ABSTRACT

SELVIANA, VIVI. Learning Lessons from a REDD+ Initiative: Assessing the Implementation Process, Forest and Community Outcomes, and Impacts on Local Households in Central Kalimantan, Indonesia. (Under the direction of Dr. Erin O. Sills).

The traditional rural population of Indonesia is highly dependent on forests for their livelihoods, including both products and services for both market and subsistence. Thus, their livelihoods are threatened by economic development activities that lead to deforestation. In this context, REDD+ can potentially be a win-win for local and global populations, protecting livelihoods while it mitigates climate change. However, there is significant controversy over whether REDD+ can achieve this potential. The controversy partly reflects highly varied understandings about what REDD+ really is and how it will be implemented on the ground.

To shed light on this debate, a detailed explanation of how one REDD+ project has been implemented and counterfactual-based evidence on its livelihood impacts are presented in this thesis. The Katingan Mentaya Project was launched in 2009 and issued its first carbon credits in 2017. To accomplish this, it implemented a bundle of interventions, which are categorized as restrictions on forest access and/or conversion, forest enhancement, non-conditional livelihood enhancement, conditional livelihood enhancement, environmental education, and tenure clarification. Based on detailed income data collected at three points in time (2011, 2014, and 2018) in communities both inside and outside the intervention area, a difference-in-difference model was estimated in a matched sample in order to test the effects of these interventions on household income (derived from forests and total).

Learning Lessons from a REDD+ Initiative: Assessing the Implementation Process, Forest and Community Outcomes, and Impacts on Local Households in Central Kalimantan, Indonesia.

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DEDICATION

I am dedicating my thesis to my family. A special feeling of gratitude to my beloved mother, Hariyati and beloved father, Sumariyono who taught me to be my own person, to believe in myself, and never give up on my dreams. To my brother, Eko Setiawan and sister in law, Dwi Septiani as well as my nieces, Arzetti Ummu Muthia and Emre Salihamidzic for the endless supports. To friends, colleagues, and all of those who have supported me along the way.

BIOGRAPHY

Vivi Selviana was born in Gisting, Lampung, Indonesia. She obtained a B.S. in Forestry, Forest Management concentration at Bogor Agricultural University (IPB) in 2012. She completed an international exchange program of the Ohio State University (The Ohio Program) as an intern at Monterey Bay Nursery in Watsonville, California in 2014. She worked as part of the palm oil sustainability team in an international non-governmental organization. She was awarded a USAID PRESTASI (Program to Extend Scholarships and Training to Achieve Sustainable Impacts) scholarship to pursue her master's degree in Natural Resources with concentration in International Resources and a GIS Certificate at North Carolina State University in Fall 2017. She also received a field research fellowship as part of the Global Comparative Study on REDD+ from CIFOR (Center for International Forestry Research). She conducted her field research on a subnational REDD+ project in Indonesia. Upon completion of her M.S. degree, she will return to Indonesia in hopes of making more contribution to her country.

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INTRODUCTION

Forests play a major role in the global carbon cycle. Deforestation has been a major source of greenhouse gas emissions (FAO, 2012). Standing forests absorb approximately 2.6 billion tons of carbon dioxide every year (IUCN, 2019). Forests could also play a major role in both climate change adaptation (Thuy et al., 2014).

Tropical forests account for more than half of the carbon stored in terrestrial vegetation (Saatchi et al., 2011) and are also the largest source of forest carbon emissions (Visseren-Hamakers, 2012). In Indonesia, deforestation is the largest source of greenhouse gas emissions. From 2001 to 2018, Indonesia lost 25.6Mha of tree cover, equivalent to 10.5Gt of CO_2 emissions (Global Forest Watch, 2019). In 2018 alone, Indonesia lost 1.22 million ha of tree cover, equivalent to 480 million tons of carbon dioxide of emissions (Global Forest Watch, 2019). The emissions are partly due to peatland degradation and loss. The country's 21 million ha of peatlands release huge volumes of carbon and greenhouse gas (Indrarto et al., 2012) when deforested or otherwise degraded.

Reducing Emissions from Deforestation and forest Degradation plus enhancing forest carbon stocks (REDD+) in return for financial payments has received considerable attention as a way to mitigate the effects of climatic change. The framework was introduced at the 13th Conference of the Parties (COP 13) of the United Nations Framework Convention on Climate Change (UNFCCC) in 2007 in Bali, Indonesia. The COP called for developing countries to be provided incentives to support climate mitigation effort through forest conservation (COP, Paris 2015). With the third largest area of tropical forest of any country, Indonesia's forestry sector has huge potential for mitigation through REDD+. Forest conservation could be key to fulfilling the government's pledge to voluntarily reduce carbon emissions by 26% by 2020 or 41% with

international support (Luttrell et al., 2014). This commitment has attracted funding and attention from donors (McGregor et al., 2015) which made Indonesia now a global trailblazer exploring modalities for REDD+ (Agung et al., 2014). One of the biggest donors to support Indonesia in the REDD+ implementation is the Government of Norway, with a pledge of up to US$1 billion conditional on performance.

In Indonesia, many REDD+ initiatives have been implemented at the subnational scale. Thirty-five subnational initiatives were identified in Indonesia during the first generation of REDD+ (Sills et al., 2009). These subnational initiatives could be considered as a first step toward national approach on REDD+ (UNFCCC 2007: Decision 2/CP.13). Subnational REDD+ initiatives also offer invaluable learning opportunities on REDD+ implementation, providing insights on both project scale and robust national REDD+ initiatives.

The financial mechanisms for REDD+ are considered to pose risks to local rights and livelihoods (Brockhaus et al., 2012; Lawlor, Weinthal, & Olander, 2010). Multilateral donors, negotiators at the UNFCCC, and policymakers in the US Congress have acknowledged the legitimacy of these concerns (Lawlor, Weinthal, & Olander, 2010). Perhaps the most prominent concern is that REDD+ will restrict access to the forest by the approximately 80 million people (38% of the total population of Indonesia in 2006) who depend on the forest for their livelihoods (Poffenberger, 2006; Enrici & Hubacek, 2018). Thus, the UNFCCC has agreed to safeguards, or measures to avoid harms while promoting benefits (i.e. the Cancun safeguards agreed at COP16 in 2010). Effective implementation of these safeguards depends on information about the relationship between REDD+ and local people, including the causal impacts of REDD+ on local livelihoods. This type of information can be beneficial for the future design and implementation of REDD+ inititatives, in order to achieve their dual environmental and socio-economic goals. Project

implementers increasingly seek certification by the Community, Climate, and Biodiversity Alliance (CCBA), which focuses on the co-benefits of REDD+, such as supporting livelihoods and stimulating economic development as well as reducing poverty (Sunderlin et al., 2016). Exploring the co-benefits and the impacts of REDD+ projects through intensive empirical evaluation will provide real evidence to assist in resolving the controversies of livelihood implications of REDD+ (Jagger et al., 2011).

In this thesis, I present a careful, quantitative description of how a subnational REDD+ initiative was implemented, with particular attention to how it sought to achieve both environmental and socio-economic goals. I seek to shed light on the benefits that the project sought and that may or may not have been achieved, and the challenges faced by this project as a result of the political, economic, and stakeholder dynamics at the local and national level. Additionally, I assess whether and which specific interventions have occurred, and when, where, and what have been the impacts on household well-being. Finally, I also assess whether the REDD+ project affected local community behavior in clearing the forest around where they live. Understanding the impacts of REDD+ can lead to improvements in intervention design, thus strengthening the quality of the interventions. In the future, this analysis could also help to identify the best types of interventions for achieving co-benefits for local communities (Sunderlin et al., 2016). The findings presented are aimed to discuss the effectiveness and efficiency of REDD+ policy at the broader scale including international and national level.

CHAPTER ONE: REDD+ IN INDONESIA

1.1 REDD+

Clearance of forest land is a major source of global emissions (Stern, 2008). Indonesia is one of the countries with the most carbon emissions from deforestation, and it is also one of the countries that has attracted the most investment in initiatives to reduce deforestation in order to mitigate climate change, known as REDD+ (McGregor et al., 2015). Indonesia has also been actively participated in REDD+ negotiations at the international level by hosting the UNFCCC COP 13 Bali Action Plan in 2007. It was the first country to have legal instruments on REDD+ at the national level (Costenbader, 2009). Thus, Indonesia has become one of the leaders in developing countries in terms of international efforts to reduce emissions from deforestation and forest degradation (Moeliono et al., 2014).

In this chapter, I describe about the role REDD+ initiatives in climate change mitigation, how REDD+ projects have been implemented locally in Indonesia, and the role of subnational REDD+ projects in Indonesia REDD+ policy. I discuss what benefits may or may not be being achieved to project goals on the subnational project implementation, and what challenges these projects are facing at the local and national level. In addition, this chapter also explore type of interventions (e.g. restrictions on forest access and/or conversion, forest enhancement, non-conditional livelihood enhancements, conditional livelihood enhancement, environmental education, tenure clarification) or other type of intervention of REDD+ initiative have occurred, when, where, and what are the impacts on the environment and household well-being. Further analysis of this study was steering the evaluation effort towards the most relevant interventions for local communities in the REDD+ initiative area which presented in chapter 2. The insights on

REDD+ provided in this chapter aim to inform REDD+ policy makers, practitioners, and communities for future design and implementation.

1.1.1 What is REDD+?

REDD stands for Reducing Emissions from Deforestation and forest Degradation. REDD is primarily intended to prevent forest loss and reduce emissions from deforestation and forest degradation through land use change (Leventon et al., 2014). REDD was initially designated to address the rapid loss of high biomass tropical forests, which is the largest source of forest carbon emissions (Pistorius, 2012). It is a climate mitigation mechanism by which developing countries received financial reward for any emissions reductions achieved that are associated with a reduction of forest conversion (Parker, Mitchell, Trivedi, & Mardas, 2008). This concept was proposed for the first time in 2005 during the Conference of the Parties (COP-11) in Montreal.

The concept of REDD evolved to REDD+ with the addition of new components. REDD+ goes beyond actions to lessen deforestation and forest degradation. In 2007, Parties to the United Nations Framework Convention on Climate Change (UNFCCC) at COP-13 in Bali proposed REDD+, which is described as "policy approaches and positive incentives on issues relating to reducing emissions from deforestation and forest degradation in developing countries and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries" (UNFCCC Decision 2/CP.13–11).

UN-REDD claimed that REDD+ creates a financial value for the carbon stored in forests by offering incentives for developing countries to prevent the deforestation and forest degradation

activities to reduce their emissions from forested lands and invest in low-carbon pathways to sustainable development.

As part of the CIFOR (Center for International Forestry Research) Global Comparative Study on REDD+ (GCS-REDD+), the REDD+ definition adopted from CIFOR book "*Realising REDD+: National strategy and policy options* by Angelsen, 2009. REDD+ is a set of policies or actions that aim to reduce emissions and increase removals, and for the final outcomes of those policies or actions (i.e., reduced emissions and increased removals) (Angelsen et al., 2009).

1.1.2 Why REDD+?

The forest sector is one of the most promising early frontline approaches to mitigate climate change (Sunderlin, et al., 2017). As a result of the 2015 Paris Climate Agreement, countries around the world have agreed that tropical forests must be included on the efforts to mitigate the negative effects of climate change (Duchelle et al., 2017). Around 10% of net global carbon emissions derived from forest conversion to other land uses (IPCC, 2013). Based on Saatchi et al. (2011), there is an evidence that tropical forest account for more than half of the carbon stored in terrestrial vegetation. However, deforestation and degradation of tropical forests produce 70% of tropical land-use emissions (Le Quéré et al., 2015). Solving the problem of deforestation and forest degradation is critical for mitigating climate change.

REDD+ initiatives conceive of forests as carbon pools and ecosystem services providers, which are governable through science and markets (McGregor et al., 2015). REDD+, to a certain extent, could also support biodiversity conservation due to spatial overlap between carbon-rich and biodiversity-rich areas (Visseren-Hamakers et al.,2012). Clearly, REDD+ could provide strong incentives for forest conservation. Although the original focus of REDD+ is to reduce

carbon emissions caused by the forest conversion, the scope of REDD+ has expanded and now covers multiple objectives in the sustainability domain (Hein & van der Meer, 2012). REDD+ is a way to strengthen the local communities' livelihoods, protect indigenous rights, and achieve environmental and social co-benefits through forest carbon financial mechanism (Cromberg, Duchelle, & Rocha, 2014; Enrici & Hubacek, 2018).

REDD+ can be considered as a potential win–win solution by saving the environment and supporting local livelihoods (Angelsen & Atmadja, 2008; Brown, Seymour, & Peskett, 2008; Lawlor, Madeira, Blockhus, & Ganz, 2013; Poudyal et al., 2016). REDD+ projects have received attention not only for their potential as climate change mitigation (Leggett & Lovell, 2012) but also for their reputation as a relatively quick, easy, and low-cost way to slow climate change (Jagger et al., 2011). Hence, REDD+ attracts support from various non-governmental and international actors, as well as participants in carbon markets. REDD+ also receives support because of its potential to attract funding for the tropical forests biodiversity conservation and generate a new income for poor rural populations across the tropics (Jagger et al., 2011). For example, UN-REDD and the World Bank's FCPF have strengthened REDD+ readiness programs by providing visibility and international resources (McGregor et al., 2015). After the Cancun Agreement (UNFCCC) in 2010, donors pledged funds with total of US$5 billion to support early action on readiness of REDD+ in the developing countries up to 2012 (Kanninen et al., 2010). With this funding, REDD+ initiatives have been implemented across the tropics, on both national and subnational levels, to benefit host countries both environmentally and socioeconomically. Securing continued funding will be critical to the success of these initiatives, as with any program associated with environmental protection and conservation.

The REDD+ framework is designed to reverse the increasing pressure on forest land and establish opportunities for essential reforms both inside and outside the forestry sector (Brockhaus et al., 2012). REDD+ could not only protect forests, but also support developing countries in securing economic benefits from carbon trading. Moreover, the REDD+ framework promotes equity international by calling on developed countries to compensate developing countries that terminate or reduce their forests clearance activities (Ituarte-Lima, McDermott, & Mulyani, 2014).

1.2 Evolution of REDD+ initiatives in Indonesia

Indonesia's economy has been dependent heavily on its natural resources (Luttrell et al., 2014), including forestry sector. The country official forest land use zone is classified into two main categories: state forest and non-state forest areas. State forest is defined as an area that is designated by the government as forest area or zone (kawasan hutan) despite the area forested or not. The state forest has three categories of forest function that are production, conservation, and conversion. The production forests mainly for timber production and the conservation and protected forests for ecosystem conservation and wildlife habitat protection. Whereas, the conversion forest area designated to be converted into agriculture plantation (e.g. palm oil) or other development projects. The production forest classified as natural production forest (Hutan Alam/HA) and plantation forest (Hutan Tanaman Industry/HTI). Individuals, cooperatives, state owned enterprises or private companies can manage the production forests to extract timber but could not privately owned the area. The government only grants a temporary permit (Izin Usaha Pemanfaatan Hasil Hutan Kayu/IUPHHK). The permit validation depends on the type of the concession permit. Concession permit for natural production forest (IUPHHK-HA) valid for 55 years and can be extended based on the performances of the permit holder every five years

evaluation. While the concession permit for plantation forest (IUPHHK-HTI) valid for 60 years and can be extended up to 35 years. A new type concession was launch in 2007 under government regulation No.6/2007 and Ministerial Decree P61/2008. The concession designated for ecosystem restoration inside the production forests, known as ecosystem restoration concession or ERC (IUPHHK-Restorasi Ekosistem). The permit valid for 60 years and can be extended up to 35 years. The ERC aims for forest protection, enrichment and maintenance, flora and fauna habitat population rehabilitation. However, the ERC holders still allow to extract timber and non-timber forest products (NTFPs), also utilize environmental services including carbon sequestration and storage.

1.2.1 History of REDD+ in Indonesia

REDD+ has gained substantial momentum as a mechanism to cut global carbon emissions in developing counties. Many developing countries across tropics are embracing REDD+ to fund their forest conservation programs. Based on UNFCCC NDC, approximately 40 countries were identified REDD+ or forests as part of their Nationally Determined Contributions (NDCs) in term of mitigation strategy (Bos et al., 2017).

Indonesia is one of the developing countries in which various policies, institutional frameworks, and pilot activities related REDD+ have been established (Luttrell et al., 2014). According to Mulyani and Jepson (2013), Indonesia is a major target for REDD+ mechanism adoption. This is because Indonesian forests comprise the third largest tropical forest area, with 68% of its landmass—equivalent to 131.3 million hectares of forests coverage (Ministry of Forestry, 2012). The Indonesian rainforest ranks as the fourth largest forest carbon stock globally, and its peatlands have the largest carbon stock compared with anywhere else in the tropics (Food and

Agriculture Organization of the United Nations [FAO], 2011). However, deforestation rates in the country are high, with rates estimated at 1.7 million ha per year and average carbon emission 585 million ton/year between 2001 to 2018 (Butler, 2019). In 2018, Indonesia lost 1.22 million ha of tree cover, equivalent to 480 million ton of CO2 of emission with 340k ha of this loss occurred within primary forests and 907k ha within natural forests (Global Forest Watch, 2019). An estimated 60% of Indonesia's emissions come from forest and peatland fires and drainage as well as the conversion of forest to non-forest uses (Boer et al., 2009). This has put Indonesia among the world's top emitters in land-based emissions. Responding to this situation, the Government of Indonesia has offered high-level political support for the adoption of REDD+ adoption (Strassburg et al., 2008). Thus, the forestry sector in Indonesia has huge potential for climate mitigation through the implementation of REDD+ framework.

Indonesia has set ambitious targets for reducing its emissions from deforestation. In 2007, President Yudhoyono declared that Indonesia would reduce its emissions through a strategy to control land use change and prevent fires in peatlands (Moeliono et al., 2014). In December of the same year, the national development plan: Indonesia's response to climate change, was launched by the Indonesian National Development Planning Agency (Badan Perencanaan Pembangunan Nasional [Bappenas] (Indrarto et al., 2012). This policy aimed to enhance and support implementation of the national climate change response strategy for 2004–2009 and provide input on the plan for 2010–2014 (Bappenas, 2009).

In the lead up to the UNFCCC COP in Paris, the Indonesian government pledged to voluntarily reduce its greenhouse gas (GHG) emissions by 26% unilaterally by 2020 (Luttrell et al., 2014). The government called for international partnerships to increase its ambitious contributions to the Paris Climate Agreement and reduce emissions up to 41% with international support by 2030

(Reuters, 2009). Shortly after President Yudhoyono officially announced this commitment during G20 meeting on September 2009, the government reaffirmed its commitment through a Second National Communication (SNC) issued by the Ministry for Environment, as mandated in Article 12.1 of the UNFCCC (Indrarto et al., 2012). According to the REDD Desk, the government of Indonesia also enacted a national action plan to addressing climate change and has included forests rehabilitation as one of the priorities in its National Medium-Term Development Plan for 2010-2014. This has made Indonesia a global leader in international efforts to reduce emissions from deforestation and forest degradation, and to enhance forest carbon stocks in developing countries (Moeliono et al., 2014).

Indonesia has passed a number of laws to facilitate REDD+ implementation, including a law for guidance on REDD+ pilot projects [Ministerial Decree P68/2008] and a law for the implementation procedures of reducing emissions from deforestation and forest degradation (REDD) [Ministerial Decree P30/2009]. In April 2012, the government put in place Ministerial Regulation P20/2012 as the basic principles and criteria to demonstrate REDD+ activities and the rights and obligations of the proponents of forest carbon project (SSEK, 2012).

Indonesia was involved in international REDD+ funding mechanisms including REDD readiness through UN-REDD and the Forest Climate Partnership Facility (FCPF), reforms and investment through UN-REDD and Forest Investment Program (FIP) as well as the global REDD fund/market established by the UNFCCC (Agung, Galudra, Van Noordwijk, & Maryani, 2014). As a member of the UN-REDD Programme, Indonesia received USD$ 5.6 million funding in March 2009 for its National Programme. The funds were deployed for readiness and focused on stakeholder participation; technical methodological design; the establishment of measurement,

reporting, verification (MRV), and payment mechanisms; and institutional capacity building for decentralized REDD+ implementation on a subnational level (UN-REDD, 2008).

In March of following year, the UN-REDD's Multi-Partner Trust Fund were granted funds to start the programme's inception and implementation phase. In October 2012, the phase I of Indonesia's UN-REDD Programme had ended. In January 2011, a total of USD$ 225,000 was granted under Indonesia's Forest Investment Program (FIP) after the government submitted a Readiness Preparation Proposal (R-PP) to the FCPF Participants' Committee in June 2009 (Climate Investment Funds, 2011). The FCPF has extended US$3.6 million in grants to Indonesia since early 2011 to support REDD+ readiness. The funds have augmented research by the Ministry of Forestry into future land-use demands, demographic developments, and revenue-sharing structures for REDD+ (McGregor et al., 2015).

