Despite the success of reforestation efforts in the 1980s, the forests in Setiling Village were damaged as a result of “local logging license” between the years of 1985-2000. The logging policy, implemented by the Central Lombok Forestry Service, resulted in conflict with the local police due to an inappropriate procedural permission; the Forestry Service provided a license directly to a private company without going through the appropriate process.

A sawmill opened in early 2010 threatens forests in Setiling. The company operating the sawmill buys timber from community gardens and encourages people to replace the harvested tree crop with sengan. Sengan is not used for furniture production in the local market. However, timber produced for furniture production is commonly perceived to fetch higher market prices. From the focus group discussion with stakeholders it is believed that the comparatively small compensation for sengan timber leads Setiling villagers to harvest the mahogany trees that were planted in the 1980s. These trees are currently more than 35 cm in diameter.

Deforestation in Lantan Village occurred around the national park, covering areas such as Cempake, Pendok Sentul and Pakis. Deforestation has mainly occurred through the conversion of natural forest to plantations, and the subsequent sale of natural and plantation timber to timber middlemen. Intercropping yields such as coffee, cocoa, bananas, durian, jackfruit and *rambutan* were sold by debt bondage to buy basic necessities. Forest encroachment has been occurred since 1970. Communities cut timber to be sold in Mataram or in Teratak. However, when Community Forestry permits were issued, illegal logging activities declined. Before the Community Forestry implemented, people were not able to easily enter the forest. The use of armed forest rangers to patrol national park land resulted in the decline of community and forest interaction. However, because of economic pressure and a lack of other economic opportunities, community members remained desperate to re-enter the forest. Hence, as a solution, local people were asked to become a smallholder farmers in the Community Forestry program. This solution resulted in the improvement of intercropping cultivation and the decline in illegal logging. When the Community Forestry project began in 2003, people benefitted from access to water and land for intercropping cultivation. This access has led to increased community welfare. One example of this improved welfare includes the motorcycles purchased within the village, on credit. A combination of factors has led to the increased harvesting of community forests in Lantan. Stall-fed, community-managed cattle fodder needs prompted members to advocate for wider canopy gaps, to facilitate the growth of grass on community lands. People concerned that the state will reclaim timber, then they began to harvest and sell timber to furniture, for use and sale as firewood. People usually harvested twigs and branches first, and then moved to harvest trees with a diameter of less than 30 cm for sale or private use.

People without agricultural land entered the Community Forestry area to plant tubers, a practice that continues today. While there was an attempt to move the community's agricultural production from the forest by building a complex barn for animal husbandry, this resulted in very little behavioural change. People still enter the forest, especially the Community Forestry area, to sustain their daily necessities. However, the community maintains the animal husbandry barns, believing that government-owned resources are not to be lost. As a result of this and previous programs, the Lantan community members seem willing carry out development programs.

Agricultural commodities from Karangsiden Village include coffee, jackfruit, and avocados, which were sold to the local market. This village is bordered by a protected forest, located approximately 2 km from the main village area, while the distance of the village to the National Park reached 25 km. Forest and community interactions mostly revolved around the collection of firewood and collapsed timber for building materials and firewood. In 1998/1999 there was an employee of the Forestry and Estate Service of Central Lombok Regency who permitted the collection of wood waste. However, this

employee also would pay community members of Karangsidemen to harvest healthy mahogany trees, purchasing the timber for approximately IDR 500,000 to 600,000 per m³. This compensation is far below the normal market price and the harvesting of mature mahogany trees resulted in forest damage between the 1998-2000. Waste timber extraction activities in the area of Orong Lengku Dewuh, within the Research and Development Forest of Wanariset Jorang Bunut, Sembilir, reached 52 ha in 1997/1998. These areas have been transformed into Community Forestry area, totalling 403 hectares. Involving the community in the utilization of waste wood (cutting down trees using fallen timber permit), where the payment did not comply with community efforts, resulted in the complete harvest of mahogany trees between 1997-2001. In 1997, a waste collection was permitted in Orok Lengkudewuh, followed by Simbilir in 1999 and in Jorang Bunut 2001. Jealousy was also triggered because the community felt that they were safeguarding the forest, yet entrepreneurs came from outside the area. There are also contemporary examples of deforestation and forest degradation around the Village of Karangsidemen. In 2009, squatters came from West Lombok and two people from Presa Sasaot Hamlet, Sasaot Village, and West Lombok Regency were arrested in the Labah Kopah area by forest officials. Efforts to repair the damage to the forest were initiated by planting mahogany along with multipurpose tree species, including robusta coffee, cocoa, avocado, jackfruit, durian, rambutan and mangosteen in the Community Forestry area.