In addition, Indonesia receives international support for forest management improvement through bilateral projects—for example, the Forest Governance and Multistakeholder Forestry Programme in 2007–2010 with the British Government and Forestry–Climate Change Project in Central and East Kalimantan in 2009–2016 (Indrarto et al., 2012). In addition, a $200 million World Bank Forest Investment Programme Climate Change Development Policy Loan offers up to $80 million in grants and concessional loans for REDD+ development pending preparation of a Forest Investment Strategy. Bilateral donors, including Norway, Australia, Germany, Japan, the United Kingdom, the USA, and South Korea, are also important provisioners of REDD+ finance (McGregor et al., 2015)

Among donors who offered financial supports to Indonesia, Norway is the most influential international donor. The governments of Norway and Indonesia signed a Letter of Intent (LoI) in

Oslo in May 2010. The LoI declares that Norwegian government supports Indonesia in the preparation and implementation of REDD+. Norway has pledged up to US$1 billion: $200 million for preparation and transformation up to 2014 with the remainder ($800 million) for performance-based payments for carbon emission reductions. Indonesia will receive the latter type of payment if they achieve emissions reduction.

The activities arrange in the LoI proceed in three phases: (1) preparation (started May 2010), (2) transformation (from January 2011 until the end of 2013), and (3) contributions to verified emission reductions (from 2014 onwards). In the first phase, the main steps for the Indonesia's REDD+ strategy implementation included: completed a national REDD+ strategy, established a special REDD+ agency, and selected a subnational REDD+ pilot. Activities in the transformation phase was focus on capability building on a national level, policy development and implementation, and legal reforms and law enforcement. This second phase aimed to ready Indonesia for the final phase: contribution to verified emission reductions. After national emission reduction has been met a UNFCCC reference level and independently verified, Indonesia will receive its payment from the Norwegian government. Payments are made based on ton units of carbon reduction.

In May 2011 the Indonesian government established a two-year moratorium (Presidential Instruction No.10/2011) on the allocation of new concessions on forest land as part of the LoI transformation phase. The moratorium prohibited the issuance of forest use licenses in peat lands and primary forests for two years (Murdiyarso, Dewi, Lawrence, & Seymour, 2011). The moratorium was focus on peatland and primary forests conservation only, while other forest areas remained open to investments including timber and plantation (Brockhaus et al., 2012). The moratorium was not affected existing permits. The moratorium then extended in 2013 by the

new President (Presidential Instruction No. 6/2013) and in 2015 (Presidential Instruction No.8/2015) also in 2017 (Presidential Instruction No.6/2017).

As part of the preparedness phase, through Presidential Decree no. 25/2011 in September 2011, a new REDD task force was established by President Susilo Bambang Yudhoyono. The task force is responsible for the establishment of REDD+ financing mechanisms, preparation of measurement, reporting, and verification (MRV) institutions, and effective implementation of the moratorium (CIFOR, 2011). In September 2012, the REDD+ task force launched the National REDD+ Strategy, as a basis for REDD+ planning, including the institutional setting and implementation guidance.

Another REDD+ agency was created in September 2013 through Presidential Decree (Peraturan Presiden—PP) No. 62/2013: The National REDD+ Agency (Badan Pengelola REDD+ [BP REDD+]). BP REDD+ was a nonstructural governmental institution, and its main agenda is "Beyond Carbon, More than Forest," which acknowledges that REDD+ not only contributes to climate change mitigation but also to sustainable and equitable stewardship of its land, inhabitants, and natural resources (UNDP, 2019). However, Joko Widodo, the new President of Indonesia after Susilo Bambang Yudhoyono, dissolved the BP REDD+ due to little recognition from other government agencies resulting the slow progress on REDD+ in Indonesia. The agency was merged with the Environment and Forestry Ministry in 2015 to enable extra monitoring abilities in order to improve the agency's performance.

In recent years, Indonesia and Norway have continued their long-term bilateral partnership on forests and climate mitigation by collaborating to support the efforts of Indonesian government to protect and restore peat ecosystems in the country. One form of support from Norwegian

government was deploying US$50 million in financial assistance to the Peatland Restoration Agency (BRG) in 2016. The funding is part of the $1 billion commitment made by Norway in 2010. Indonesia has already made a significant commitment to restore 2 million hectares of peatland by 2020. Referring to the Indonesia Minister of environment and forestry, Siti Nurbaya (2019), through Presidential Decree Number 1/201, president Joko Widodo mandated the Peatland Restoration Agency to perform a peat restoration plan.

The third phase of LoI encountered a delayed due to the Indonesian government has not yet completed the second phase in 2014. The country still does not have a comprehensive integrated MRV system, which is required by both the agreement and the UN Framework Convention on Climate Change (UNFCCC). Instead, Indonesia has continued in the transformation phase to prepare for the Contribution for Verified Emission Reduction phase. Finally, in February 2019, Indonesia confirmed that carbon emissions from deforestation declined in 2017. According to Indonesian Minister of Environment and Forestry Siti Nurbaya, Indonesia lowered the annual deforestation rate from 1.09 million hectares to 480,000 hectares between 2014 and 2017. As the governments of Norway and Indonesia have agreed to the rules for results-based payments for reduced emissions, Indonesia will receive the first payment for reduced emissions since the climate and forest partnership between the two countries began in 2010. This will be the first payment for reduced emissions since the climate and forest partnership between the two countries began in 2010. After annual emissions reductions are independently verified, Norway will guarantee payments to Indonesia for approximately 4.8 million tons of CO2 (Norwegian Embassy, 2019). With that number, Indonesia will be the largest rain forest nation to receive payments for reduced deforestation at the national level.

Hundreds of subnational REDD+ initiatives have emerged across the tropics over the last decade, which allowing a comparison of different approaches in measuring carbon emissions impacts (Bos et al., 2017). Consistent with the large stocks of forest carbon, Brazil and Indonesia have a higher number of projects compared with other tropical countries (Jagger et al., 2011). Indonesia has been extensively involved in REDD+ since it was adopted as a tool to mitigate carbon emissions. As stated by Sills et al. (2009), during the first generation of REDD+ projects, 35 initiatives were identified in Indonesia. The projects were mostly located in Kalimantan (15 projects) and Sumatra (10 projects), in addition to several projects on Java (2), Sulawesi (3), and Papua (5). Project sizes vary from 10,000 to 4.2 million hectares (Sills et al., 2009). By 2012, Indonesia had more than 60 REDD+ activities that were either on going or still in the preparation phase (FCPF, 2012). These activities support the REDD policy development at the subnational pilot projects and the national level. Currently, many subnational REDD+ initiatives still being implemented in Indonesia led by diverse actors, including nonprofit organizations, for-profit companies, and government agencies. The initiatives are varied and include a community carbon pool, restoration and conservation, and a carbon trading scheme.

1.2.2 REDD+ Challenges

Climate change is a pressing issue with a very complex policy and disagreement about the nature of the problem, the cause underlying its problem, and the best way to address it. Climate change is a wicked problem due to the openness, complexion, and imperfectly understood (Prins & Rayner, 2007). The term “wicked” in this context refers to an issue that is highly resistant to resolution and lacks clear definitions of the boundaries of the problems or its solutions (Rittel & Webber, 1973).

As a framework for mitigating climate change, REDD+ is also a wicked problem. As described by Levin et al. (2012), REDD+ emerged as part of the global community's long-term efforts to addresses rapid forest loss and degradation and the threats posed by climate change, which are "super wicked" problems that require swift and effective global responses. REDD+ is such a problem, in the context of a socio-ecological system that requires adaptive management (Ostrom, 1998; Newig, Günther, & Pahl-Wostl, 2010; Newman & Dale 2005). These problems require creative mapping and innovative adaptive responses, as well as the effective information exchange that is perceived as credible, salient, and legitimate by stakeholders (Moeliono et al., 2014).

One of the challenges REDD+ projects in Indonesia often face is a situation in which forest conservation projects need to compete with other land uses such as oil palm plantations, which can be highly profitable (Hein & van der Meer, 2012). Existing land allocation procedures, particularly regarding forest conversion, lack clarity and transparency; this, in turn, causes tenurial conflict among stakeholders and harms the rights of the local community (Brockhaus et al., 2012; Doherty & Schroeder, 2011; Felker, Bong, DePuy, & Jihadah, 2017; Patel et al., 2013). The lack of clarity in the law of community land rights in Indonesian worsens the risk of conflict with local communities (Mulyani & Jepson, 2013), and hence local communities may bear the negative effects of these mitigation efforts (Godden & Tehan, 2016). Moreover, government agencies and NGOs use different maps, which lead to overlapping tenurial claims and conflicts. Addressing such problems takes time and resources and the adoption of innovative approaches. The Indonesian government has undertaken efforts in that direction by developing the Integrated Cadastral Mapping and Survey system. This started with the provision of base maps from six

REDD+ pilot provinces that were funded through REDD+ grants associated with the LoI between Indonesia and Norway (McGregor et al., 2015).

Another obstacle of the REDD+ mechanism is the diversity of stakeholders involved, which has triggered debate regarding its implementation. REDD+ actors in Indonesia can be grouped into four main categories: government, NGOs, private sector, and local communities living in and around the project areas. Each group plays its own role (Indrarto et al., 2012). The business sector has been one of the important actors in the REDD+ debate, which often acts to oppose its progress (Luttrell et al., 2014)—for example, powerful interests in the palm oil and timber industries, which are two of the key drivers of deforestation in Indonesia (McGregor et al., 2015).

Although Indonesia has established numerous policies and pilot activities for REDD+; considerable political, bureaucratic, financial hurdles, and stakeholder dynamics exist across scales and at the local level must be overcome (Enrici & Hubacek, 2018; McGregor et al., 2015). This includes Indonesia's complex legal system, within which every ministry has its sectoral laws and often engages in conflict with others. Also, many divergences existing in forestry regulations between the national and subnational governments (Barr et al., 2006). Political struggles between different scale of government levels including district, provincial, and national governments have emerged during the decentralization process (Barr et al., 2006), resulting in overlapping and unclear rights and duties among them (Moeliono et al., 2014). Further, there are still many overlapping regulations; inadequate forestry law enforcement; no transparency in terms of permit processes and forest management; and high levels of corruption, collusion, and institutional weakness (Dermawan et al., 2011). Combined, these factors have produced poor

enforcement of environmental and social protections system (Dermawan et al., 2011; Indrarto et al., 2012; Mulyani & Jepson, 2013). Moeliono et al. (2014) and Indrarto et al. (2012) report that consultations and information exchange between REDD+ actors have mostly been one-way and top-down and tend to be concentrated within relatively similar organizations, and the exchanging information only with one another within governmental organizations. Based on these findings, the process of forming policy should ensure that REDD+ to be more transparent, inclusive, and accountable, as well as promoting transformational exchange in information to address problems. Thus, working across agency boundaries is increasingly important in order to understand, respond to, and tackle these problems, because they go beyond the capacity of any one organization. A better understanding of the problem requires (1) the perspective of multiple organizations and stakeholders and (2) the effective delivery of any measure identified as a possible solution that requires the involvement, commitment, and coordination of multiple organization and stakeholders (Australian Public Service Commission, 2019).

REDD+ can be led by the government but not always dominated by the government. Many of the REDD+ projects in the country are led by various actors, such as a private profit company and a private nonprofit organization that implement the programs depending on support from international funding—for example, the World Bank through the Forest Carbon Partnership Facility (FCPF) and the UN-REDD Programme. Other REDD+ projects are funded through payments generated by international markets selling carbon credits. In the case of Indonesia, sellers are often not able to find REDD+ buyers, and so many REDD+ pilot projects activities turn to alternative funding options outside of carbon payments because the challenges in securing sufficient funding (Enrici & Hubacek, 2018). Uncertainty over the future of a climate change international agreement may affects directly on carbon market demand and prices that may lead

to a negative perception of the REDD+ mechanism economic viability (Mulyani & Jepson, 2013). If REDD+ is to succeed, it must move beyond bilateral-fund-based relationships and toward integration into international markets, which bring their own standards of accountability and transparency (Luttrell et al., 2014).

1.3 REDD+ Subnational Initiative: The Katingan Mentaya Project

1.3.1 Project Description

REDD+ can be implemented through a subnational project-based approach (Resosudarmo, Duchelle, Ekaputri, & Sunderlin, 2012). Subnational approach is considered as a first step toward national approaches (UNFCCC 2007: Decision 2/CP.13). REDD+ subnational projects are being initiated in many countries in various stages of development and forms (Kshatriya, Sills, & Lin, 2011), and over 300 subnational projects have been implemented across the tropics (Simonet et al., 2014), including Indonesia. Indonesia had more than 60 REDD+ initiatives in 2012 (FCPF, 2012) which also located in Kalimantan. Kalimantan comprises approximately 5.7 million hectares of peatland (Carlson et al., 2013). Kalimantan is the second most heavily forested of Indonesia's seven major islands (Margono, Potapov, Turubanova, Stolle, & Hansen, 2014) but has experienced high levels of deforestation (Gaveau et al., 2016). One of the drivers of the deforestation in Kalimantan was industrial activity, such as the rapid expansion of palm oil plantations (Carlson et al., 2013). By 2020, estimated 18–22% of Indonesia's total GHG emissions are from the expansion of industrial plantations on peatlands (Ludang & Jaya, 2007).

On December 30, 2010, the REDD+ Task Force selected Central Kalimantan as the pilot province for REDD+ activities as part of the LoI between Indonesia and Norway (Indrarto et al., 2012). Central Kalimantan had been chosen as it has the third largest area of forest cover in

Indonesia and its regional governments were considered to be committed to REDD+ implementation (Indrarto et al., 2012), which experienced the second highest rate of deforestation from 2000 to 2008 (Broich et al., 2011). In 2010, Central Kalimantan had 12.3 million ha of natural forest, extending over 80% of its land area (Global Forest Watch, 2019). During 2011 to 2018, average loss of tree cover was 197,485 ha/year with average carbon emission 75 million ton/year (Butler, 2019). In 2018, Central Kalimantan lost 110k ha of tree cover, equivalent to 42 million ton of CO2 of emission with 44.8k ha of this loss occurred within primary forests and 97.5k ha within natural forests (Global Forest Watch, 2019). Thus, Central Kalimantan was designated as the first pilot province for REDD+ (Walsh & Hidayanto, 2012). One of the REDD+ project is the Katingan Peatland Restoration and Conservation Project, which is known as the Katingan Mentaya Project.

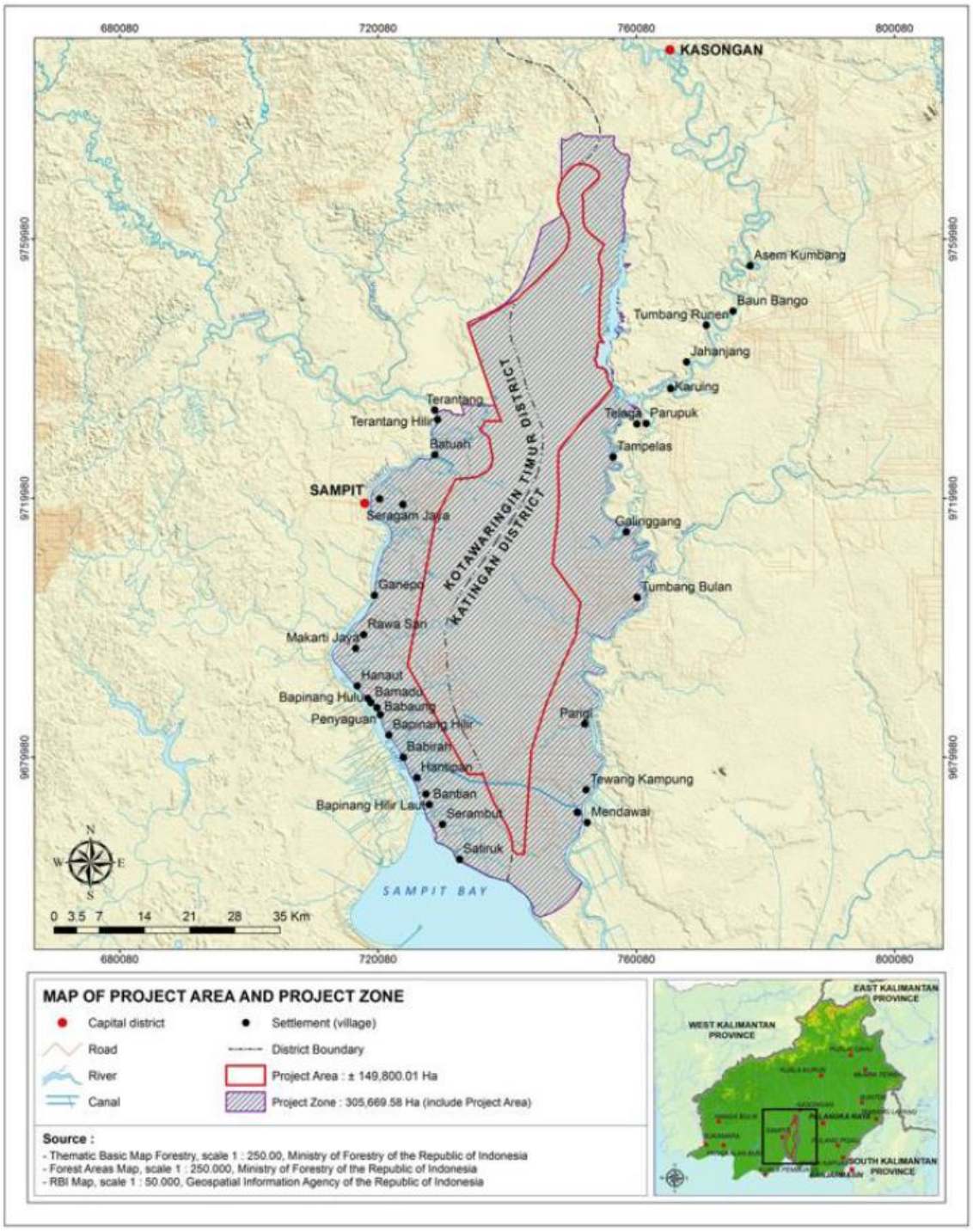
The Katingan Mentaya Project is an ecosystem restoration initiative on peat swamp forest with the express purpose of creating a business based on conservation of the forest. The project was founded and is managed by PT Rimba Makmur Utama (PT RMU). According to PT RMU, “The goal is to develop and implement a sustainable land use based on a solid business model that is aligned with REDD+, mitigates the impact of climate change through preserving and restoring peatland ecosystems, and creates sustainable economic development opportunities that improve rural communities’ livelihood”. The project covers 157,845 ha across two districts of Katingan and Kotawaringin Timur in Central Kalimantan Province, which includes one of the largest remaining intact peat swamp forests in Indonesia. The project area is rich in biodiversity, habitat of many high conservation value species, including the Bornean Orangutan (Pongo pygmaeus), Proboscis Monkey (Nasalis larvatus), and Southern Bornean Gibbon. It not only stores vast

amounts of carbon and provides clean water for people in surrounding villages but also supports local livelihoods including farming, non-timber forest product harvesting, and fishing.

The project area is managed through an Ecosystem Restoration Concession (ERC). The ERC scheme was established in 2007 by the Ministry of Forestry (MoFor). It only can be applied to production forest for degraded areas. According to the government regulation ERCs defines as "re-management and restoration efforts on former Production Forest, including biotic and a-biotic components, with the objective to reestablish a biological balance" (Buergin, 2016). The ERC holder is obliged to enact restoration activities, but they allow to generate revenues from payments for environmental services such as carbon storage and sequestration (Brockhaus et al., 2012). ERC licenses are valid for 60 years and can be extended for another 35 years. Even though ERCs appear to be popular among some REDD+ project developers (Madeira, Sills, Brockhaus, Verchot, & Kanninen, 2010) as a promising strategy to reverse deforestation and forest degradation and restore degraded ecosystems, several large REDD+ projects have struggled to obtain ERC licenses. ERCs can only be acquired by a private entity and are very limited. Obtaining an ERCs is a long process and full of uncertainty. The government may reject the ERC issuance or issued an ERC but only grant the concession with a different number of proposed areas.

The Katingan Mentaya Project was initially proposed to cover a project area of 203,570 ha across the entire peat dome between the Mentaya River on the west side and the Katingan River in the east side. However, MoFor granted PT RMU an ERC license (Minister of Forestry Decree SK 734/Menhut-II/2013) for 108,255 ha in 2013 that only covered approximately half of the proposed area and not the entire peat dome. Then, in 2016, the Indonesian Department of

Environment and Forestry granted a second concession for ERC PT RMU for 49,497 ha (Head of Investment Coordinating Board (BKPM) Decree SK 23/1/IUPHHK – RE/PMDN/2016).



Source: The Katingan Mentaya Project VCS Verification Report, 2016

Figure 1.1 Map of The Katingan Mentaya Project Area

The final combined ERC area of nearly 157,845 HA is shown in Figure 1.1. The concession excluded 34 villages located in the peat dome and likely to be affected by the project both because of the biophysical linkages and because some of the areas that they traditionally used were included in the ERC. These villages were considered to be the poorest in the district (Indriatmoko et al., 2014). The majority of people in the project zone make a living from small-scale farming such as rice cultivation, fruit gardens, non-timber forest products (e.g., gemor, jeluntung, medical plants, and honey), and traditional fisheries, as well as agroforestry including rubber tapping, coconut, and rattan cultivation. Other sources of income in these villages are small businesses such as kiosks, food stalls, swallow nests, taxi boat operation, and working as laborers for mining or oil palm plantation companies.

The Katingan Mentaya Project is a performance-based business. Proponents will receive funding if the project achieves GHG emission reductions and sequestrations against a business as usual scenario (baseline). The project has gained certification from the Verified Carbon Standard (VCS) and the Climate, Community and Biodiversity Standards (CCBS). The VCS is overseen by a group of partners from business, government, and nonprofit sectors, and is underpinned by scientific methodologies for the quantification of emission reduction and removal, including by avoiding deforestation and forest degradation under the REDD+ scheme (McGregor et al., 2015). According to the Katingan Project report, the VCS project duration is 60 years, valid from the beginning of the project start date of November 1, 2010 and ending on October 31, 2070. As for the CCB Standards aim to ensure that REDD+ projects are meet a bundle of environmental, ecological and economic sustainability criteria and indicators elements including climate, community, and biodiversity (Melo, Turnhout, & Arts, 2014). It also ensures that the projects are designed and implemented in participatory manner involving relevant stakeholders and such

projects contribute to the alleviation of poverty and the protection of biodiversity both inside and outside the project boundaries (Merger, Dutschke, & Verchot, 2011).

The project has implemented a variety of activities to protect the peatland (REDD + WRC)—specifically, by avoiding planned deforestation (APD), restoring the hydrology and ecosystem functioning of the peatland by the rewetting of drained peatland (RDP), and reforesting part of the project area that was drained and deforested before the project began (ARR) combined with the conservation of undrained and partially drained peatland (CUPP). Through these activities, during the first monitoring period in 2015, the project achieved emissions reductions of 12,748,612 tons of GHG emissions (The Katingan Mentaya Project VCS Verification Report, 2016)

Project activities also include peat swamp restoration in heavily degraded areas of all ecosystem types within the project boundaries; threatened species rehabilitation and habitat protection; fire prevention and suppression; protection and law enforcement activities to prevent illegal exploitation and encroachment of the project area; community-based business development to reduce environmentally unfriendly activities and foster sustainable alternative livelihoods; microfinance development; and sustainable energy development.

1.3.2 Project Proponent and Other Stakeholders

A mapping of stakeholders involved in the Katingan Mentaya Project presented in Figure 1.2. The stakeholders involved in this project was identified through Survey of Intervention with proponent, key informants in the study villages, and from fieldwork observation. The key player of this project is PT Rimba Makmur Utama (PT RMU), as it was developed and managed by the company. The company is responsible for the project management, financial, and project

implementation. Proposed program activities are to be carried out in collaboration with project partners including Permian Global, the Puter Indonesia Foundation, Wetland International. Permian Global is an investment firm committed to the protection and revitalization of natural forests as part of climate change mitigation. It encompasses a team of forest conservationist, scientist, and asset management experts to create the best potential forest carbon projects. The Puter Indonesia Foundation *(Yayasan Puter)* is a non-profit organization, their main mission is to develop and implement innovative approaches to community-based processes. The foundation leads the community development of Katingan Project activities. Another partner is Wetlands International, an international NGO dedicated to restoring and maintaining wetlands for their benefits, both environmental and social. Those stakeholders have high interest on the project outcomes and high power on the project implementation.

Other stakeholders discovered in this project including the national government of Indonesia, local governments (provincial, district, and sub-district). They have high power due to the issuance of the project concession and as for the national government have higher interest due its goal in achieving a national REDD+ mechanism. The local government on a village level and customary groups see the REDD+ project has a potential in improving local communities' livelihoods but has low power on the project implementation. There are also NGOs that have programs in the project zone since the ERC located next to Sebangau National Park. Furthermore, farmers' groups, local women's organizations, and local communities in the project zone have low power in the project implementation. Whereas the interest level also categories in the lower level due to lack of understanding on REDD+ framework. In addition, there are other private companies identified near the project area.

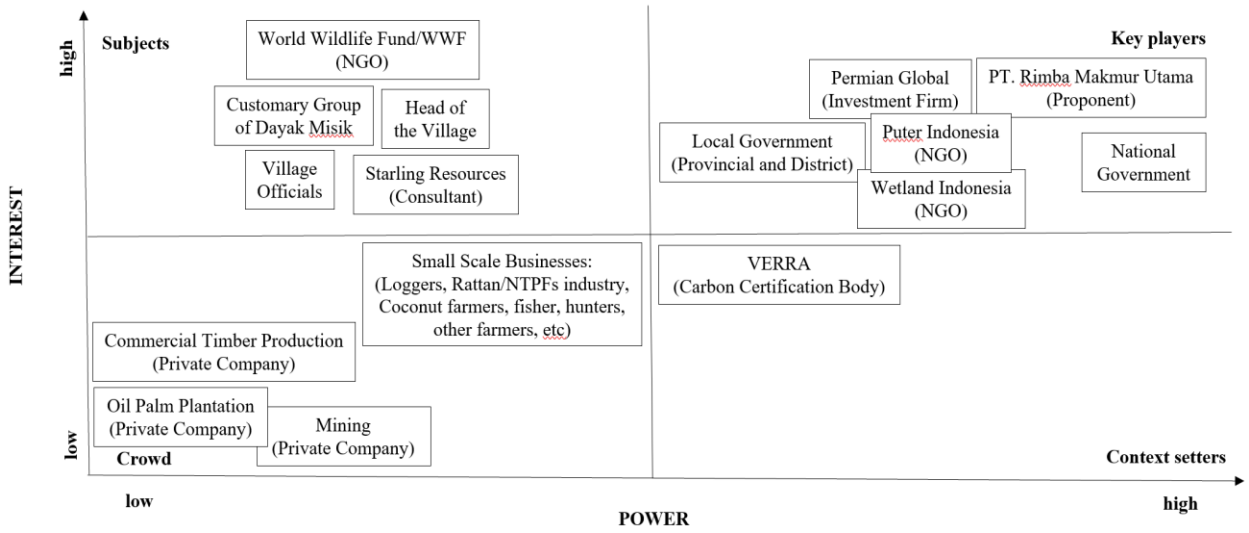


Figure 1.2 Stakeholder Mapping of the Katingan Mentaya Project

1.3.3 Design of the Project

Through REDD+ financing, which is focusing on the carbon market, the Katingan Mentaya Project obtained ERC to preserve and prevent the peatland ecosystem from the big actors to be converted to other land use such as palm oil plantation or timber production. The project also carries out restoration activities to maintain and enhance ecosystem services for the overall well-being of the project-zone communities.

The project lies above the peatland and part of peatland dome and surrounded by villages which the local communities in those villages dependent on the environment resource. Thus, the project activities also focus on the local community. The project educates local community about the value of environment resources to increase the local community knowledge and awareness of the environment. The project creates sustainable economic development opportunities to increase the household income and enhance rural communities' livelihood as well as reduce poverty of the communities in the project zone. The interventions activities aim to assist a sustainable economic

development by supporting the development of small to medium sized businesses through microfinancing, improving skills in natural resources management, and facilities or processing equipment establishment. All those activities intended to have an impact on reducing the land-based carbon emission.

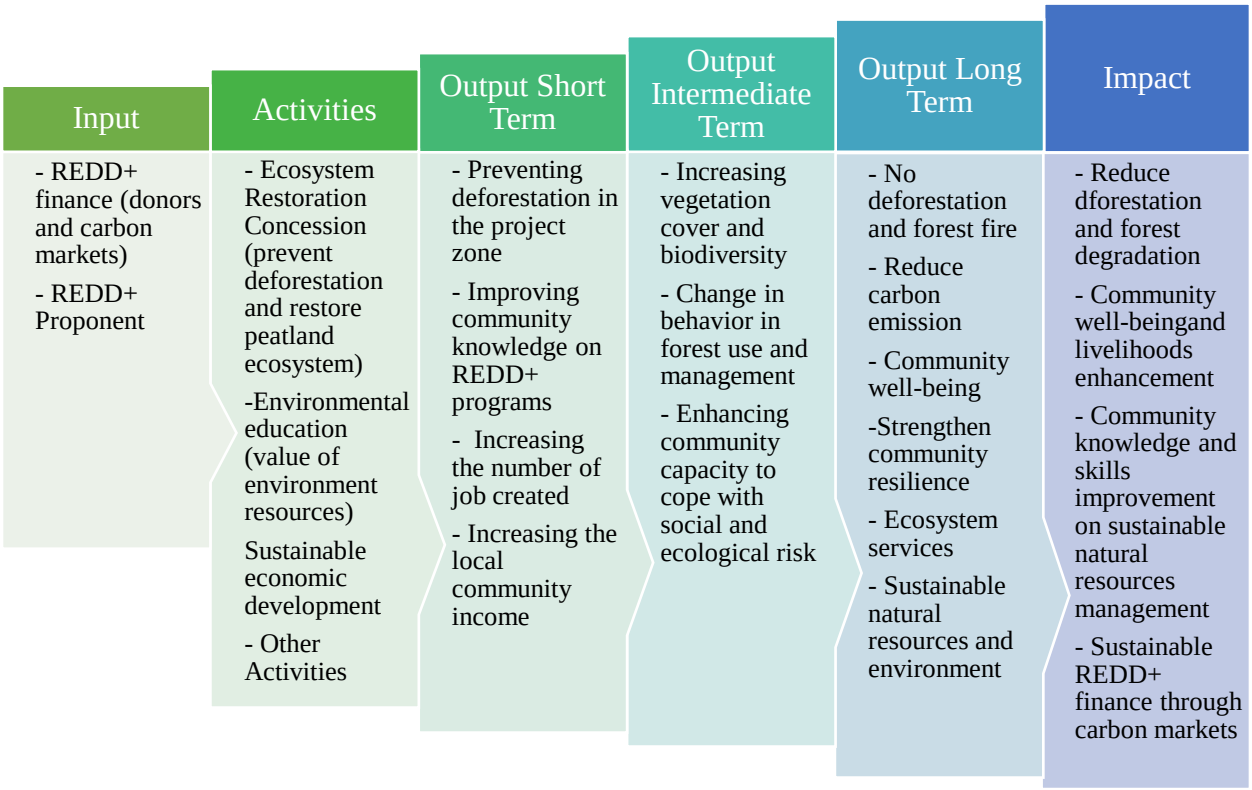


Figure 1.3 Theory of Change of Katingan Mentaya Project

1.3.4 Timeline of Project Implementation

PT. Rimba Makmur Utama was founded in 2007 by Dharsono Hartono (Chief Executive Officer) and Rezal Kusumaatmadja (Chief Operating Officer). Preparation for the Katingan Mentaya Project was performed from October to December 2007. The preparation process included studies of the biophysical peatland forest and social and land tenurial aspects in the initial project

location. In November 2008, PT. RMU submitted its application for an ERC license to MoFor (Indriatmoko et al., 2014). In the following year, PT. RMU started to introduce the Katingan Mentaya Project to local communities around the project area. With the help of Puter Indonesia, project socialization; an activity which is intended to disseminate information about REDD+ and the project activities as well as its potential impacts; was conducted through village meetings in some of the villages (Hartono, 2011). The company also launched a limited community engagement activity in collaboration with Puter Indonesia. Puter Indonesia has implemented many activities to prepare local communities readiness for REDD+. The activities vary, and are associated with tenurial security, women's empowerment, environmental education, and livelihood improvement (e.g. Community Participatory Mapping, Establishment of Community Rubber Gardens, Fresh Water Fisheries Improvement, Rattan Craft Business Development, Provision of investment funds for the community).

In October 2013, MoFor issued PT. RMU an ERC license for 108,255 ha in Katingan District. PT. RMU then entered into a partnership with Permian Global to secure a long-term financing for the project. Shortly afterward, PT. RMU initiated activities for forest conservation and community development that targeted communities in the project area in collaboration with Puter Indonesia.

In 2014, PT. RMU was still pursuing to obtain an ERC license for the remaining proposed area. In 2016, the Indonesian Department of Environment and Forestry granted the second concession for ERC PT. RMU for 49,497 ha (Head of Investment Coordinating Board (BKPM) Decree SK 23/1/IUPHHK – RE/PMDN/2016).

In November 2016, the Katingan Mentaya Project was verified under the VCS and Triple Gold CCB standards. In the same year, the project was also validated by VCS and CCB. In May 2017, the first Verified Carbon Unit (VCUs) of the project were issued from the Katingan Mentaya Project. In July 2017, the project processed its second VCS verification. In May 2018, the Katingan Mentaya Project went through its third VCS verification. In November 2018, the project participated in signing a pledge to implement the 10 principles of the United Nations Global Compact. On January 29, 2019, the Katingan Mentaya Project started to cooperate with KPHP Central Mentaya Seruyan Hilir in the management of production forest areas.

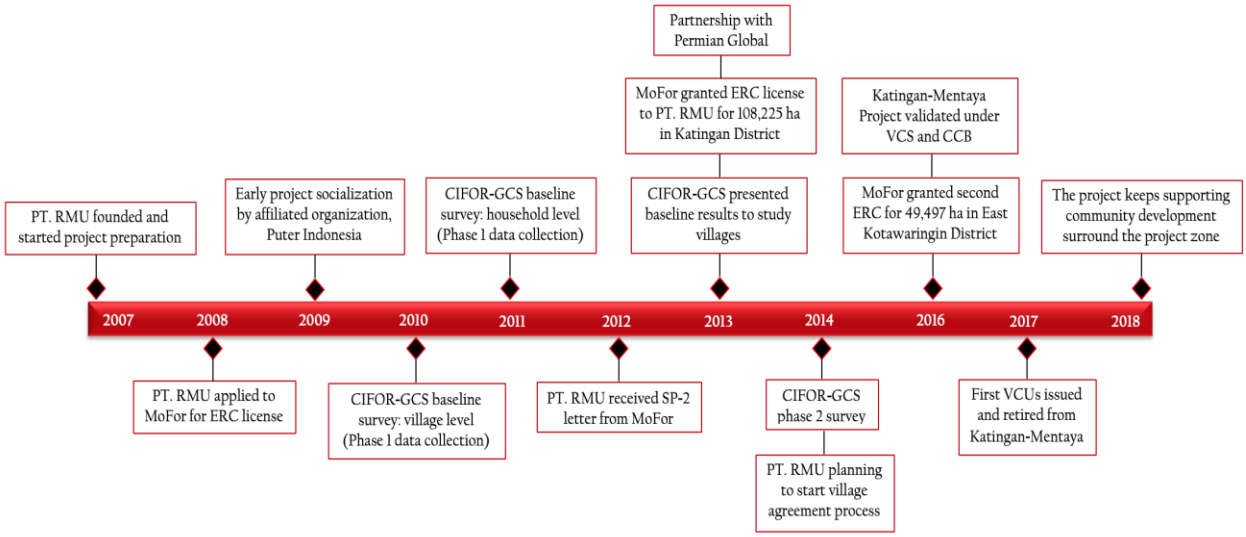


Figure 1.4 Timeline of the Katingan Mentaya Project

1.4 REDD+ Interventions

The Katingan Mentaya Project is representative of the global trend towards community-based conservation (Sills & Jones, 2018). This trend reflects the belief that when local economic concerns are taken into account, forest conservation efforts have a greater chance of success (Ferrarro & Hanauer, 2011). This trend also applies to REDD+ and is reflected in principles such

as the Cancun Agreements and the UN-REDD Social and Environmental Principles and Criteria. Community engagement is broadly perceived as important for the effectiveness of REDD+ (Agrawal & Angelsen, 2009; Hayes & Persha, 2010; Sunderlin et al., 2014).

Community-based approaches aim to improve local community livelihoods and well-being while safeguarding the environment. Some policy actors focus on enhancing REDD+'s socioeconomic benefits (Brown et al., 2008). In addition, bilateral aid organizations often concentrate on supporting local livelihoods and private investors prioritize emissions reductions that are consistent with corporate social responsibility (CSR) objectives (Sills et al., 2009). This is evidenced by the widespread adoption of voluntary certification standards such as the Climate, Community, and Biodiversity (CCB) Standard, which requires forest carbon projects to deliver socioeconomic co-benefits (Lawlor et al., 2013). At the same time, REDD+ has evolved, and conditional rewards are no longer the main focus. Some observers predict that nonconditional interventions will be more important than conditional ones (Sunderlin et al., 2016).

In order to characterize the specific interventions in the Katingan Mentaya Project, information was elicited from the project implementers and from other key informants about the specific activities taking place in the project intervention area. These interventions were listed in the household survey, and respondents were asked which had involved their households (see Table 1.1). In addition, they identified (1) which of the numerous interventions was likely to have the most effect on their livelihoods, both positive and negative (2) which was likely to be most effective in improving the forest capacity in sequestering the carbon, and (3) how the interventions had affected the local community, the respondent's land, and other natural resources (e.g., agricultural or livestock practices , forest uses and resources, forest clearing).

Consistent with GCS-REDD+, I define "forest intervention" as a program or project activity, introduced or supported by a non-village entity (conservation organization, NGO, branch of government, private company, REDD+ proponent organization, etc.), aimed intentionally at directly or indirectly influencing the way stakeholders manage and use local forests (Sunderlin et al., 2016). The interventions can focus on reducing deforestation and forest degradation, enhancing forest carbon stocks, protecting biodiversity and watershed, preventing hillside erosion, or providing livelihood alternatives for local people.

More specifically, the GCS guidelines for field work framed interventions as follows. (1) A forest intervention can be either REDD+ or non-REDD+. (2) It is aimed at protecting natural or managed forests. (3) The activities can be intended to change the behavior of actors who are either inside or come from outside the initiative boundaries. (4) Many kinds of interventions can aim to protect and enhance forests, including those that are directly applied in and around forests and those that protect forests indirectly. (5) Interventions can begin anytime, either before or after the REDD+ initiative was launched, but, crucially, must have been in force (in the sense of being applied) at any time from the beginning of the REDD+ initiative until the current date. (6) Interventions in control villages must correspond to the time frame of the matching REDD+ initiative.

In the data processing phase, forest interventions were classified into seven subtypes. The first type is restrictions on forest access and/or conversion (RFAC), such as boundary setting on restricted forest use; monitoring; forest access and use policies; enforcement of forest protection laws and regulations including fines; land use planning which aimed for forest protection. The second type is forest enhancement (FE), such as reforestation or afforestation (e.g., involving the community in planting tree seedlings), and improved management that increases carbon stock

and the quality of existing forests (e.g., reduced-impact logging). The third type is non-conditional livelihood enhancements (NCLE), such as any kind of livelihood support that does not require local communities to change their behavior in using forest. The fourth type is conditional livelihood enhancements (CLE), including any kind of livelihood support that requires participants to protect or improve forests in exchange for receiving this support (e.g., providing households with subsidized annual agricultural goods or equipment on the condition that no forest clearance for swidden fields; providing community associations with a payment for environmental services or Payments for Ecosystem Services (PES) on condition that they prevent deforestation successfully. The fifth type is environmental education (EE) including any kind of information dissemination or outreach about the benefits of forest protection and enhancement and the negative consequences of deforestation and degradation of forests for society at large. The sixth type is tenure clarification (TC), including activities to solve contested or unclear ownership and access rights to forest lands (e.g., forest boundaries clarification, ownership and access rights to forests). The last type is other interventions (OI), such as any forest intervention activity that does not fit into any of the subtypes above.

1.4.1 Forest Interventions in REDD+ Villages

The REDD+ villages in the Katingan project were subject to a bundle of forest interventions including restrictions on forest access and/or conversion, forest enhancement, nonconditional livelihood enhancement, environmental education, tenure clarification, and other interventions. These interventions were implemented not only by the REDD+ project proponents, but also by government agencies, NGOs, or partnership among those implementers. While the number of interventions that occurred in each REDD+ village varied, we recorded at least two of the following interventions in every village.

1. Establishment of Community Rubber Gardens (FE)

   This activity was facilitated by the Puter Foundation, which aimed primarily to restore peatland conditions around the villages in addition to providing economic benefits in the future. Since 2009, local communities have prepared rubber seedlings to be planted on their degraded lands, which encompass about 160 ha. Nearly 70% of the population in each village participated in the event. Each household was given a grant of IDR 1.500.000/ha for planting 400 tree seedlings. The activities included clearing land, digging trenches, building nurseries, planting, and maintenance. Village representatives visited the neighboring district of Kotawaringin Timur to learn about similar activities in those areas. This activity was discontinued, because it was only a one-year program from 2009 to 2010. The potential impact of this activity on the forest comes from restoring peatland conditions around villages by planting rubber in open peatland areas or any degraded lands owned by villagers. This activity may improve the quality of existing forests and reduce illegal logging, since the community gets economic benefits from selling rubber resin.

2. Community Nursery “Kebun Bibit Rakyat” (NCLE)

   This program, facilitated by the District Forestry Service Office, began in 2012 and ended in 2015. It runs on different sources of funding each year, including through DAK-DR (reforestation fund), BP-DAS Kahayan (Kahayan watershed management unit), and the district budget. This activity was conducted in the villages in rotation, due to the limited availability of funds. The program has not only been implemented in intervention villages but also in control villages. Its purpose is to plant trees they grow in the nursery

on degraded land owned by the community to gain a future economic benefit. Usually, each household receives assistance to plant 2 ha of land. Each group of farmers typically consists of up to 25 households, and in one village there are at least three farmer groups. The potential impact of this activity on the forest is that producing their own high-quality seeds within their villages may increase the local community's motivation to plant their land, especially degraded land, with those seeds. Although it is a pilot project with only about 6 ha planted in each village, this activity may change the behavior of the local community by motivating them to keep planting degraded land and generating income. As a result, local people will decrease their activities in the forest.