3.4. Deforestation in Kopang District

Telon Ambon Hamlet is located in Wajageseng Village in Kopang district. The main livelihood sources were mostly from palm sugar and livestock, while the mainstays of agricultural commodities were palm sugar, intercropping of upland rice, bananas, durian and jackfruit. Telon Ambon Hamlet is directly adjacent to the Protection Forest and National Park of Gunung Rinjani. Interaction between the communities and protection forest occurred through the intercropping of upland rice, banana, durian and jackfruit. Additional community interaction with the national park occurred through the collection of grass for fodder and harvesting bamboo that had been planted earlier by the community in 2004. Due to the distance from the hamlet to the district capital and the village community members had to sell their yields to middlemen, and as a result often received very low bids. Community interaction with the forest has been long-standing. Reforestation took place in 1975 and thinning was conducted in 1987. Illegal cutting have been started during such time, the forest were cleared without leaving any waste. Since at the end of their year eighties to present, people have been cutting down and replace the forest with rice.¹ In addition to community interactions, there were several sawmill permits issued illegally by the Trade and Industry Service. The lack of raw material permits was not an obstacle to issuing sawmill permits; the sawmill would buy timber in bulk or per stem from the community with more emphasis on private forests (*Hutan Rakyat*).

3.5. Deforestation in Praya District

Forests are mostly located in the southwest part of Praya, currently becoming part of the district of southwest Praya or Praya Barat Daya District (after disaggregation of districts) located about 15 km from the regency capital of Praya. Deforestation and forest degradation occurred in the secondary forests during the period of 1995 to 2000 and again in 2000-2005. During the period of political reform from 1995 to 2000, these forest areas were in chaos. Within five years (1995-2000) about 600 ha of forest in Praya Barat Daya district was deforested. The deforestation continued through 2005 by more than 200 ha. In total, about 900 ha of secondary forest in Praya Barat Daya was deforested within 10 years, from 1995-2005. To rehabilitate those forests, local government proposed to develop the People Forest Plantation (*Hutan Tanaman Rakyat* = HTR). The local government proposed 900 ha of forests to be allocated for HTR and received approval from the Minister of Forestry for 895 ha. Currently, the regency head has released permission for HTR in the two villages, namely Pandan Indah and

Mangkung. Besides those villages, there are two more villages in Praya Barat Daya district proposed for HTR, which are villages of Kabul and Batu Jangkih.

3.6. Drivers of deforestation and forest degradation in Central Lombok

Timber industries, i.e. sawmills and furniture, produce forest degradation. Local people often log timber from forests illegally and sell it to timber middlemen, who supply raw material for sawmills and furniture industries. Therefore, it is important to enforce monitor illegal timber trading among illegal loggers, as well as timber industries. In 1990es, local government appointed a private company as the logging contractor to harvest small-scale timber, so called “waste wood” in some areas. It was practiced for several years and was generally poorly supervised. It generated further problems because of a lack of involvement with local people, and it then created disappointment for the local people on the system which triggered illegal logging in some forest areas. Illegal logging is usually performed by local people; however, most of these local people are funded by investor(s) or capital owners. The illegal logs provide raw material for sawmills and other timber industries. A small portion of illegal logs is also used for personal purposes, such as house construction and firewood.

The political reform movement of 1998 saw the widespread practice of illegal logging. A huge amount of timber was extracted from forests from 1998 to 2002. After 2002, illegal logging practices decreased because, at the time, many strong operations emerged to combat illegal logging. Besides law enforcement, the lack of commercial timber in the forests and increasing interest in local conservation resulted in decreasing of illegal logging. Investors in agricultural crop production also influenced deforestation and forest degradation on Lombok. Some investors provided funding for local people to encroach onto forest areas and cultivate agricultural crops. Also, most people have depended on these investors to sell their agricultural products. Investors sought to secure more land for planting agricultural crops in order to increase profits. Farmers supported investors because a larger crop area means larger household income. The tobacco industry on Lombok is another underlying agent for forest degradation. On Lombok, many people cultivate tobacco as their primary commodity. To receive added value, local producers dry the tobacco leaf before selling. Cooking tobacco with firewood is considered the method that produces the highest quality tobacco. Thus, a large volume of firewood has been extracted to serve tobacco industries, without significant replanting.