3. Forest and Land Fire Prevention: "Socialization on Forest Fire Prevention by RMU and partners/ Sosialisasi Kebakaran Hutan, and Forest Fire Monitoring with Community" (RFAC)

   This activity was called the Establishment of Firefighter Teams (i.e., a form of community monitoring of forests). The establishment of firefighters' teams began at the end of March 2014. From 2015, PT. RMU focused on the socialization of forest fire prevention in 34 villages in collaboration with the Regional Disaster Management Authority (BPBD), Department of Fire Fighting and Disaster Management (DPPK), the army, local police, and the Forum of the Sub-district Leader (Muspika). In 2018, the socialization was conducted in April and May. PT. RMU conducted forest fire monitoring as part of forest and land fire prevention in some of the villages surrounding the area. This activity involved three or four local people monitoring hotspots and patrolling forest areas in one-week turns, especially during the dry season. The potential impact of this activity on the forest is increasing the local community's awareness of how

to prevent forest and land fires in their area. It also changes their behavior in terms of clearing land for agricultural purposes (i.e., no longer using fire). The establishment of fire brigade teams, training, and regular patrols may prevent forest and land fires in the fields and help to extinguish any fires that occur.

4. Fresh Water Fisheries Improvement (NCLE)

   This activity was carried out in 2011 by the Puter Foundation. During the same period, the WWF carried out a similar activity in some villages within the initiative boundaries. This activity aimed to strengthen community livelihoods, included support for the provision of floating net cages, the establishment of fishponds, and fish hatchlings such as nila and *Toman* (*Channa micropeltes*/Giant Snakehead). In 2015, PT. RMU and 13 villages surrounding the concession signed a memorandum of understanding (MoU). In the MoU, PT. RMU committed to support the villages based on village planning. Some villages included fisheries in their planning. The activities of this program focus on support for the provision of floating net cages (Keramba), procuring food and fish hatchlings such as nila, supporting marketing efforts, and providing assistance for fish farmers if they face challenges in collaboration with the district's fisheries office. One group of fish farmer was built one floating net cages. The floating net cages were built 2 up to 3 for fish farmers in each village. One fish farmer group consist of 5-10 people. This activity aimed to support the implementation of village planning and create an alternative source of income for the local community that, later on, could change their behavior regarding forest and land use. However, based on evaluation of the program after one year, Puter Foundation and the local communities decided not to continue the program. The potential impact of this activity on the forest is creating an alternative/other income

source which, by being located near villagers' homes, may reduce or eventually phase out logging activity and encroachment or other activities (e.g., forest clearing for agriculture) in the forest.

5. Rattan Craft Business Development (NCLE)

   This program was facilitated by the Puter Foundation with funding from the Global Environment Facility–Small Grants Programme (GEF-SGP) and aimed to enhance the ongoing community livelihood of rattan handicraft making. This activity included the provision of funding for women's small-scale businesses. Funding support ceased after one year, but the Puter Foundation and PT. RMU are currently assisting villagers in the marketing/exporting of rattan products. This activity started in 2011 and is still ongoing in two villages; in one of the villages, the activity stopped in 2013 due to lack of interest from the local community. The potential impact of this activity on the forest is supporting the local potential of NTFPs: In this case, rattan may increase the livelihood options and income for the local community. Improving the quality of rattan may help the community switch their source of income to NTFPs rather than timber. Forest exploitation by local communities is expected to lessen as livelihood options increase.

6. Provision of investment funds for the community (NCLE)

   The Puter Foundation facilitated the formation of a credit union scheme (*simpan pinjam*) for women by providing seed funds. This activity is similar to the credit unions funded through the National Community Empowerment Program (Program Nasional Pemberdayaan Masyarakat/PNPM) Mandiri. Approximately IDR 60 million were supplied by the Puter Foundation for this activity, which was carried out in 2009. In 2014, PT. RMU continued the activity. Its potential impact on forest land is increasing

livelihood options, as this source of local income may indirectly influence how local communities use and manage local forests. It may lessen forest exploitation, since residents have more options, such as establishing small businesses.

7. Community Participatory Mapping (TC)

   This activity was carried out in all of the villages adjoining the PT. RMU—both in Katingan and Kotawaringin Timur—in 2009 and ended in 2013. The activities were carried out by three different organizations: the Puter Foundation in three villages, the Simpul Foundation in one village, and the Cakrawala Indonesia Foundation in one village. The activity aimed for clarification of village borders and establish village land use plans and produced thematic maps: Administrative Area Maps, Land Use Maps, Village Management Plans, Village Asset Maps, River Network Maps, and Farmers Group Maps. The potential impact of this activity on forest land is that having clear village borders can improve the tenurial security of local community lands and avoid land conflicts. This may provide protection against encroachment and other illegal activities in the area outside their territories. Establishing land use plans based on suitability may optimize and sustain the land.

8. Socialization (*Sosialisasi*) of REDD+ and REDD+ activities (EE)

   This activity is intended to disseminate information about the environment and the economic impacts of deforestation. Activities were carried out at the beginning of 2009 by PT. RMU and continued by the Puter Foundation. Activities include displays of posters and discussion of them in village meetings. This is not an isolated activity, but rather is usually done in tandem with activities that support alternative livelihoods (e.g., credit unions for women). Currently, this activity focuses more on the dissemination of

information about PT. RMU and its vision, mission, and programs. The potential impact of this activity on forests is helping local communities to gain knowledge about REDD+ and its activities. Understanding the important roles forests play, especially in relation to global warming and other environmental issues, may increase social awareness of local communities in terms of protecting the forest. It is also important to disseminate information about PT. RMU's vision, mission, and programs to gain support from local communities surrounding the project area. With their support, the REDD+ initiative may achieve its goals.

9. Ecosystem Restoration Concession Boundary Setting (*Penetapan Tata Batas*) (TC)

   This activity was implemented at the end of 2015 with the involvement of all villages surrounding the PT. RMU concession area in Katingan District and ended in 2016. It was conducted in the villages in Kotawaringin Timur District. The results of participatory community mapping were reconciled with PT. RMU's working area map endorsed by MoFor. The potential impact of this activity on forests is that creating a clear land tenurial boundaries may avoid land conflicts between local communities and PT. RMU. The most important aspect is to set clear boundaries that identify land that should be protected and restricted from conducting activities that could damage forests (e.g., logging, mining, etc.).

10. Agreements with Local Villages [MoU] (OI)

    This activity aims to establish Village Agreements between PT. RMU and the community. The MoU contains detailed information on PT. RMU activities including ecosystem restoration, forest conservation and protection, forest research and development, and community development. Community development programs were

also based on village plans. This activity was implemented in 2014. Agreements are renewed every 3 years. In the first period (2014-2018), 13 villages in Katingan District signed agreements. However, in the second period (2018-2021) only nine villages who signed an MoU with PT. RMU. In Kotawaringin Timur District, only two villages signed an Agreement with PT. RMU in both periods. The potential impact of this activity on forests is that establishing official partnerships with local communities may motivate trust and respect between the two parties. Both parties will support each other if agreed upon objectives are met. Such relationships may increase the success of or even fast forward the REDD+ initiative's goals.

11. Reforestation and Nursery Development (FE)

    The reforestation activity is intended to improve the forest ecosystem by planting degraded lands within PT. RMU's working area (this is obligatory, based on a national government regulation). It began in 2016 with a total of 200 ha near the Hantipan Canal. This activity involved the local community, usually in groups of 5-7 daily workers who transported the seeds (Pulai, Jelutung, Blangeran), laid out planting lines, and planted each area. The potential impact of this activity on forest is improving forest quality. Reforestation has the potential to absorb carbon and preserve degraded land and biodiversity. In addition to ecological benefits, the activity yields economic benefits for the local communities directly involved. It may also change residents' behavior in terms of how they manage land and forests.

    Nursery development aims to prepare the seedlings and help to improve degraded lands within PT. RMU's working area. This activity started in 2015 and involved five villages, in which 2-3 community members at a time worked as daily paid labor in the nursery.

Since the nursery is located far outside the village settlement, workers rotate in shifts. In 2015, PT. RMU also supported the establishment of a nursery that now independently produces seedlings (Jelutung) that will be sold to the local market.

The potential impact of this activity on forests is that producing their own seeds in their villages may increase the local community's interest in planting their land, and especially degraded areas, with their seeds, and provides a way for communities to understand the objectives of PT. RMU. This activity may change the behavior of local communities by motivating them to keep planting their degraded land. In addition, it also be a source of potential income.

12. Capacity Building for Gender Empowerment (Microfinancing) (OI)

    This activity, which aims to assist sustainable local community development by supporting the development of small- to medium-sized businesses, started in 2014. PT. RMU provides the support needed to train recipients in the financial planning and management skills needed to independently operate small businesses. The microfinancing channeled through local community groups, known as Kelompok Swadaya Masyarakat (KSMs), which are often consist entirely of women. The potential impact of this activity on forests is that creating more livelihood options as sources of local income may indirectly influence how local communities use and manage local forests. It may also lessen forest exploitation, since they have more income-producing options.

13. Livestock Distribution

    This program was started in 2013 and facilitated by the WWF. The program aims to provide an alternative livelihood option for increasing local well-being by distributing livestock to the local community.

14. Rubber Seed Distribution

    This activity was facilitated by the WWF, which distributed rubber seed to local communities within the project area. It aimed to provide an alternative sustainable livelihood for local people that might reduce their dependency on forests. Rubber tapping offered economic benefits for people in the villages that surround initiative boundaries.

1.4.2 Forest Interventions in Control Villages

In control villages, forest interventions also occurred including restrictions on forest access and/or conversion, forest enhancement, nonconditional livelihood enhancement, and tenure clarification. These interventions were implemented by government agencies and NGOs. Two types of interventions were implemented in both REDD+ villages and control villages: Community Nursery and Forest and Land Fire Prevention. However, the REDD+ project proponent did not participate in implementation in the control villages. As in the REDD+ villages, each of the control village was also subject to at least two interventions from the following list.

1. Community Nursery (Kebun Bibit Rakyat) (NCLE)

   This was the same program that was implemented in intervention villages (refer to the explanation above for details).

2. Forest and Land Fire Prevention (RFAC)

   This was the same program that was implemented in intervention villages (refer to the explanation above for details). However, in the control villages, the proponent is not involved in this activity—only the Regional Disaster Management Authority (BPBD),

Department of Fire Fighting and Disaster Management (DPPK), army, local police, and Forum of Sub-district Leader (Muspika).

3. One Million Trees (FE)

   This program was implemented by the Central Kalimantan Forestry Office in 2017 and aimed to plant Sengon trees (*Albizia chinensis*) on unproductive or degraded land owned by local people. It was expected to be an additional income source for local communities that joined the program. The Central Kalimantan Forestry Office targeted approximately 1,000 households for the program.

4. Seedling Distribution and Herbicide (FE)

   The Central Kalimantan Agricultural Office distributed rubber seedlings and herbicide to villages in Central Kalimantan Province. Rubber is one of the commodities that can grow well in the areas involved, and is also a fast-growing tree that can quickly generate income from its resin. Herbicides were distributed to clear land as a substitute for fire to prevent the forest and land fires that occur often, especially during the dry season.

5. Tenure Security Support for Rattan Farmers (TC)

   This program was facilitated by the WWF starting in 2010. The activity aimed to clarify the boundaries of rattan farmers' land in the targeted villages to avoid land conflicts. This may provide protection against encroachment and other illegal activities in the area outside their territories.

6. Tree Seedling Distribution (NCLE)

   This activity was carried out by the Central Kalimantan Forestry Service Office in 2015. They distributed Gaharu tree (Aquilaria malaccensis) and Jabon tree (*Neolamarckia cadamba*) seedlings to be planted on local community land. Jabon is a fast-growing tree

that can be harvested in five years, and Gaharu has a high economic value. The goal of the program was not only to provide an alternative livelihood for local people but also to prevent them from performing illegal logging.

7. Fruit Seedling Distribution (NCLE)

   Various species of fruit tree seedlings were distributed by the Central Kalimantan Agricultural Office. The seedlings include mango, rambutan, and durian. The program was conducted in 2015 and aimed to offer additional sources of income for the local community and to reduce local community activity in the protected area.

Table 1.1 Forest Interventions Inside and Outside the REDD+ Initiative

Village Type	Intervention	Intervention type	Implementer	Year(s) of implementation	No. Villages involved		No. Households involved	
					Phase 2	Phase 3	Phase 2	Phase 3
REDD+	Community Nursery	NCLE	Central Kalimantan Forestry Service Office	2012-2015	4	4	38	43
	Forest and Land Fire Prevention	RFAC	Proponent and Partners	2013/2016-present	1	4	8	70
	Creation of Community Rubber Garden	FE	Affiliate Organization	2010	2	1	14	17
	Fresh Water Fisheries Improvement	NCLE	Proponent and Affiliate Organization	2015	1	2	Missing	24
	Community Participatory Mapping	TC	Affiliate Organization	2009/2013	3	2	17	9
	Socialization of REDD+ and REDD+ Activities	EE	Proponent and Affiliate Organization	2009/2014-present	4	4	28	34
	Ecosystem Restoration Concession Boundary Setting	TC	Proponent	2015	N/A	2	N/A	11
	Agreement/MoU with Local Villages	OI	Proponent	2015-2018/ 2018-2021	N/A	4	N/A	15
	Reforestation and Nursery development	FE	Proponent and Affiliate Organization	2015	N/A	1	N/A	5

Table 1.1 (continued)

REDD+	Rattan Craft Business Development	NCLE	Proponent and Affiliate Organization	2011	1	1	2	1
	Provision of Investment Funds for Community (Women)	NCLE	Proponent and Affiliate Organization	2011/2014	3	2	30	29
	Livestock Distribution	NCLE	WWF	2013	RDNK	1	RDNK	8
	Rubber Seeds Distribution	NCLE	WWF	RDNK	0	N/A	22	N/A
Control	Community Nursery	NCLE	Central Kalimantan Forestry Service Office	2012-2015	3	4	9	18
	Forest and Land Fire Prevention	RFAC	Central Kalimantan Forestry Service Office	2014-present	N/A	4	N/A	50
	One Million Trees	FE	Central Kalimantan Forestry Service Office	2017	N/A	2	N/A	5
	Seedling Distribution and Herbicide	FE	Central Kalimantan Agricultural Office	2013/2017	N/A	1	N/A	5
	Tenure Security Support for Rattan Farmers	TC	WWF	2010	N/A	2	N/A	10
	Tree Seedling Distribution	NCLE	Central Kalimantan Forestry Service Office	2015	N/A	3	N/A	18
	Fruit Seedling Distribution	NCLE	Central Kalimantan Agricultural Office	2015	N/A	1	N/A	20

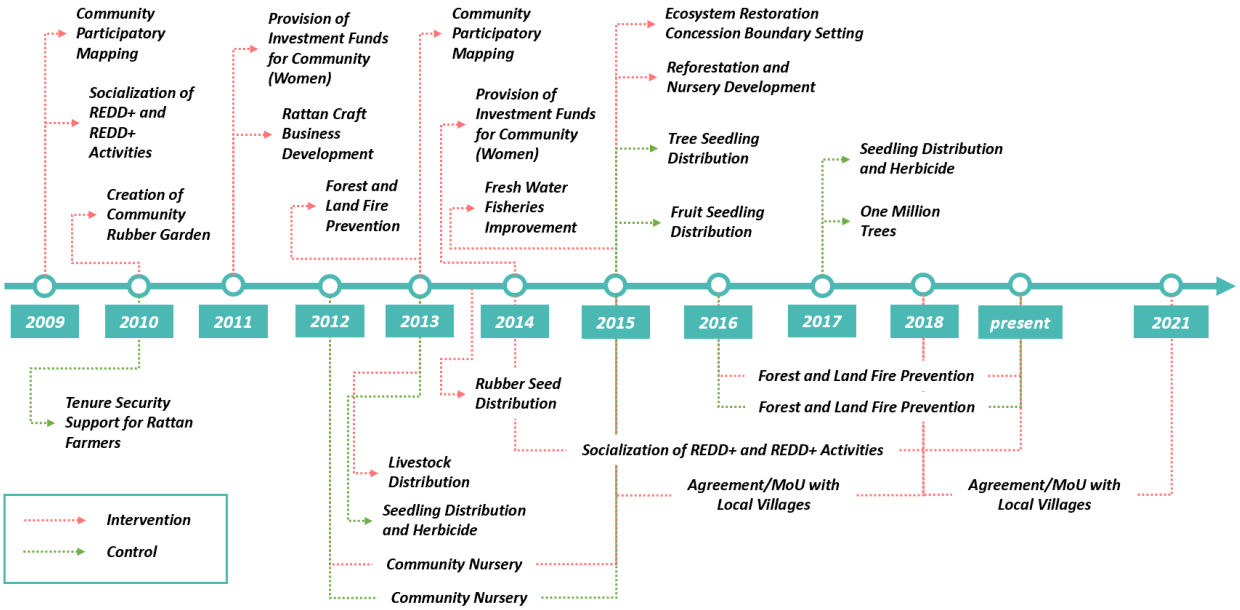


Figure 1.5 Timeline of Forest Interventions Inside and Outside the REDD+ Initiative

Figure above presented the timeline of various interventions from the project proponent, affiliate organizations, local and national government or cooperation between them. According to the project design, many of the interventions were intended to increase environmental income as the local community heavily dependent on the natural resources. Therefore, this study focuses in evaluating whether the project increases the household income and evaluate whether the project decrease the deforestation inside the village boundary as the expected result from the environmental education.

1.5 Discussion

1.5.1 Lesson Learned from the Katingan Mentaya Project

The Katingan Mentaya Project is a unique REDD+ subnational projects in Indonesia due to the fact that the project operating with an ERC. The Katingan Mentaya Project is proving that

REDD+ initiative with ERC is visible for REDD+ framework in Indonesia. ERC offers various product of business opportunity and services including reduce the carbon emissions from deforestation and forest degradation as well as from the forest production activities. Also, supporting biodiversity preservation and maintaining forest benefits such as non-timber forest products (NTFPs) and ecosystem services. Moreover, the restoration activities in the degraded land is expected to restore the ecological function of the land which beneficial not only for wildlife habitat and local community livelihood but also for absorbing carbon to lessen impact on global warming.

The Katingan Mentaya project avoided 157,845 ha of carbon rich peatland area from the deforestation which possible done by large actors such as oil palm plantation companies or mining industries. ERC can be a good alternative on the implementation of the REDD+ mechanism due to the fact that ERC valid for 60 years and can be extended up to 35 years based on the regular evaluation for every five years. The time period of the concession permit have higher potential in offering a long term REDD+ project, compare to other REDD+ projects that mostly established from the donors funding which more likely will not to be a long term project (e.g. the World Bank, through the Forest Carbon Partnership Facility, and the United Nations through the UNREDD Programme or other foreign government aids). There are so many REDD+ pilot projects activities face challenges in securing sufficient funding (Enrici & Hubacek, 2018), which prone to the project discontinuity.

On the other hand, the Katingan Mentaya Project is a REDD+ performance-based business that proponents only received funding if the project succeeds in avoiding emissions from deforestation and deforestation, forest fire, or peat decomposition also if they maintained the ecosystem of the area. The project adapting carbon offsetting mechanism to encourage parties to

take a part in forest-based emission reductions. The carbon credits can be purchased by parties in exchange of their carbon emissions to achieve their carbon reduction goals. Through this business model, the project can secure its funding and secure the area from deforestation and forest degradation. Securing continued funding will be critical to the success of the REDD+ initiatives and thus ERC offer a great opportunity to the REDD+ initiative in Indonesia.

However, there are some drawbacks of the REDD+ initiative with ERC. The REDD+ initiative is relatively a new concept in Indonesia, there are differences in the concept of ERC and in implementing the policy. It made ERC less attractive compare to other forest business such as natural production forest and forest plantation. Therefore, dissemination on ERC to local government both provinces and districts is needed to gain support in the issuance process and implementation as well as monitoring of the projects. Central and local government should have strong coordination and share responsibility with other stakeholders (proponents, partners, investors, and affiliated organizations) to avoid overlapping power due to regional autonomy. Also, appropriate research and technology supports is needed to optimally manage the area within ERC. In addition, ERC is not completely free from encroachment such as illegal logging or illegal mining, thus local community supports and participations are very important to avoid encroachment activities as well as to prevent tenurial conflict.

1.5.2 Lesson Learned from REDD+ Interventions

Based on the list of the interventions, the interventions on the REDD+ villages focus more on nonconditional livelihood enhancement (NCLE). NCLE interventions offer local community to get any kind of livelihood supports that does not require them to change their behavior in using forests. This kind of intervention aims to provide alternative livelihood for the local community

and thus local community could eventually reduce their activities which not environmentally friendly (e.g. logging, mining, swidden agriculture which mostly clearing the land with fires). There was no conditional livelihood enhancement (CLE) intervention identified, even though the initial of REDD+ project was lean towards the CLE interventions where the local community requires to protect or improve local forests in exchange for receiving any kind of livelihood supports such as agricultural subsidize or a payment for environmental services (PES).

Forest interventions were identified in both villages not only in the REDD+ villages. The number of interventions that being implemented in control villages fewer than the number of interventions in the REDD+ villages. The interventions in the control villages mostly carried out by the government because Indonesian government has been active in forest conservation and protection program. There is only one intervention implemented by NGO in the control villages. This condition might have occurred due to the similarity of village characteristics between the control and REDD+ villages as the result of village matching process. The control villages were the target villages for the forest intervention program from the government.

According to Table 1.1, REDD+ project has causing a crowding out phenomenon in the REDD+ project area. The table shows that the government implemented program outside the REDD+ project zone after the project has started in late 2013. Only two programs (Community Nursery and Forest and Land Fire Prevention) was implemented in both inside and outside the REDD+ project zone. The Community Nursery was carried out before the Katingan Mentaya Project has started. The Forest and Land Fire Prevention is a national program in preventing forest and land fire across the country, the government is the main implementer with PT. RMU as their partner in this program for the REDD+ villages. The company also has been conducting hot spot monitoring on forest area within the project zone intensively especially during dry season.

CHAPTER TWO: ASSESSING THE IMPACT OF THE REDD+ INITIATIVE

2.1 Introduction

REDD+ initiatives have impacts not only on carbon sequestration and other environmental outcomes such as reducing fire risk and conserving biodiversity, but also on the socioeconomic conditions of local populations (Tacconi, Mahanty, & Suich, 2010; Cromberg et al., 2014; Jagger et al., 2011). This study provides evidence on how REDD+ interventions affect people who live within project areas through a quantitative evaluation of one REDD+ project in Indonesia. Better understanding of the livelihood impacts of REDD+ projects can lead to improved design of REDD+ in the future.

In this chapter, I present a detailed explanation of how one REDD+ project has been implemented and counterfactual-based evidence on its livelihood impacts. I both quantify the impacts of REDD+ interventions and examine the reasons for those impacts. I also consider how the design and implementation of this REDD+ project affected forests and household livelihoods. Specifically, I evaluate whether changes in forest cover differ inside and outside the REDD+ project area. I analyze household survey data on income (both cash and in kind) and its sources, to assess whether the REDD+ initiative is significantly and causally associated with changes in forest income and forest use of the local communities. I investigate whether the REDD+ project changed local attitudes regarding forest use. I review local people's participation in project design and implementation, whether as part of a community or as individuals. Finally, I consider the migration trends of people into and out of the project area.

2.1.1 Data and methods

This chapter draws on panel data collected in three waves at two different scales. I evaluate outcomes at both the village and the household scales. At the village scale, focus groups elicited reported change in forested area and quality over the 24 months prior to the data collection. Local involvement in the project design and implementation, along with migration in and out, were also discussed. At the household scale, I calculate a measure of annual household income from agriculture, forestry, livestock, business, wage, or other sources in the 12 months prior to the household survey. The survey also elicited reported change in forest use and clearance over the past 24 months, in addition to the reasons for those changes. These data are available from a survey that occurred as the REDD+ project was being launched and surveys in two subsequent years as the project was being implemented. The surveys were conducted in selected villages in the project intervention area and in matched villages outside the intervention area (Sills et al. 2017).

The study design is "before-after-control-intervention," or BACI. This allows comparison of detailed income and forest use before and after the launch of the REDD+ project among households subject to the intervention and similar households outside the intervention area. By examining changes in income, I control for any fixed, unobservable characteristics of villages and households that could otherwise confound the analysis. And by comparing intervention and control villages and households, I control for any contemporaneous changes in regional climate, markets, or policies.

2.2 Objective

The purpose of this study is first to provide a careful, quantitative description of how a subnational REDD+ initiative was implemented, with particular attention to how it sought to achieve both environmental and socioeconomic goals. This includes understanding how villages were selected into interventions, since it is clear that not all villages were treated with the same intensity by the proponent. I assess whether and which specific interventions have occurred and when, where, and what are the impacts on household well-being. First, I compare trends in forest and community outcomes in matched intervention and control villages. Second, I examine changes in household income level and sources, divided into environmental (including forest); agriculture, livestock, and animal husbandry; and business and other. The larger sample size at the household level allows estimation of fixed effects models and attribution of changes in income to REDD+. Finally, I assess whether the REDD+ project affected forest clearing behavior by the local community at the household level.

Understanding the impacts of REDD+ projects can lead to improvements in the design of REDD+ as implemented both through projects and through national policies and measures. The analysis presented here could also help to identify the best types of interventions for supporting the well-being and income of local communities in areas targeted by interventions to reduce deforestation and forest degradation (Sunderlin et al., 2016).

2.3 Methodology

2.3.1 Global Comparative Study (GCS) Project

My research is part of CIFOR's Global Comparative Study on REDD+ (GCS REDD+). Initiated in 2009, GCS REDD+ aims to provide knowledge and information about REDD+ and ensure that REDD+ policy makers and practitioners have access to and use evidence from experiences with REDD+ across the tropics (Young & Bird, 2015). This chapter is part of the second module and the third phase of the GCS, which are focused on assessing the performance of REDD+ subnational initiatives over the medium-term.

The GCS is conducting research at the subnational level in six countries in order to assess REDD+ project performance in accomplishing effective, efficient, and equitable (3E+) outcomes and to support the design and implementation of REDD+ projects and policies. Specifically, the second module of the GCS applied the BACI study design to 16 subnational initiatives in six countries across the tropics: Brazil, Cameroon, Indonesia, Peru, Tanzania, and Vietnam (Sunderlin et al., 2016). This chapter focuses on one of those initiatives, the Katingan Mentaya Project in Indonesia.

2.3.2 Study Design: Before-After-Control-Intervention

The BACI study design employed by the GCS allows estimation of the causal impact of an intervention by computing the difference between the average outcome for program participants (intervention area) and the average outcome for similar subjects that are not participating in the program (control area), compared with their outcomes before the intervention (Jagger et al., 2011; Shadish, Cook, & Campbell, 2002). This allows attribution as long as the target and

comparison groups are comparable (i.e. the intervention and comparison groups would have had the same outcomes if there had not been any intervention). The intervention and control villages were selected through a matching routine to ensure that they were similar. If any remaining differences between households in the matched villages are time-invariant, they will affect outcomes both pre- and post-intervention and thus are swept out by differencing.

This is an example of a 'quasi-experimental' analysis, which is intended to overcome problems of selection bias and construct credible counterfactuals by employing careful research design and statistical techniques (Caplow et al., 2011). Randomized experiments are considered to provide the closest approximation to the ideal evidence on impacts (Kellog Foundation, 2004). When households are randomly assigned to a program, differences between the participant group and comparison group can be attributed to the program. Matching in combination with DID approximates a randomized experiment by selecting participant and comparison groups with similar distributions of characteristics and then only considering changes over time, thus sweeping out any fixed (time-invariant) differences between the two groups.

Effects estimated using the BACI approach are widely accepted in evidence-based decision-making in public policy (Angrist & Pischke, 2010). Applied to REDD+, the BACI study design allows the analyst to control for changes in deforestation that are unrelated to REDD+ interventions and thus distinguish between the effects of REDD+ and possible confounding factors (Bos et al., 2017).

2.3.3 Sample

For this program evaluation, the GCS conducted village and household surveys in eight study villages for each REDD+ project: four intervention villages and four control villages. Villages

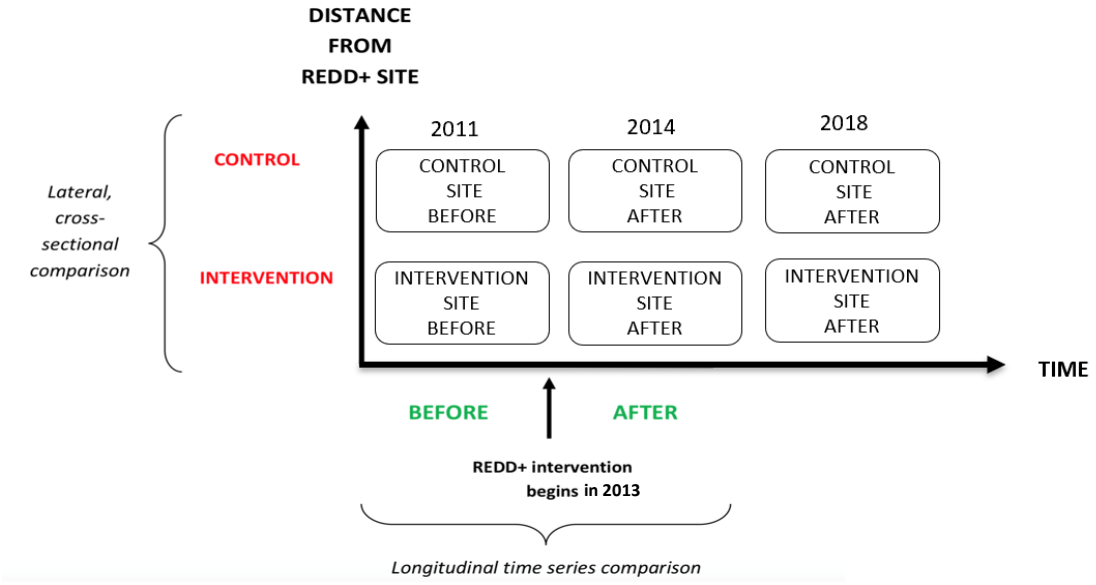
located in the REDD+ project area that are subject to REDD+ interventions are called intervention villages or REDD+ villages. Selected nearby villages that are not subject to REDD+ interventions are called control villages. By design, they have similar characteristics because they were chosen based on covariate matching of village characteristics (Sills et al., 2018). To select these villages, field research teams first identified a pool of candidate intervention and control villages, then collected and submitted data on those villages. The study design team then identified subsets of matched intervention and control villages for each project, using covariate matching (Sunderlin et al., 2016).

The quality of the matched sample of villages across the six study countries was confirmed using data from a village survey conducted in each of the selected villages. The intervention and control villages were found to have statistically similar means on a range of characteristics (Sills et al., 2017). As in the overall sample, the intervention and control villages in the sample for Katingan have statistically similar means across a range of characteristics (Table 2.1). However, this is largely due to the small sample size (8 villages), so we also consider the implications of the absolute differences. In terms of absolute differences, even though the REDD+ villages much further from roads, the REDD+ villages are closer to market, suggesting that they should be subject to greater pressures for deforestation and degradation.

Table 2.1 Characteristics of Intervention and Control Villages in the Sample: means and t-test for difference in means.

	N	Means		p > |t|
		REDD+	Control	
Village land (hectares)	8	11462.50	5950.00	0.4660
Village forest land (hectares)	8	7258.75	3852.85	0.4720
Population of villages (people)	8	1597.25	1422.00	0.8137
Distance to nearest road usable by cars during all seasons (kilometers)	8	20.75	3.25	0.2576
Distance to nearest market (kilometers)	8	0.50	6.63	0.1346
GDP at Province/State level (IDR/year)	8	12100000	12075000	0.3559

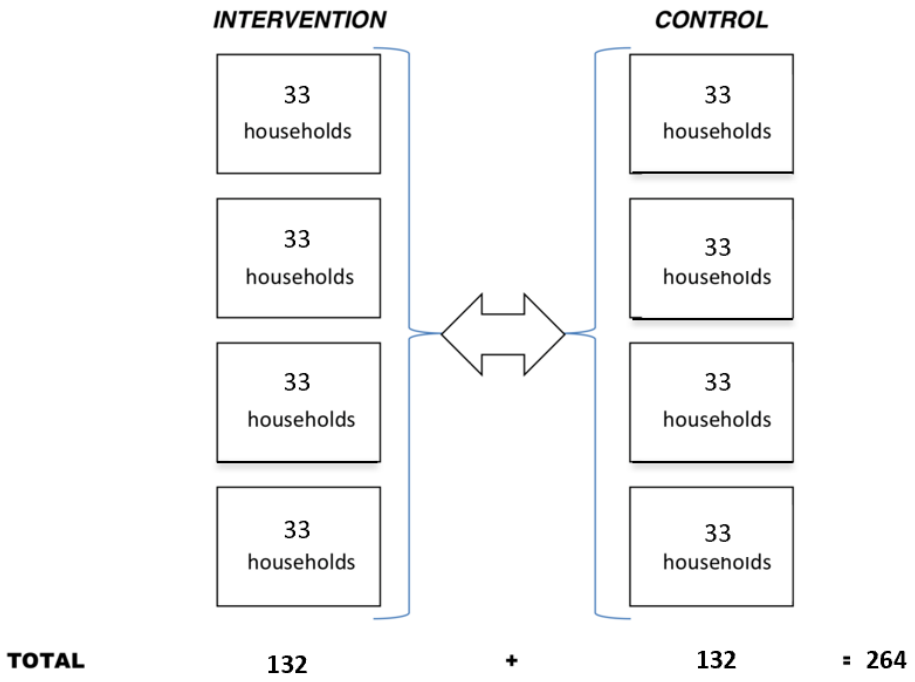
The "pre" phase, or the "before" phase of the survey occurred in April 2011, prior to implementation of the REDD+ project and any activities related to the project. The "post" or "after" phases occurred just after the project proponents began implementing activities, in April 2014, and again four years later, in July 2018.



Source: Sunderlin et al., 2016

Figure 2.1 Before–After/Control–Intervention (BACI) Method

The targeted sample size for the GCS survey is 30 households per study village (both control and intervention) (Figure 2). However, based on Sunderlin et al. (2016), field teams were advised to select larger samples than the target number of households in case some of selected survey participants refuse to participate for various reasons or the household moved out from the study village or was dissolved. Thus, for the project considered here, at least 33 households were sampled from each of eight villages for a total of at least 264 households surveyed in each year of the survey. Households were selected through simple random sampling from a list of all households in the study villages.



Source: Sunderlin et al. 2016

Figure 2.2 Sample of Study Villages

A total of 265 households were surveyed in both the first (2011) and second phase (2014), and 272 households in the third phase (2018). Some of the households interviewed in the first phase

were not re-interviewed in the second or third phases for various reasons, including migration out of the village, dissolution due to death, refusal to be interviewed, or simply because they were away during the period of data collection. The sample size was maintained because a supplemental sample was drawn in order to ensure that the total sample remained representative. Specifically, in 2014 and 2018, a sample was drawn from the list of new households that had either migrated to the village or had formed through marriage or cohabitation since the previous phase. Household were selected from this list using the same sampling ratio originally applied in the village. If that did not increase the sample size to 33, then further replacements were drawn from the list of households that had lived in the village since 2011. Households that were interviewed in Phase 1, and then moved away from the study village so that they were not interviewed in Phase 2, but then moved back to the study village after 2014 and prior to 2018, were also interviewed in 2018.

2.3.4 Fieldwork Methods

The field research was done in three phases. Before data (prior to the REDD+ program implementation) were collected in the first phase (2011), and after data were collected in a second phase (2014) and a third phase (2018). In each of these waves, quantitative data were obtained through detailed and formal interviews of the head of households (the male or female responsible for the management of the household) in eight study villages. In addition, a more qualitative survey with both closed-ended and open-ended questions was administered through focus group discussions at the village level, as well as semi-structured interviews with village authorities, leaders of local farmers groups, and other key informants to understand the broader impact of the REDD+ program in the whole intervention area.

For this chapter, secondary data were also collected through desk review. These data were obtained from websites and other online sources and review of selected documents at the project sites. The secondary data were analyzed to extract information related to the survey main objective. They include demographics, land cover map, climatic information, land tenure and use, village infrastructure, local agricultural practices, other biophysical data, and third-party studies. In addition, as discussed below, remote sensing data on land cover were used to estimate change in forest cover within villages boundaries identified through discussion with key informants in the village.

I supervised data collection in the third phase in 2018. Prior to the survey, I interviewed several staff members of the project proponent to identify specific new interventions and to confirm whether the previous interventions that had been implemented in 2014 were still ongoing. Assessing whether and which specific interventions have occurred, when, and where is a key step in impact evaluation (Sills et al., 2017). This information was reviewed several times with the proponent's General Field Manager in the Bogor office and staff from the Department of Community Development. The information obtained from these key informants served as the basis for deciding when to collect after data, defining which villages were subject to which intervention, and updating the instrument in the survey to extract information on the participation of household in the interventions (Sills et al., 2017). In each village, I interviewed key informants to collect basic information about the demography, settlement, and infrastructure of the village; village institutions and forest use regulations and rules; local wages and prices (commodity, property, and other assets); and village land tenure and use. The key informants were both internal and external to the community, including people in positions of authority and individual specialists. An intervention survey was also conducted with key informants in both

intervention and control villages to list the interventions that had occurred in the village, whether as part of the REDD+ initiative or not, thus confirming the intervention list obtained through interviews with staff of the proponent organization.

In each survey wave, a village survey was administered in each village through focus group discussions that were widely publicized and open to any village resident (including adult males and females). Each focus group include at least 10 people to represent the village. The village survey was designed to reveal the broad impact of the REDD+ program on the community as a whole. This survey[1] elicited information on livelihoods in the village and changes over time; changes in forested area, quality, and use; views on tenure security over agricultural and forest resources; perceptions of changes in well-being; and involvement in and assessment of forest interventions.

In addition to the focus group for the village survey, a focus group discussion with only women was convened in each study village. Each of these focus groups included at least 10 adult women. The objective was to ensure that women's voices were heard, because in some villages, only men participated or only men expressed their opinions in the village focus groups. When women are a small minority in focus groups, they may tend to support the opinions stated by men rather than offering their own perspectives. The data from these focus groups with women are not analyzed in this thesis.

[1] The survey instruments are available from http://www.cifor.org/library/3286/technical-guidelines-forresearch-on-redd-project-sites-with-survey-instruments-andcode-book/.

The household questionnaire included close-ended and open-ended questions about household members, household assets, household income, household perceptions of well-being, well-being changes for the 24 months prior to the interview, and household involvement in and assessment of forest conservation interventions. All the questionnaires used for this research are available upon request to CIFOR.

2.3.5 Forest Cover and Quality Change Measurement

In this study, forest cover and quality were measured to discover the impact of the REDD+ project on the forest. Forest is defined as an area of more than 0.5 ha, with trees that should be able to reach a minimum height of 5 m, with tree canopy cover of more than 10%, and which is not primarily under agricultural or urban land use. The definition excludes land that contains trees but is designated for agricultural or urban uses such as oil palm plantation or agroforestry (FAO, 2010).

Forest cover was assessed based on the national land cover data available upon request from the Ministry of Environmental and Forestry of Indonesia. I calculated the change in forest cover in both REDD+ and control villages. The boundaries of the study villages were based on participatory mapping with key informants in each villages and thus were an approximation.

In the village survey, respondents were asked about their perception of the forest cover and quality change in 24 months prior to the data collection (2011, 2014, 2018). Responses were recorded as increased, stayed the same, or decreased.

2.3.6 Data Analysis (Statistical Analysis Method)

2.3.6.1 Descriptive Analysis at Village Level

At the village level, descriptive analysis is used to compare outcomes in villages inside and outside the REDD+ project area and gain insight on the potential impacts of the REDD+ intervention on the communities. Specifically, changes in forest area, forest quality, and forest use are calculated and presented in graphs and tables. A summary of community involvement and residents' assessment of the project are also presented using tables. To preserve confidentiality, the village names are not reported. Where the full distribution of responses is of interest, they are reported using the labels REDD+ 1 to 4 and Control 1 to 4 for the eight villages in the sample.

2.3.6.2 Fixed-effects Models for Household Income

The household survey data are panel (also known as longitudinal or cross-sectional time-series) data collected in three waves. The first wave was in April 2011, establishing a baseline before the REDD+ project was implemented. The second was in April 2014, shortly after the Katingan Mentaya Project had started in October 2013. The third was in July 2018, after 5 years of project implementation. Panel data models have the ability to control for all stable covariates, without actually including them in a regression equation, by using within-individual variation only to estimate the parameters and then averaging the estimates over individuals (Allison & Waterman, 2002). I estimate such "fixed-effects models" to estimate whether the REDD+ project affected household income, either from environmental sources or in total. The estimated coefficient on intervention vs. control villages identifies any selection effect, and the estimated coefficients on temporal indicators for after the intervention and specifically 5 years after the intervention

identify any temporal trends. The estimated coefficient on the interaction terms between type of village and time period indicate the effect of REDD+, controlling for all time-invariant variables.

Fixed-effects models control for time-invariant variables that have not been or cannot be measured (Allison, 2009). These include easily measured variables such as sex, race, and ethnicity, and also unobservable variables, such as intelligence. The model treats time-invariant and possibly unobserved differences between individuals as a set of fixed parameters that can either be directly estimated or partialled out of the estimating equations (Allison, 2006). In this model, treatment effects are estimated based on the comparison of the outcomes for a household during periods when it was part of an intervention with outcomes during periods when it was not part of the intervention. This produces approximately unbiased estimates of the parameters of interest (Allison, 2006). The cost of this estimation strategy is that the effect of time-invariant factors cannot be identified. However, the fixed-effects model is considered to be the gold standard for identification in economics and political science (Schurer & Yong, 2012).