In certain cases, law enforcement was not effective due to collusion between officers and businessmen. Some respondents stated that illegal logging, illegal timber trading, and forestland encroachment occurred because they practices were “backed-up” by officers, including military personnel, policeman, forestry official, or local government officers. While it is difficult to prove collusion among officers and businessmen, such a relationship between business and regulator remains a concern for combatting practices of illegal logging, timber trading, and forest encroachment in a more effective way. Safeguarding forest requires active community participation. Therefore, the socialization of safeguarding activities should provide insights and options for communities in and around the forests, focusing on whether the community wants to participate in the Community Forestry program.

It is important for people to know and understand the consequences of Community Forestry program implementation, so that their participation reflects a rational choice made after weighing advantages and disadvantages. Implementation of Community Forestry program should also consider current conditions and desires that are developing in society. At this time, people have experienced the economic benefits of the Community Forestry program and want to continue it. Therefore, the benefits of Community Forestry programs, such as community involvement in maintaining forests, utilization of non-timber forest products, as well as cultivation of crops on land under the stands through intercropping pattern, should be maintained. Meanwhile, the negative side of Community Forestry programs, such as a tendency to expand intercropping area, should be minimized. It might be possible to reduce intercropping expansion through the selection of species and shade tolerant plants with high economic value. The great need for firewood in the tobacco industry threatens forest sustainability, and solutions must be formulated. Efforts to replace firewood with coal, as suggested by the local government, were not successful. In addition to being largely unused by farmers, coal is a non-renewable natural resources

and produces high emissions that are not environmentally friendly. The best available solution is to create a plantation on, or to rehabilitate, the degraded land around the buffer zone of Gunung Rinjani National Park and around the borders of protection forests, using fast growing species that provide efficient firewood.

Deforestation and forest degradation are complex and interrelated with other issues. Deforestation and forest degradation in Central Lombok were mostly caused by tenurial problem and economic reasons, including: the needs for timber and other forest products, encroaching forest land for agricultural crops, expansion space for intercropping, extracting firewood for cooking tobacco and infrastructure development. First, needs for timber and other forest products. Logging was conducted in some areas of Lombok, some of which was illegal, to provide raw material for timber industries. These industries, often located in villages and amenable to purchasing locally harvested timber (regardless of legality), mostly included milling and furniture production. Locally harvested timber was typically accepted in these people living in and surrounding the Community Forestry areas have direct interactions with forest for extracting firewood, fruits, medicinal plants, and other forest products. Second, encroaching forest land for agricultural crops and grazing. In addition to logging, encroachment was a consistently prevalent problem that caused a decrease in quantity and quality of the forest in Central Lombok. Most cases of encroachment were done to convert forest into agricultural areas and for crop cultivation. Besides planting crops, people living around Gunung Rinjani National Park entered the forest to collect grass and in some areas, converting forest into grazing areas. Third, expansion space for intercropping. Encroachment also occurred in some agroforestry allotments. After participating in Community Forestry Programs, local people often enjoyed better income from intercropping within agroforestry allotments. However, after two years, trees were growing bigger and began to crowd out food crops beneath the canopy, as these food crops did not have enough space and light to grow. This resulted in declining income from intercropping which led some local people to harvest trees prematurely in order to preserve land for food crops. Forth, extraction of firewood for tobacco industries. The local government was trying to reduce this threat by offering solutions to replace firewood with coal as fuel for cooking tobacco. It was not easy to implement this solution, due to some resistance from tobacco farmers who argued that the quality of tobacco cooked with coal would not be as good as tobacco cooked with firewood. Also, from an environmental perspective, replacing firewood with coal would not solve the problem because coal is produced from non-renewable resources and allegedly poured whole far greater emissions than wood. Fifth, forestland conversion for infrastructure and economic development. Unlike the problems associated with the use of forest products (wood and non-wood) as well as encroachment, which generally leads to forest degradation, deforestation on the Island of Lombok was also caused by the conversion of forest areas for the benefit of other sectors. In addition to conversion to agricultural land and plantations, conversions of forest areas were also done because of regional area expansions. With an expansion land was required for the development of economic activities and infrastructure, which were usually carried out with the request for forest-land conversion.

This study indicates that the causes of deforestation and forest degradation in and around Mount Rinjani were mostly economic and tenurial reasons (table 3). Most people in Lombok works as farmers, who depend on the availability of land for agricultural. However, almost half of the land in the regency was allocated for forest area and only 27% of land used for agriculture. This indicates that farmers has to compete to manage limited agricultural lands for their livelihoods. Limited area for agriculture resulted in forest encroachment to establish gardens, rangeland, and illegal logging to supply timber for construction, furniture, and firewood.