SAS Enterprise Guide® version 7.13 and RStudio version 1.1.463 were used for data organization, visualization, and analysis. A total of 906 observations were used in the analysis. The response variable is household income (in total or from the environment), and the key coefficients of interest are on the interaction terms.

The equation for the fixed effects model used in this study is

$$y_{it} = \alpha_i + \beta_1 x_{it} + \beta_2 x_{it} + \beta_3 x_{is} + \beta_4 x_{it} x_{is} + \varepsilon_{it}$$

where:

y_{it} the i^{th} value of the income over t^{th} time. i=1 to 302, and t=2011, 2014, and 2018

α_i the unknown intercept for each household (n household-specific intercepts)

$\beta_1 \ldots \beta_4$ the coefficients for explanatory variables

x_{it} Indicators for time period *t* of household *i*

x_{is} Indicators for Control/Intervention status *s* of household *i*

ε_{ij} the error term

Following the fixed effects model, I further explore income dynamics by calculating the mean and standard deviation of income from each source (environmental income, agriculture income, livestock and animal product income, business income, wage income, and other income, as well as total income) in the REDD+ and control villages in the three waves of data collection (2011, 2014, and 2018), evaluating differences with t-tests. I take the same approach with forest use, including rate of forest clearing, forest consumption, and "forest cash," or revenues earned from forest products. To provide context, I examine whether and how communities were involved in forest interventions that occurred during REDD+ implementation (2014 and 2018). I link the two by examining the association between livelihood outcomes and household participation in different types of interventions.

2.4 Results

2.4.1 Village Level Outcomes

At the village level, the information collected through focus group discussions allows us to examine forest area and quality change as well as community perceptions of and involvement in the REDD+ project. Across villages, 10 to 38 people participated in each focus group. The percentage of women among focus group participants ranged from 0% to 77%. This variation in participation by women was at least partly due to the fact that another focus group discussion was held only with women in each village, and in some cases, women may have preferred to

attend that meeting with women only. In addition to focus groups, we analyzed satellite data on forest cover change within the village boundaries that had been determined by participatory mapping. The REDD+ villages are all located in the peat dome within the area originally proposed for the ERC, but their village boundaries straddle the boundaries of the ERCs that were finally issued by the government.

2.4.1.1 Forested Area and Quality Change

Forest cover change in the study villages are presented in Figure 2.3 and Table 2.2. Using the national land cover data from the Ministry of Environment and Forestry of Indonesia and the village boundaries from the participatory mapping in village survey, forest cover within the boundaries of both REDD+ and control villages in six years were calculated, including two years prior and the year of each wave of the survey (2011, 2014, and 2018). This allows us to compare change in forest cover determined from satellite images with local perceptions of changes in forest cover, which were elicited for the two years prior to each survey wave.

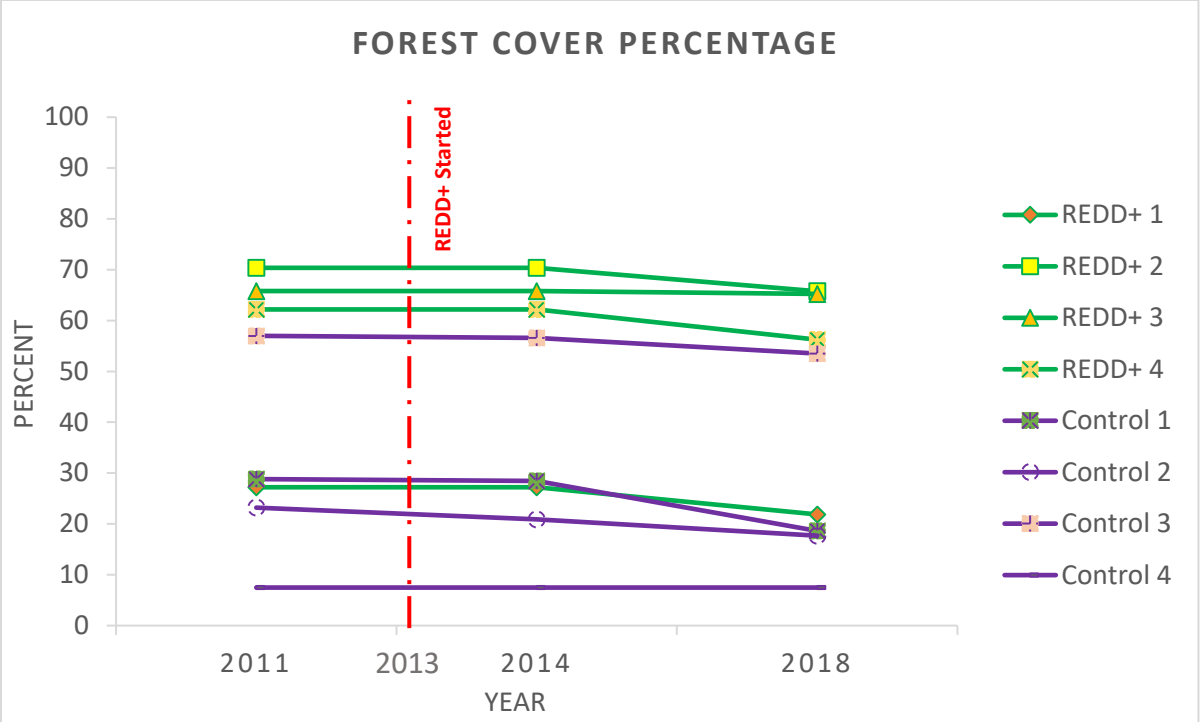


Figure 2.3 Forest Cover on Village Land

Table 2.2 Percent Forest Cover in REDD+ and Control Villages

Study Village	Forest Cover Percentage					
	2009-2011		2012-2014		2016-2018	
	2009	2011	2012	2014	2016	2018
REDD+ 1	27.21	27.21	27.21	27.21	21.86	21.86
REDD+ 2	70.52	70.36*	70.36	70.36	65.75	65.75
REDD+ 3	65.80	65.80	65.80	65.80	65.23	65.23
REDD+ 4	63.01	62.18*	62.18	62.18	56.23	56.23
Control 1	28.81	28.81	28.81	28.46*	25.92	18.62*
Control 2	27.47	23.20*	22.30	20.89*	19.19	17.68*
Control 3	59.85	56.99*	56.99	56.58*	53.54	53.50*
Control 4	8.73	7.48*	7.48	7.48	7.48	7.48

*Note: * = Decreased over two years prior to survey*

The REDD+ village areas are generally more forested than the control village areas. No change was detected in the forested area of REDD+ villages between 2011 and 2014, but the forest area decreased in three out of four REDD+ villages between 2014 and 2018. Focusing in on this

deforestation between 2014 and 2018, the area deforested was located outside the ERC boundaries in two cases (REDD+ 2 and REDD+ 4) and inside in one case (REDD+ 1).

In contrast, forest cover in three of the control villages decreased in both time periods. In absolute terms, the decrease in forest cover between 2011 to 2014 was 11 ha, 234.5 ha, and 28 ha in control 1, control 2, and control 3, and 303 ha, 325 ha, and 212 ha between 2014 and 2018. The fourth control village had a constant low percent forest cover.

While satellite data provides an objective measure of changes in tree canopy, it may not capture what people experience on the ground in terms of changes in forest area and quality. Therefore, I also examine change in local community perceptions of changes in forest area and quality inside their village boundaries. The village survey elicited perceptions of changes in forest cover and quality change in the 24 months prior to the survey (2009-2011, 2012-2014, 2016-2018). These perceptions were recorded as whether forest area has increased, stayed the same, or decreased.

Table 2.3 Forest Area Change in REDD+ and Control Villages (in the last 2 years)

Study Village	2011			2014			2018		
	I	SS	D	I	SS	D	I	SS	D
REDD+ Village	2	-	2	1	2	1	3	-	1
Control Village	-	-	4	-	-	4	-	-	4

Notes: I = Increased; SS = Stayed the Same; D = Decreased

Based on local community perceptions (Table 2.3), the area of forest in all control villages decreased throughout the time from 2011 to 2018. These perceptions are in line with the satellite land cover data presented in Table 2.2, which also show that most of the control villages experienced a decrease in forest cover. In contrast, local perceptions about forest cover trends in REDD+ villages varied. In 2011, the villagers in the REDD+ 1 and 2 village believed that the

forested area inside their villages has increased. On the other hand, the villagers in REDD+ 3 and 4 believed that the forested area inside their villages has decreased. In 2014, respondents in REDD+ 2 thought that their forested area has increased, while respondents in REDD+ 3 and 4 thought that their forested area stayed the same, and in REDD+ 1, respondents thought that their forested area has decreased. In 2018, respondents in REDD+ 1, 3, and 4 asserted that the forested area in their villages had increased, while in REDD+ 2, respondents said that the forested area in their village had decreased. These perceptions are inconsistent with the satellite data in Table 2.2. These data suggest that two REDD+ villages experienced a decreased in forest cover in 2009 - 2011, but otherwise, there was no detectable change in the forest cover from 2012-2014 or from 2016-2018.

Thus, local residents perceived that the loss of forest area slowed and even reversed in the REDD+ implementation area, different from the conclusion that would be reached from analysis of satellite data. In the control villages, both local perceptions and satellite data point to a decline in forest cover.

Table 2.4 Forest Quality Change in REDD+ and Control Villages (in the last 2 years)

Study Village	2011			2014			2018		
	I	SS	D	I	SS	D	I	SS	D
REDD+ Village	2	-	2	-	2	2	2	1	1
Control Village	-	-	4	-	-	4	-	-	4

Notes: I = Increased; SS = Stayed the Same; D = Decreased

The focus groups also elicited perceptions of forest quality change over the 24 months prior to the survey. Table 2.4 above shows the change in forest quality in the study villages. Across the waves, all control villages consistently reported decreases in forest quality as a consequence of the decreasing forested area. The situation was more variable in the intervention villages both

before and after implementation of the REDD+ project. In the REDD+ villages, the local communities of the REDD+ 1 and 2 village believed that the forest quality increased and the local communities of the REDD+ 3 and 4 village believed that the forest quality decreased in 2011. In 2014, the REDD+ 3 and 4 village communities perceived that the quality of the forest stayed the same and the REDD+ 1 and 2 village communities perceived that the quality of the forest decreased. In 2018, the communities in the REDD+ 3 and 4 village thought that the forest quality increased and the community in the REDD+ 1 thought that the forest quality stayed the same, while the community in the REDD+ 2 thought that the forest quality decreased. Similar to Table 2.3, Table 2.4 suggests more positive trends for forests at baseline in intervention compared to control villages.

2.4.1.2 Involvement in and Assessment of the REDD+ Initiative

Focus group discussions in the intervention villages also elicited perceptions of the REDD+ project. In phase one of data collection, the questions focused on village knowledge of and involvement in REDD+. In phases two and three, the questions focused on understanding the impact pathways of a variety of forest interventions, including but not limited to those sponsored by REDD+.

Table 2.5 Knowledge of REDD+ in Villages Selected for the Intervention Area in 2011

Name	Heard of REDD+	Heard of Katingan-Mentaya Project	Understanding of REDD+
REDD+ 1	✓	✓	✓
REDD+ 2	x	x	x
REDD+ 3	x	x	x
REDD+ 4	✓	✓	✓

Notes: x = No; ✓= Yes

At baseline, only two out of four villages interviewed in the intervention area had heard about REDD+ and had an understanding of what REDD+ is about. The villagers stated that REDD+ is a policy/project to restore/increase forest cover or to reduce forest destruction, rehabilitate peatland, and sell carbon offsets. The focus groups revealed that these two villages had learned about REDD+ from the proponent, PT. RMU, and in one case, also from an NGO.

Table 2.6 Participation in the REDD+ Initiative

Village Name	Involved in REDD Decision			Involved in REDD Implementation		
	2011	2014	2018	2011	2014	2018
REDD+ 1	x	x	N/A	✓	x	x
REDD+ 2	N/A	✓	N/A	N/A	✓	✓
REDD+ 3	N/A	✓	N/A	N/A	✓	x
REDD+ 4	x	✓	N/A	x	✓	✓

Notes: x = No; ✓= Yes; N/A = Not Applicable (N/A in 2011: The proponent had not yet introduced the project idea to villages; N/A in 2018: The project had already been implemented in villages)

International standards for REDD+ require that the implementers (or proponents) obtain Free Prior and Informed Consent (FPIC) from local people. Table 2.6 indicates that in 2011, none of the villages in our study had been involved in deciding whether they should or should not participate in the Katingan Mentaya Project of PT. RMU. However, in 2014, focus group discussions in three of four intervention villages indicated that they had participated in decision-making about implementation of the Katingan Mentaya Project in their villages. Residents of REDD+ 2 and REDD+ 4 had been consulted for FPIC regarding the Katingan Mentaya Project. In REDD+ 3, a village meeting was held to discuss the proponent's request for consent.

On the other hand, focus group participants in REDD+ 1 reported that they had been involved in the design and/or implementation of the Katingan Mentaya Project by PT. RMU in 2011 but not in 2014 or 2018. This may be because shortly before the first wave of the survey, PT. RMU had

held a meeting to explain the project, but then did not continue to seek local input in the following years. The three other villages reported that they had been involved in the design and/or implementation of the Katingan Mentaya Project by PT. RMU in 2014 and 2018, except for REDD+ 3, which was not involved in 2018. In REDD+ 2 and REDD+ 3, the proponent held a meeting to explain how the project would be implemented and to get input from villagers on how to implement the project. The proponent sought information from local people on tenure arrangements and livelihood activities, and asked them to participate in (better) enforcement of forest rules. In REDD+ 4, villagers were also asked to participate in community-based carbon monitoring, as well as participating in an educational or training event related to the project.

Table 2.7 Local perceptions of the Katingan Mentaya Project

Village Name	REDD+ Explanation		REDD+ Permission		Involvement in REDD+ Implementation	
	2014	2018	2014	2018	2014	2018
REDD+ 1	N/A	--	N/A	--	N/A	--
REDD+ 2	+	-	+	+	+	-
REDD+ 3	+	x	+	--	+	--
REDD+ 4	+	x	x	+	+	+
Village Name	REDD+ Community Development		Well-being Improvement		Forest Protection Improvement	
	2014	2018	2014	2018	2014	2018
REDD+ 1	N/A	--	N/A	--	N/A	--
REDD+ 2	N/A	--	x	--	N/A	+
REDD+ 3	N/A	--	+	--	N/A	--
REDD+ 4	+	x	x	x	x	+

Notes: -- = Very Negative; - = Negative; x = No Effect; + = Positive; ++ = Very Positive; N/A = Not Applicable

Table 2.7 presents the overall assessment of the REDD+ initiative's performance in the Katingan Mentaya Project. The focus groups discussed how well the proponent had explained the goals and implementation of the project to the community. In 2014, three of the four villages gave

positive ratings. In 2018, REDD+ 1 gave a very negative rating because of confusion among villagers about the REDD+ definition. The second point of discussion was whether and how the proponent sought permission from the community for the project to go ahead. In 2014, REDD+ 2 and REDD+ 3 gave positive ratings, but in 2018 REDD+ 3 gave a very negative rating. In contrast, in 2014 REDD+ 4 did not report any effect of the proponent's asking permission, but in 2018 it reported a positive effect. The third point of discussion had the villagers rate the involvement of the community in implementation of the Katingan Mentaya Project. As shown in the table, in 2014 three villages (REDD+ 2, REDD+ 3, and REDD+ 4) gave positive ratings. In 2018, however, REDD+ 2 and REDD+ 3 village gave very negative and negative ratings, respectively. Only REDD+ 4 still rated this positively in 2018.

The fourth point of discussion focused on the development of the community's capacity to implement the Katingan Mentaya Project. Based on village surveys in REDD+ 1, REDD+ 2, and REDD+ 3, there was no development of the community's capacity to implement the project in 2014. This is likely because the development program was only available in REDD+ 4, where participants in the focus group gave a positive rating but then reported no effect 4 years later. However, when the community capacity development program (including improvement in local livelihoods and improvement in tenure security) was expanded to the other villages in 2018, it generally was rated very negatively by the focus group participants. Fifth, the focus groups discussed whether the Katingan Mentaya Project had improved well-being in their community. There were mixed results in 2014, and generally very negative results in 2018.

Lastly, the focus groups discussed whether the Project had improved forest protection. However, in 2014, interventions to protect or enhance forest had only begun in one village (REDD+ 4, which reported no effect). In 2018, these interventions were being applied in all villages and

received a very negative rating in REDD+ 1 and REDD+ 3, but positive ratings in REDD+ 2 and REDD+ 4.

Additionally, in phase 3, ratings of development of the community's capacity to implement the Katingan Mentaya Project in terms of improving local livelihoods were very negative in three villages; REDD+ 4 reported no effect. As for ratings of development of the community's capacity to implement the Katingan Mentaya Project in terms of improving tenure security were very negative in REDD+ 1 and REDD+ 3, because the villagers worried that the company would grab their land or limit their access to the forest, which is their main income source. In contrast, REDD+ 4 reported that the program had increased the village's tenure security because the proponent helped the village map the village's boundaries.

Overall, there were changed in the local community perceptions on the Katingan Mentaya Project and its activity from 2014. The obvious perception changes are from the villages that the project have not been implemented in 2014. There was one village that has negative perceptions in every REDD+ initiative performances due to the lack of understanding on REDD+ mechanism.

2.4.1.3 Migration

The REDD+ project could also have an impact on the migration of local people. People might be more likely to move out of villages in the project zone due to the limitations on forest access, or people might be more likely to move in due to the opportunities and benefits offered by the REDD+ project. Therefore, I also compare patterns of in and out migration in REDD+ and control villages.

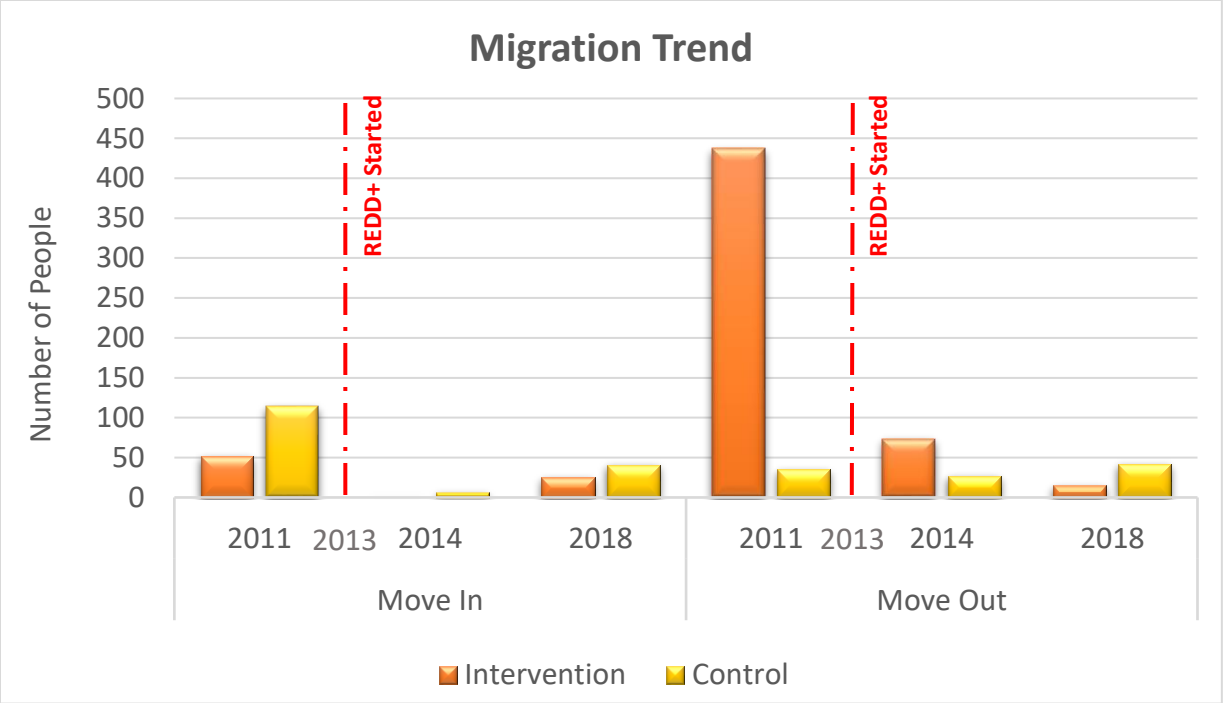


Figure 2.4 Reported Migration In and Out of REDD+ and Control Villages

Key informants in the villages reported on migration into and out of the village in the two years prior to the survey. As shown in Figure 2.4, at baseline, there had been many more people moving out of intervention villages and many more people moving into control villages. This trend continued in 2014, but then in 2018 there had been more movement both into and out of control villages. People reported moving into intervention villages mostly for family reasons (e.g., marriage, children) and to gain access to land and natural resources as a livelihood opportunity (control villages also reported that people moved in because of access to health care and social services, access to roads and transportation, and business opportunities). The reasons people move out of intervention villages include the lack of livelihood opportunity, looking for work, and family reasons (e.g., marriage, children) (control villages also reported that people moved out because of lack of livelihood opportunities and seasonal work). Based on Figure 2.4, it appears possible that REDD+ helped stabilize the population after a few years of

implementation. Due to differences at baseline and other factors that may have varied across villages, attribution cannot be established.

2.4.2 Household-level Outcomes

At the household level, I investigate changes in local people's behavior around forest use including both consumption and cash generated from the forest products. I compare trends in forest clearance, products and sales reported by the households in REDD+ and control villages to assess whether it is plausible that REDD+ affected attitudes regarding forest use. Moreover, I evaluate the impact of REDD+ on household income derived from the environment (forest and non-forest), agriculture, livestock and animal products, business, wage or any other income.

2.4.2.1 Forest Use

In the household survey, respondents were asked directly about their recent history of forest clearing in the last 24 months, and whether it had increased, stayed the same, or decreased compared to the past.

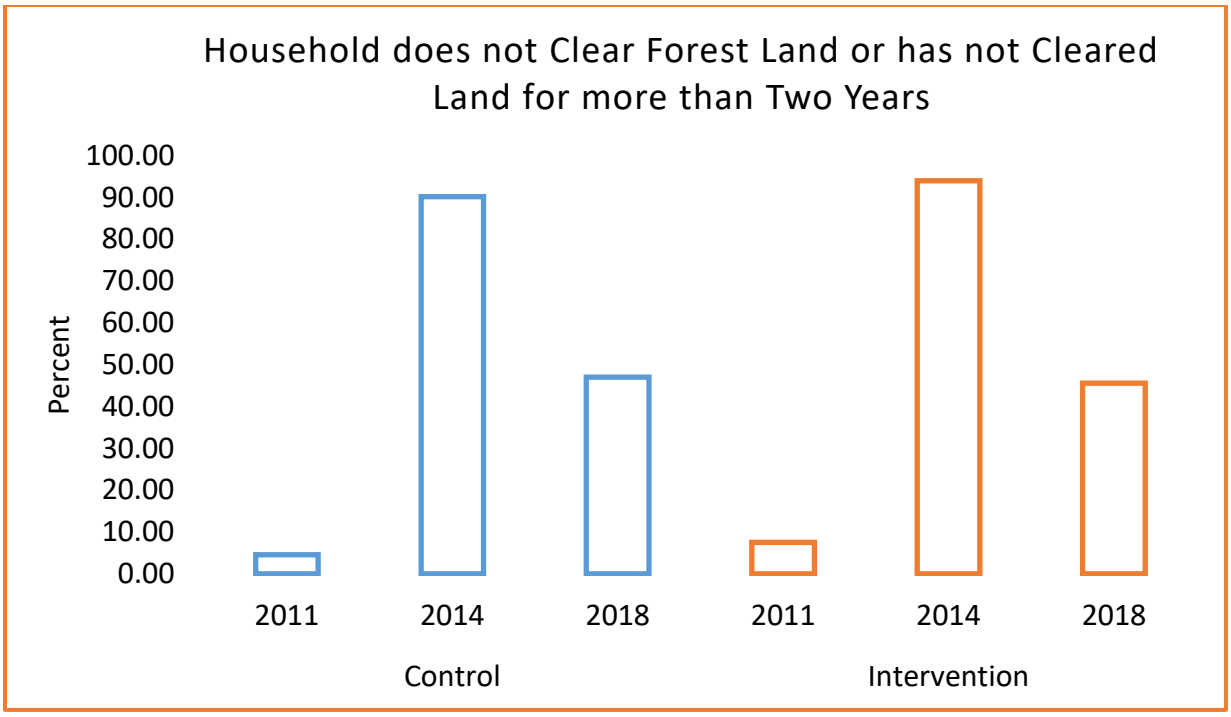


Figure 2.5 The percentage of households who does not clear the forest land or has not cleared land for more than two years in both study villages.

The figure shows that the percentage of households who did not clear the forest land or has not cleared land for more than two years in REDD+ villages was higher than in the control villages except in 2018: 7.5% (vs. 4.5%) in 2011, 94% (vs. 90%) in 2014, and 45.5% (vs. 47%) in 2018. The percentage substantially increased after the implementation on the Katingan Mentaya Project in 2014 in both intervention and control villages. However, the number decreased in 2018, about 5 years after the implementation of the REDD+ project. Both intervention and control villages have the same trend. Throughout the three waves of data collection, the average percentage of households who did not clear forest land or has not cleared land for more than two years in REDD+ villages was higher (49%) compared to control (47.25%) villages. Figure 2.6 displays the full range of responses in both intervention and control villages. At baseline (2011),

the ratio of households that cleared and did not clear forest in the past 2 years (2009-2011) was 95% and 5% in the control villages.

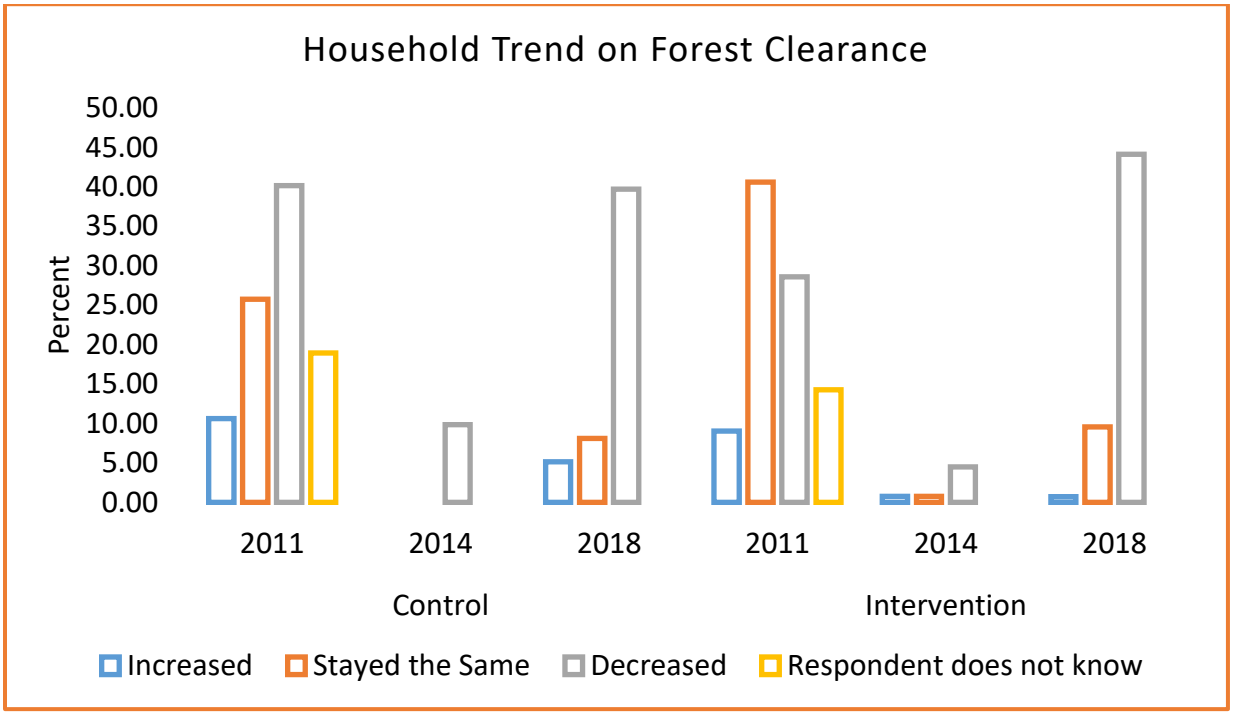


Figure 2.6 Trends in Forest Clearing by Households in REDD+ and Control Villages (in the last 2 years prior to the data collection period, compared to the past)

Among the households who had cleared forest in control villages, the households that had decreased forest clearance is higher (40%) than the households that increased in forest clearance (11%). Another 26% of households did not reduce the area cleared and the rest (20%) did not know whether they had increased/stayed the same/decreased in clearing forest. However, in 2014, there was a significantly higher number of households that did not clear any forested area (90%), and the remaining households that cleared forested area—about 10%—were decreasing in the area of forest cleared compared with the past. The ratio was the opposite from that of 2011. In 2018, 53% of the households cleared forest; 40% decreased in terms of area, 8% cleared

about the same amount of area, and 5% increased the cleared forested area compared with the past.

Meanwhile, in intervention villages, in 2011, 92.5% of households reported that they had cleared forest and only 7.5% of households had not cleared forest. Among the household who reported had cleared forest, 28.5% of households decreased the area that they cleared, 9% increased, and 41% cleared the same amount as before within 2 years. However, about 14% of household did not know whether had increased/stayed the same/decreased in clearing forest. As in control villages, the intervention villages also experienced a significant increase in the number of households that cleared forest, but the number slightly more than the number of households in control villages (94%), and only 6% cleared forested area in 2014. Among the households that cleared forest, 4.5% declared that the total area they cleared decreased, 0.75% declared that it had increased, and 0.75% declared that it had stayed the same. In 2018, the number of households that had cleared forest was higher (54%) compare with 2014, with 44% decreasing, 9% clearing the same amount, and only 1% increasing the area they cleared.

Across the three waves, the percentage of households who cleared forest land in REDD+ villages (52.75%) was higher compare to control villages (51%). However, statistical analysis shows that there was no significant difference in the forest clearance behavior of the household who cleared forest between intervention and control villages in 2014 and 2018 with p-value 0.7032 and 0.5220 respectively.

2.4.2.2 Forest Products Consumption

Households were also asked about their recent history of forest product consumption, and whether it had increased, stayed the same, or decreased over the previous 24 months.

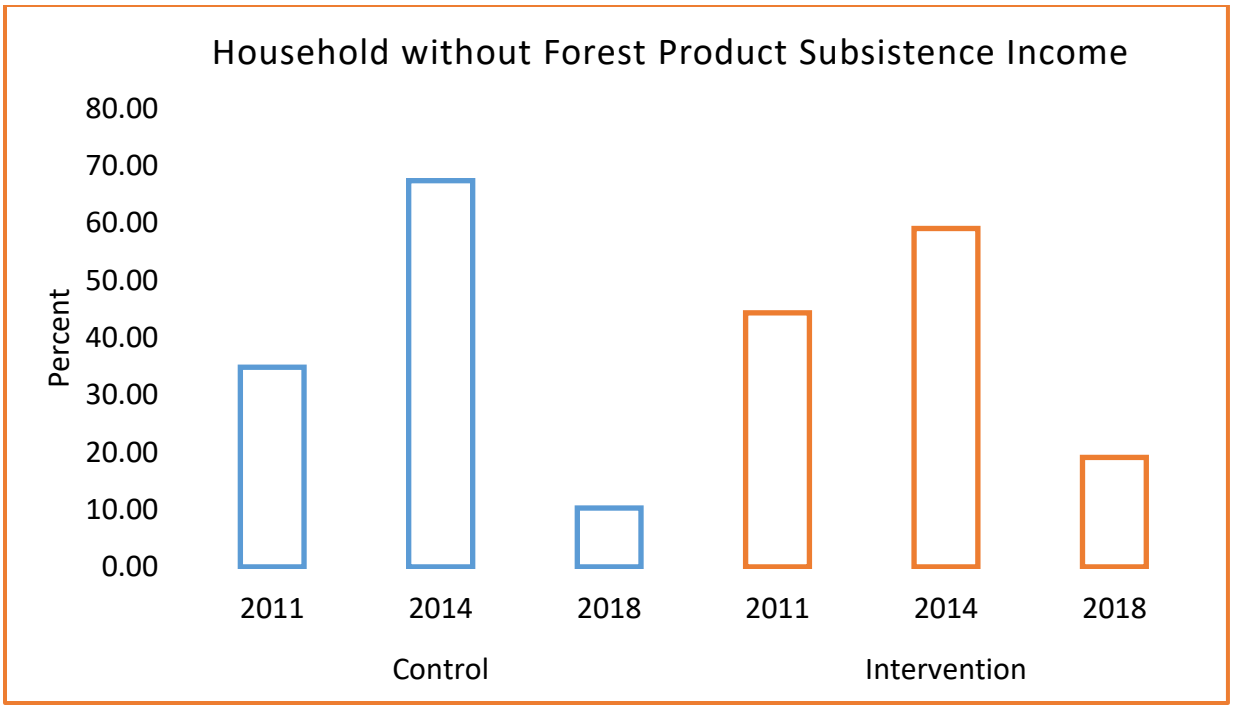


Figure 2.7 The percentageof households who had not consumed the forest products in both REDD+ and control villages.

The figure shows that the percentage of households who did not consume the forest products in REDD+ villages was higher than in the control villages throughout the study period, except in 2014. The number increased after the implementation on the REDD+ Project. However, the number significantly decreased in 2018 from 67% to 10% in control villages and from 60% to 19% in REDD+ villages. The average percentage of household who did not consume the forest products in REDD+ villages was higher compared to control villages with percentage of 41% and 37% respectively.

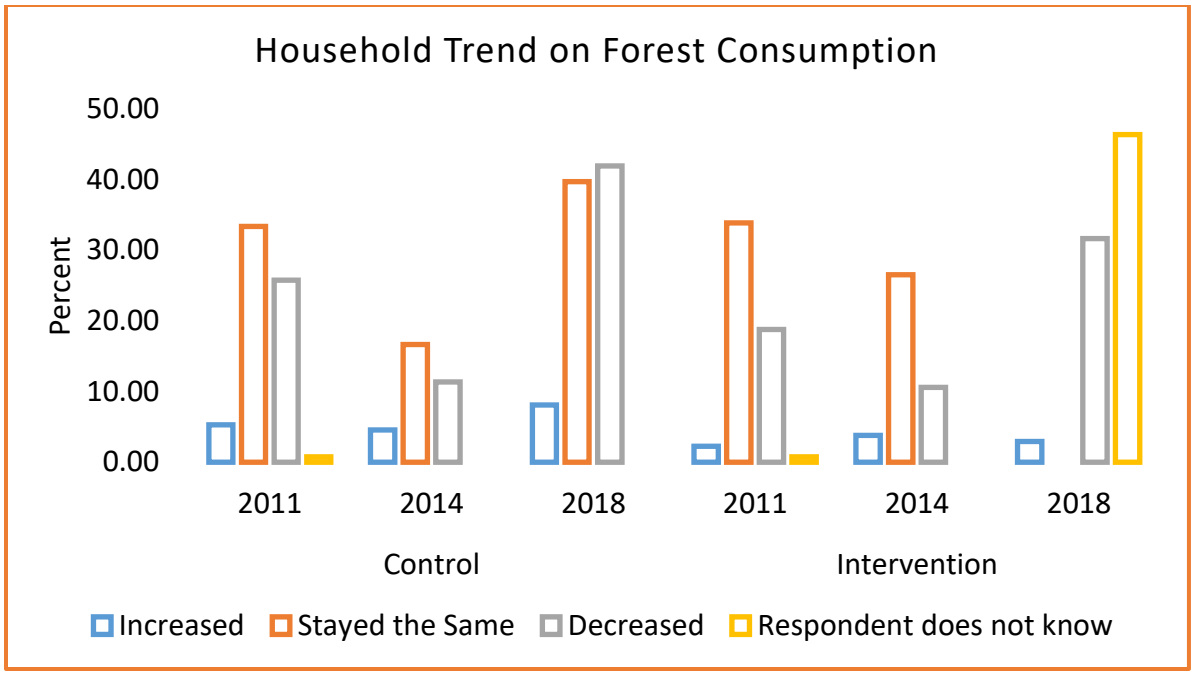


Figure 2.8 Household Behavior in Forest Product Consumption in Villages Inside and Outside the REDD+ Initiative (in the last 2 years prior to the data collection period)

The number of households who consume forest products in intervention villages in 2014 decreased from 56% in 2011 to 41% in 2014 but increasing up to 80% in 2018. Among the households who consumed forest products, the largest proportion who reported increasing consumption was 4% in 2014. In contrast, most households experienced decreasing consumption of forest products, from 11% to 32%, with the highest decrease in 2018. The number of households who did not know whether they had increased/stayed the same/decreased in their consumption was very high in 2018 about 46%.

In control villages, the number of households who consume forest products decreased from 65% in 2011 to 33% in 2014 and then increased again in 2018, up to 90%. Among the households that consumed forest products through 2011-2018, the greatest percentages who reported increasing

forest products consumption was 8% in 2018. The percent of households who reported decreasing forest consumption averaged 30% across all three waves.

The average percentage of household who consumed forest products in control villages was higher compare to REDD+ villages with percentage of 63% and 59% respectively. Statistical analysis shows that there was no significant difference in the forest consumption behavior of the household in forest products consumption between REDD+ and control villages in 2014 and 2018 with *p*-value 0.1495 and 0.2000, respectively.

2.4.2.3 Forest Cash

Respondents were asked about their recent history of cash income derived from selling forest products, and whether it had increased, stayed the same, or decreased over the previous 24 months.

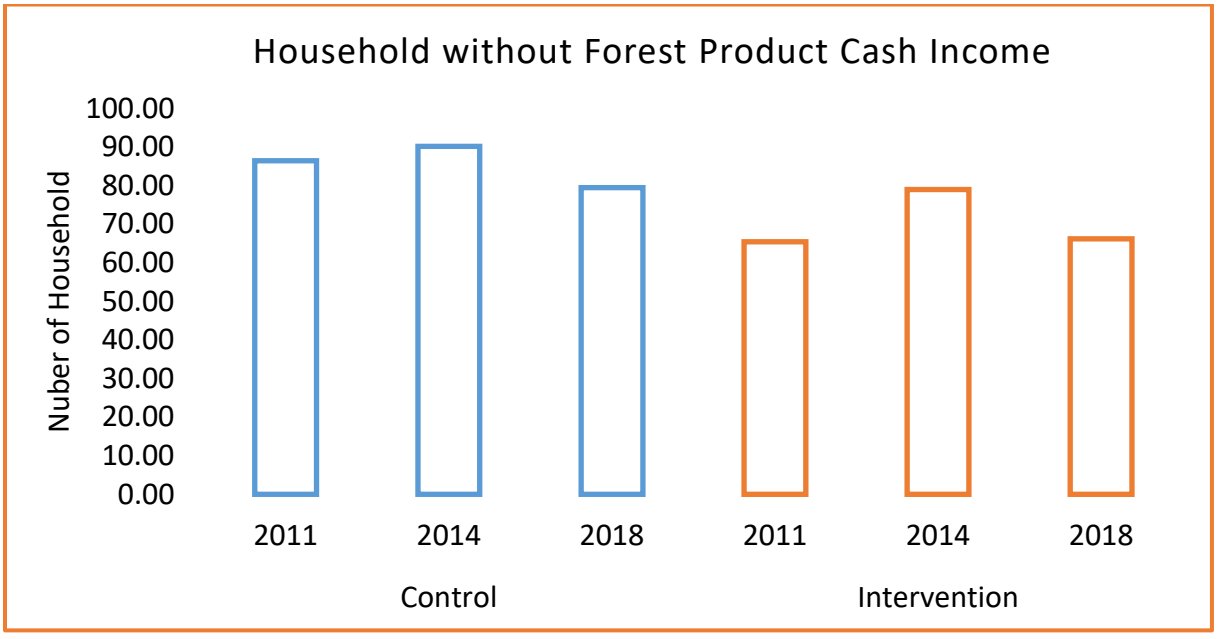


Figure 2.9 The percentage of households who had not derived cash income from forest products in both REDD+ and control villages.

A large majority of households, in all waves in both intervention and control villages, report that they did not sell any forest products. Compare to the intervention villages, the average percentage of households who did not sell any forest product in control villages was higher at about 85% of the households, while in REDD+ villages, it was about 70% of the households. The number increased after the implementation of REDD+ from 86% to 90% in control villages and 65% to 79% in REDD+ villages but then decreased in 2018 in both study villages, 79% and 66% respectively.