In addition to economic interests (95.65%), at the same time respondents residing in Central Lombok were most likely to cite tenurial problems (89.86%), particularly forest use conflicts as a reason for forest encroachment. This indicates that most respondents perceived both economic interests and tenurial problems as the main causes for deforestation [27]. The lack of harmony between the Forest Service and forest communities began in 1985, as reforestation activities began. After the timber crops began to shade-out food-crops within the intercropping system, farmers will face problems without providing them alternative of income to sustain their living. These conflicts were triggered by the

entrance of private company with support from individual forest officer to harvest timber from the forest surrounding the park and also granted permission to take trees downed from high winds in the protection forest area in 1998-2000 without the involvement of local community. This was encouraged by the high demand for construction timber, firewood, and furniture. The high demand for timber can be monitored by the number of people who were still active in the market for selling sawn timber in Teratak and Setiling. Those timbers would then lead to Praya and Mataram.

Table 3. Perception of respondents towards reason for deforestation in Central Lombok

Villages	Number of Respondents (person)	Economic reason	Tenurial reason
District of North Batukliang:			
1. Teratak	7	7	7
2. Tanak Beak	9	9	9
3. Aik Berik	12	12	12
4. Karangsidemen	4	4	4
5. Lantan	7	4	4
6. Setiling	13	13	13
District of Kopang:			
1. Kopang	2	2	0
2. Wajageseng	9	9	9
District of Praya:			
1. Praya	6	6	4
Total	69	66	62
Percentage		95.65%	89.86%

This study indicates that according to the views of villagers and key informants, communities adjacent to forest areas were perceived as the most responsible actors for deforestation and forest degradation, besides log traders, wood processing companies, and government officials (table 4). In addition, interviews revealed that there were several exogenous factors that contributed to deforestation and forest degradation. Thus, overall forest encroachment can be divided into two general categories: first, development of settlements and public infrastructures, and second, community activities in the forest area.

Table 4. Respondent's perception towards actors caused for deforestation in Central Lombok

Villages	Perception's score			
	Community	Log traders	Wood processing companies	Government officials
Central Lombok Regency				
District of North Batukliang:				
1. Teratak	3.0	3.0	0.0	3.0
2. Tanak Beak	3.0	2.0	3.0	3.0
3. Aik Berik	3.0	1.0	3.0	3.0
4. Karangsidemen	3.0	0.0	3.0	3.0
5. Lantan	3.0	0.0	3.0	3.0
6. Setiling	3.0	2.0	3.0	3.0
District of Kopang:				
1. Kopang	3.0	3.0	3.0	0.0
2. Wajageseng	3.0	0.0	3.0	3.0
District of Praya:				
1. Praya	3.0	3.0	2.0	1.0
Average score	3.0	1.6	2.6	2.4

Noted:

3.0 = completely agree

2.0 = agree

1.0 = probably

0.0 = not mentioned

3.7. Transformation from deforestation into reforestation through Community Forestry

This study relates the importance of Community Forestry management surrounding Mount Rinjani to technical aspects of forestry, biophysical attributes, as well as social and environmental dynamics. The condition of the social dynamics around forest areas affects approaches and mechanisms required to achieve sustainable forest management. All respondents in nine villages around the forests in Central Lombok told that they benefitted from Community Forestry management. Based on the results of FGDs with stakeholders, forest management had positive impacts for communities inside and around forests. The positive impacts of forest management were divided into four categories which touch upon direct and indirect benefits from forest resources [28]: first, land use by the community -forest community was given discretion in utilizing land under the stands, e.g. harvesting dry grass and twigs for fodder and fuel wood, and cultivating crops under the stands (alley cropping); second, environmental impacts on community -forests were reported as facilitating the restoration of water resources, flood prevention, landslides, and erosion; third, economic impacts on community incomes -community forests provided land for agriculture to those people who did not own land, thus providing private income; and forth, increasing welfare -participating in community forests provided increased incomes.

People told that when there was large encroachment onto forest areas, water sources dry up and landslides, erosion, and flooding were more common in the rainy season. After formation of the Community Forestry, however, people perceived that environmental conditions began to recover and the impact of flood and landslide hazards were reduced. With the establishment of Community Forestry, people whose primarily livelihood strategies were farm work and illegal logging began participating in agroforestry within the community lands. The yields from this intercropping were used for schooling and basic household needs. In addition, certain forest species were used for natural medicine. Communities could grow vegetables, medicinal plants, bananas, potatoes and others crops for domestic consumption or sale. Before the Community Forestry Programs were established, landless households relied on selling illegal wood or working on farms in other communities to generate income. Most respondents, however, perceived that although successful to reduce deforestation Community Forestry did not guarantee “sustainable” forest management as per regulation.

After Community Forestry program installed, instead of relying illegal timber and natural resources extraction, people planted more commercial seasonal crops, such as: chili, corn, tuber, sweet potatoes, and banana through intercropping system together with timber trees. They were also maintaining trees and in between cultivating annual crops like coffee, cacao, jack fruit, and rambutan. People have started to participate in reforestation program through intercropping through Community Forestry, and planting trees through self-managed planting movements (*gerakan menanam swadaya*). To overcome the lag of log's supply for timber industries, it is very important to use lesser known timber species as well as to improve utilization of other sources for fiber or timber outside forest (see [29]).

4. Conclusions

Deforestation and forest degradation in Lombok Island, particularly Central Lombok, are a product of historical processes, beginning with the failure of reforestation programs in the 1960's. Further forest degradation occurred in the 1980's due to improper policy implementation. In the 1990's, illegal logging escalated, triggering local disappointment, as private companies received a monopoly on logging licenses. The most important era that influenced deforestation in Lombok remains the political reform movement of 1998. Similar to other Indonesian regions, the vacuum of regulation and governmental oversight permitted widespread illegal logging across Lombok. A huge number of logs were extracted from Lombok's forests from 1998 to 2002. Throughout these time periods, a constellation of policy makers, local people, timber industries, logging contractors, illegal loggers,

agricultural crops investors, tobacco industries, and collusive officer-businessmen combined to produce deforestation and forest degradation in Central Lombok.

Illegal logging practices started to decrease in 2002 as a result of anti-logging operations. Furthermore, the decrease in illegal logging was caused by lower availability of commercial timber in the forests, as a consequence of previous timber harvest and illegal logging. Increased awareness of local people in conserving forest resources is also an important factor, which explains the decreasing number of deforestation and forest degradation in the last decade. Floods, landslides, and some other environmental disasters have led local people to value the environmental functions of forests. Increasing ecotourism activities surrounding Gunung Rinjani National Park, which contributes to local economies, has changed how local people think about sustainable natural resources management.

It is not an easy task to implement sustainable development policy for a small island with a relatively dense population, such as Lombok. To support economic development, many infrastructure projects are required. Some forests had been converted, but land compensation is only partly available or it is very difficult to be verify due to land tenure claims of local people. Another problem, which drives deforestation, is the formulation of new regencies, districts or villages. This phenomenon influences direct forest conversion, because new administrative units require new sites for infrastructure facilities, including government offices, roads, and settlements. Local people require land for cultivating agricultural crops. In some areas, government allows local people to cultivate crops within forest areas within an intercropping system. Intercropping systems were implemented well, until canopy shading reduced food crop production. Due to this problem, some people removed trees. Besides the land competition of alley crops, some local people also logged timber illegally to be used personally, or to be sold in the market as raw material for construction timber, furniture, and firewood. Timber needs for firewood is relatively high, especially for cooking tobacco.

Community Forestry resulted a positive impacts in reducing deforestation in Central Lombok and at the same time has been also increasing the people income and improving the quality of environment of villages surrounding the forests. However, besides the success story of Community Forestry, until now there are still a concern regarding two activities having most potential trade off with forest resources in Central Lombok, that are: first, the increasing of area for intercropping as a result of declining crops yields due to tree canopy shading in the Community Forestry area; and second, extracting firewood, especially large-scale extraction, to fill demand within the tobacco industry. Conflict of interest between sectors also often occurs with regard to the utilization and land use, including forests. Some sectors of the economy that often clashed include: forestry, agriculture, mining, and public infrastructure. In addition to conflicts of interest between government sectors, conflicts of interest also occurred between actors in the utilization of space and the use of forest areas.

Central Lombok needs to implement a new paradigm of forest management that transforms the value of environmental function into income while simultaneously meeting the needs of the public. Possible paradigms of Community Forestry include the implementation of environmental incentive schemes, such as “payment for ecosystem services” (PES) and “reducing emissions from deforestation and forest degradation” (REDD). These schemes promise compensation for the ecosystem services, such as water and carbon storage, which can simultaneously benefit the country, local governments and local communities. However, these schemes must be able to involve key stakeholders located at central and regional levels and be implemented through an appropriate pattern to include ecological, economic and social aspects.

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