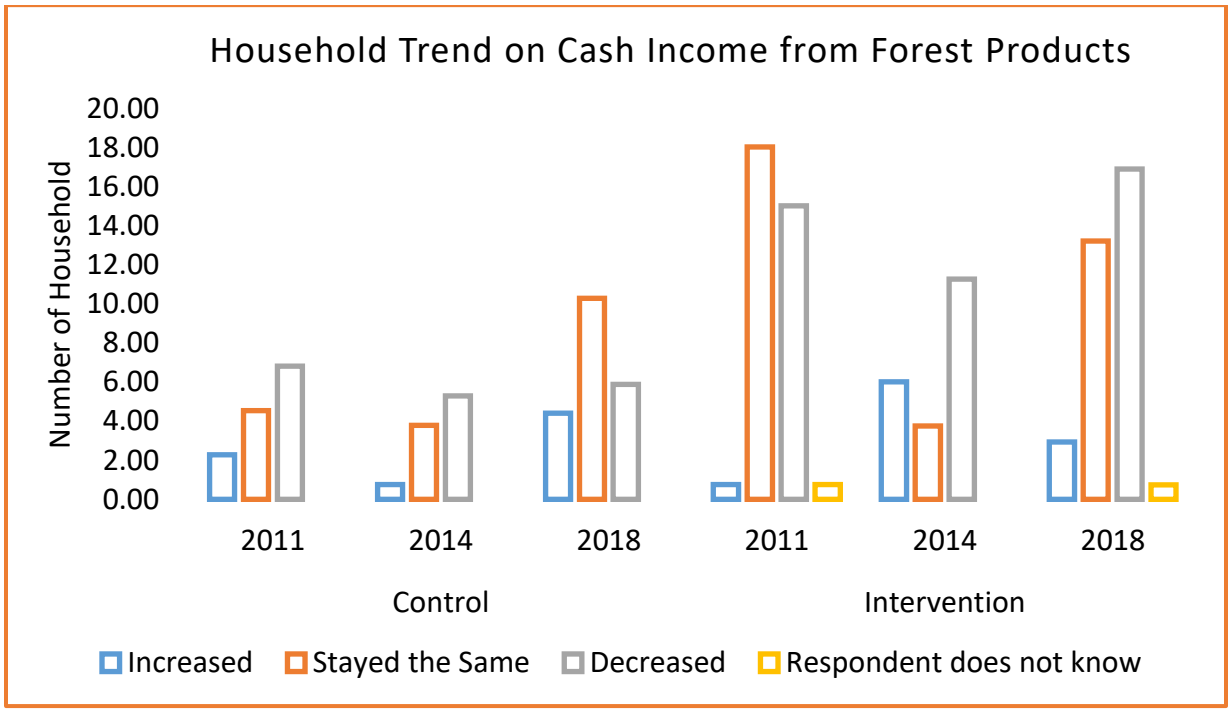


Figure 2.10 Cash Derived from Forest Products in Villages Inside and Outside the REDD+ Initiative (in the last 2 years prior to the data collection period)

Compared to households in control villages, the fraction of households that harvested forest products for sale and received cash was higher in REDD+ villages throughout three waves of data collection, with 15% of households in control villages and 30% of households in REDD+ villages. In each wave, a larger fraction of households in the intervention villages reported some

sales of forest products, with cash income generally staying the same or decreasing compared to the previous two years. The number of households who reported a decrease in cash income from forest products were about 15% in 2011, 11% in 2014, and 17% in 2018. Only 0.75% of households reported an increase in the cash derived from forest products in 2011, 6% in 2014, and 3% in 2018.

In control villages, the proportion of households who reported a decrease in receiving cash income from forest products was about 7% in 2011, 5% in 2014, and 6% in 2018. About 2% of households increased the cash derived from forest products in 2011, 0.75% in 2014, and 4% in 2018.

Across the three waves, the average percentage of households with forest products cash income in REDD+ villages was higher compared to control villages at 30% and 15% respectively. Statistical analysis shows that there was significant difference in the probability of earning cash from forest products among household in REDD+ vs. control villages in 2011 and 2014 with *p*-value 0.0011 and 0.01, respectively. However, in 2018 there was no significant difference (*p*-value = 0.2516).

2.4.2.4 Household Income

In this study, income is defined as a gross value (price times quantities of all *n* products) minus total costs (price times quantities) of all *m* purchased inputs (e.g., fertilizers, seeds, tools, and hired labor). Because only purchased input are deducted, this is like a measure of value added to family labor (Sunderlin et al., 2016). Total household income is the sum of cash income and subsistence income derived from various sources including environmental income, agricultural income, livestock and animal husbandry products, business, and other sources such as

remittances and pensions. Household income is converted to USD at 2019 market exchange rates from the Bank of Indonesia, which is the central bank of the Republic of Indonesia (https://www.bi.go.id/en/moneter/informasi-kurs/transaksi-bi/Default.aspx).

Parameter estimates from a model of total household income are presented in Table 2.8. This model includes fixed effects for each household in the sample. Controlling for those fixed effects, it estimates the effect of being in an intervention (compared to control) village and being measured after the REDD+ project (compared to before). The effect of the year 2018 is the sum of the coefficients on after and 2018. The effect of the REDD+ intervention is measured by the interaction terms between intervention villages and the after/2018 time periods. These results show that REDD+ had no significant influence on total household income, either positive or negative, witht the possible exception of a negative effect in 2014, significant only at the 15% level.

Table 2.8 Parameter Estimate of Fixed-effect Model for the Household Total Income

Parameter	Estimate	Std. Error	Pr(>|t|)
Intervention Village	3445.93	2961.38	0.2451
After time period	997.39	368.66	0.0071***
2018	929.34	370.88	0.0126**
Intervention*After	-818.33	524.31	0.1192#
Intervention*2018	-114.11	521.17	0.8268

Observations : 906
R-squared : 0.7033
Adjusted R-squared : 0.251
*Note: #, *, **, *** = statistically significant at 15%, 10%, 5%, and 1%*

Based on the design and the theory of change of the project, we expected a positive impact on the environmental income of households in villages in the project zone. Environmental income is defined as household income from products gotten from low or no management areas (forest and non-forest) such as log, firewood, bamboo, rattan, fish, bird, mushroom, forage, and mineral.

Table 2.9 presents the parameter estimates from a model of household environmental income. The results show that REDD+ had no significant influence on the household environmental income, either positive or negative.

Table 2.9 Parameter Estimate of Fixed-effect Model for the Household Environmental Income

Parameter	Estimate	Std. Error	Pr(>|t|)
Intervention	-155.71	897.13	0.8623
After REDD+	91.10	125.18	0.4672
2018	226.61	119.64	0.0589*
Intervention*After	235.48	182.40	0.1975
Intervention*2018	-137.48	170.97	0.4218

Observations : 906
R-squared : 0.541
Adjusted R-squared : 0.202
*Note: #, *, **, *** = statistically significant at 15%, 10%, 5%, and 1%*

Table 2.10 presents a comparison of income sources for households in intervention and control villages in 2011. The average total income of households outside the REDD+ project area was higher than that of households inside the project area in 2011. The average income of households that were not exposed to any REDD+ intervention was USD 1991.22/year. Households that were exposed to a REDD+ intervention, on the other hand, earned USD 1626.41/year. However, a *t*-test confirmed that there was no significant difference between the two groups. This confirms that the intervention and control villages were well matched and provides a great starting point for analyzing the impact of the REDD+ project on household income.

Table 2.10 Household Income in 2011

Variable	Group	Obs	Mean	St Dev	SDM*	Ratio of variances (I/C)	*P-value*
Environmental Income	Intervention	133	276.77	618.86	0.20	4.88	0.1167
	Control	132	179.28	280.12			
Agriculture Income	Intervention	133	515.36	1450.90	0.14	5.76	0.3226
	Control	132	361.52	604.51			
Livestock &Animal Product Income	Intervention	133	71.42	501.00	-0.11	0.57	0.5175
	Control	132	135.67	664.68			
Business Income	Intervention	133	1314.11	3619.45	-0.05	1.44	0.8117
	Control	132	1465.88	3015.98			
Wage Income	Intervention	133	733.07	705.35	-0.24	0.38	0.1005
	Control	132	958.06	1144.63			
Other Income	Intervention	133	50.07	74.00	-0.15	0.27	0.2475
	Control	132	67.41	143.17			
Total Income	Intervention	133	1626.41	2540.68	-0.14	0.98	0.2463
	Control	132	1991.22	2569.87			

*Note: #, *, **, *** = statistically significant at 15%, 10%, 5%, and 1%*

Household income from different sources after implementation of REDD+ is presented in Table 2.11. According to the findings, the total income of households in control villages is higher than the total income of households in villages inside the project zone, with the average of total income USD 2989.92/year and USD 1820.30/year, respectively.

A *t*-test confirmed that there was a significant difference in household total income, at the 1% level, between the two groups. The two income source categories that were significantly different at the 5% level were agriculture and wage income. Average agriculture income in control villages was higher than in REDD+ villages, at USD 547.68/year and USD 238.47/year, respectively.

The table also shows an interesting pattern. If only judged by average income, household income in control villages was higher in every source category of income listed in the table except for

environmental income. Villages located in the REDD+ project area had higher environmental income, at USD 485.13/year (statistically significant at the 5% level).

Table 2.11 Household Income in 2014

Variable	Group	Obs	Mean	St Dev	SDM*	Ratio of variances (I/C)	*P-value*
Environmental Income	Intervention	133	485.13	863.25	0.31	2.23	0.0188**
	Control	132	260.73	578.26			
Agriculture Income	Intervention	133	238.47	460.07	-0.53	0.45	<.0001***
	Control	132	547.68	688.24			
Livestock &Animal Product Income	Intervention	133	22.18	157.85	-0.24	0.05	0.1324
	Control	132	144.92	697.04			
Business Income	Intervention	133	1312.34	3030.16	-0.34	0.44	0.1071
	Control	132	2631.16	4543.36			
Wage Income	Intervention	133	897.49	873.23	-0.42	0.32	0.0051***
	Control	132	1425.66	1539.14			
Other Income	Intervention	133	156.65	361.41	-0.06	0.23	0.6377
	Control	132	193.88	748.81			
Total Income	Intervention	133	1820.30	2010.08	-0.42	0.35	0.0007***
	Control	132	2989.92	3373.68			

*Note: #, *, **, *** = statistically significant at 15%, 10%, 5%, and 1%*

Finally, Table 2.12 presents household income from each source and in total after more than five years REDD+ project implementation. This table shows the total income is higher in control villages (significant at 5% level). The average annual income in the REDD+ villages was USD 2641.66, compared to USD 3942.33 in the control villages.

Only two out of six income source categories were significantly different at the 1% and 10% level between the two groups, which are income from livestock and animal products, and business income. Average business income in control villages was higher than in intervention villages, at USD 2483.04/year and USD 353.04/year, respectively. The average income derived

from livestock and animal products was higher in REDD+ villages than in the control villages, at USD 126.43/year and USD 16.71/year, respectively.

Table 2.12 Household Income in 2018

Variable	Group	Obs	Mean	St Dev	SDM*	Ratio of variances (I/C)	*P-value*
Environmental Income	Intervention	138	565.68	1199.35	0.08	0.77	0.5168
	Control	136	457.72	1366.43			
Agriculture Income	Intervention	138	293.32	1060.06	-0.11	2.41	0.4080
	Control	136	388.92	682.73			
Livestock &Animal Product Income	Intervention	138	126.43	601.58	0.24	7.92	0.0973*
	Control	136	16.71	213.71			
Business Income	Intervention	138	353.04	2404.75	-0.50	0.19	0.0090***
	Control	136	2483.04	5470.19			
Wage Income	Intervention	138	2016.14	1693.82	-0.02	0.61	0.8947
	Control	136	2051.45	2167.24			
Other Income	Intervention	138	193.07	225.80	-0.19	0.01	0.1477
	Control	136	620.54	3133.25			
Total Income	Intervention	138	2641.66	2484.04	-0.30	0.19	0.0142**
	Control	136	3942.33	5661.61			

*Note: #, *, **, *** = statistically significant at 15%, 10%, 5%, and 1%*

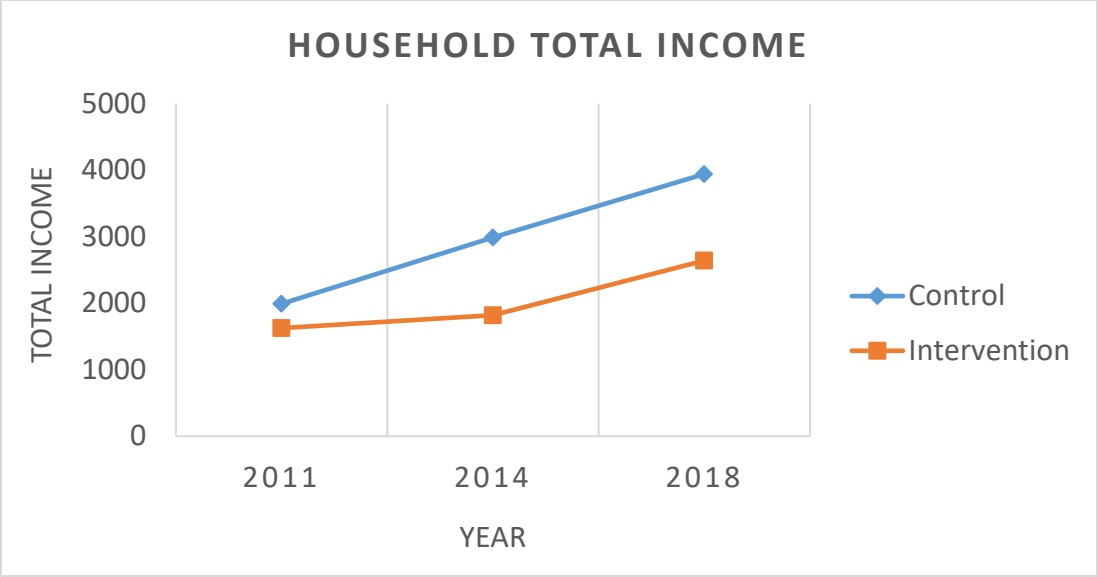


Figure 2.11 The Average of the Respondent Households Total Income in Villages Inside and Outside the REDD+ Initiative (Unit: USD/year)

Figure 2.11 displays the average of the household income in both REDD+ and control villages over time. According to the graph, both household groups experienced increasing in income. The means of income in control villages are higher than the means of income in the REDD+ villages in each year: USD 1991.22/year in 2011, USD 2989.92/year in 2014, and USD 3942.33/year in 2018 in control villages, compared to USD 1626.41/year in 2011, USD 1820.30/year in 2014, and USD 2641.66/year in 2018 in REDD+ villages.

2.4.2.5 Forest Intervention

As explained in Chapter 1, various forest interventions were implemented at both REDD+ sites and non-REDD+ sites, including restrictions on forest access and/or conversion, forest enhancement, conditional and nonconditional livelihood enhancement, environmental education, tenure clarification, and other interventions. The total number of interventions that occurred in

both village types was 18, with 13 programs applied in intervention villages and 7 in control villages. Two interventions were implemented in both types, with slightly different proponents.

The involvement of households in the interventions, or programs, varied across villages, from not participating at all in any program up to participating in 9 programs on average. However, statistical analysis found no significant difference in household total income between households involved in many programs and households involved in only one program in 2014 as well as in 2018, in both intervention and control villages, with *p*-value 0.9058 and 0.7065, respectively. Therefore, in-depth analysis is required to identify what type of interventions have the potential to increase the local community income if they participate in the program. In this section, I look for suggestive patterns by comparing incomes of participant and non-participant households in 2014 and 2018. Differences may reflect selection as well as program effects.

Information on household income based in households' involvement in the programs implemented in their villages in 2014 is presented in Table 2.13. There were eight forest intervention programs that have been implemented in the study villages. Of the eight interventions, only one program was implemented in control villages (Community Nursery). The Community Nursery program was also implemented in REDD+ villages since it was a government program. According to Table 2.13, the total income of the households who were involved in these programs were not significantly different. This suggests that these forest interventions were not having a significant impact on household total income.

Table 2.13 Household Income Associated with Involvement in Forest Interventions in 2014

Variable	Group	Obs	Mean	St Dev	SDM*	Ratio of variances (I/C)	*P-value*
Community Nursery	Involved	45	2066.76	2066.86	-0.14	0.41	0.4570
	Not Involved	121	2453.65	3241.28			
Participatory Mapping	Involved	17	1768.96	1159.73	-0.05	0.31	0.8754
	Not Involved	82	1851.10	2081.98			
Community Rubber Garden	Involved	13	1568.24	1388.14	-0.44	0.51	0.1958
	Not Involved	53	2318.36	1945.72			
Forest and Land Fire Prevention	Involved	8	2213.31	1541.11	0.61	1.79	0.1122
	Not Involved	25	1382.54	1152.70			
Investment Funds	Involved	30	1355.32	780.75	-0.41	0.12	0.1055
	Not Involved	69	2046.41	2252.64			
Rattan Craft Business	Involved	2	1189.07	268.00	-0.53	0.01	0.6035
	Not Involved	31	2312.29	2981.94			
Rubber Seeds Distribution	Involved	21	1557.01	1134.58	-0.30	0.90	0.4152
	Not Involved	12	1902.97	1198.27			
Socialization of REDD+	Involved	27	1558.05	1019.99	-0.22	0.22	0.3862
	Not Involved	72	1941.59	2197.26			

*Note: #, *, **, *** = statistically significant at 15%, 10%, 5%, and 1%*

Detailed information on household total income in 2018 based on the households' involvement in the programs implemented in their villages is presented in Table 2.14. Households who participated in "Reforestation and Nursery Development" and "Tenure Security Support for Rattan Farmers" had higher average income (USD 7,275.88 and USD 5,428.88) than nonparticipant households (USD 2,897.96 and USD 3,608.20). The Reforestation and Nursery Development program was implemented by the REDD+ project proponent. The other program was implemented by an NGO in the villages outside the REDD+ project area.

For some other interventions, there was also a significant difference in income between participant and nonparticipant households, but nonparticipant households had higher average income than the participant households. These interventions are Rattan Craft Business

Development program, with average income of nonparticipant households at USD 3,224.18/year, compared to the average income of participant households is USD 584.73/year. This might be due to the small number of people who were involved in this program, who may have been selected or volunteered because they expected lower incomes. This program was implemented by the REDD+ proponent.

Table 2.14 Household Income Associated with Involvement in Forest Interventions in 2018

Variable	Group	Obs	Mean	St Dev	SDM*	Ratio of variances (I/C)	*P-value*
Agreement with Proponent	Involved	15	1932.26	3482.63	-0.27	2.22	0.2428
	Not Involved	123	2728.17	2338.35			
Community Nursery	Involved	86	3137.44	3244.07	-0.05	0.45	0.7039
	Not Involved	188	3355.77	4845.82			
ERC Boundary Setting	Involved	10	2813.33	3437.19	0.09	1.86	0.7587
	Not Involved	60	2532.97	2522.65			
Participatory Mapping	Involved	22	2501.18	3137.30	-0.09	1.84	0.6685
	Not Involved	81	2760.06	2314.05			
Community Rubber Garden	Involved	18	3616.37	2371.30	0.34	1.45	0.3450
	Not Involved	15	2879.51	1966.62			
Forest and Land Fire Prevention	Involved	122	3717.94	4069.89	0.18	0.77	0.1471
	Not Involved	152	2941.55	4634.63			
Fisheries Improvement	Involved	24	2386.57	1833.34	-0.11	0.37	0.6732
	Not Involved	46	2670.30	2995.88			
Fruit Seedling Distribution	Involved	20	3335.36	3742.63	-0.05	0.73	0.8892
	Not Involved	13	3535.40	4373.02			
Livestock Distribution	Involved	8	1017.42	4017.51	-0.35	2.58	0.3108
	Not Involved	29	2196.02	2501.86			
One Million Tree	Involved	5	3618.85	2830.93	-0.12	0.20	0.8417
	Not Involved	62	4198.90	6382.09			
Investment Funds	Involved	37	2597.59	2530.58	-0.07	1.03	0.7461
	Not Involved	66	2764.85	2496.27			
Rattan Craft Business	Involved	3	584.73	354.31	-1.73	0.03	0.0421**
	Not Involved	30	3224.18	2123.22			
Reforestation and Nursery Dev.	Involved	5	5428.88	1590.36	1.37	0.58	0.0150**
	Not Involved	28	2897.96	2080.68			

Table 2.14 (continued)

Rubber Seeds Distribution	Involved	22	1719.76	2843.47	-0.19	0.91	0.5773
	Not Involved	15	2265.95	2982.09			
Seed & Herbicide Distribution	Involved	5	4859.42	3029.39	0.16	0.21	0.7847
	Not Involved	29	4029.56	6550.58			
Socialization of REDD+	Involved	48	2595.40	2994.45	-0.03	1.88	0.8738
	Not Involved	90	2666.33	2182.04			
Tenure Security for Rattan Farmers	Involved	10	7275.88	9951.53	0.46	3.67	0.0833*
	Not Involved	57	3608.20	5196.96			
Tree Seedling Distribution	Involved	18	5554.22	7189.45	0.32	2.00	0.1649
	Not Involved	82	3550.22	5077.57			

*Note: #, *, **, *** = statistically significant at 15%, 10%, 5%, and 1%*

2.5 Discussion

2.5.1 Impact of REDD+ on Forest Area, Quality, and Use

The findings show that the loss of forest area slowed and even reversed in the REDD+ implementation area, based on the perceptions of local residents. Residents of REDD+ villages reported variable trend, becoming more positive over time. According to local community opinion, forested area outside the REDD+ project area constantly decreased over time from 2011 to 2018, while forested area inside the REDD+ project area experienced an increase. The main driving forces of forest cover changes in the control villages were the increase in palm oil plantations, gold mining companies, and small-scale miners, as well as the abandoned Mega Rice Project established by the national government. Specifically, respondents in control villages attributed decreasing forested area to the establishment of agro-industrial firms (including palm oil plantations), small-scale loggers (including from neighboring regions), small-scale miners, and the villagers themselves. The government was also implementing a transmigration project that involved building infrastructure and re-settling households. In addition, forest fires occurred due to both natural and human causes.

On the other hand, in intervention villages, based on residents' perceptions, the decrease in forested area from 2011 to 2018 was due to villagers' activities, natural forest fires, and sedentary farming practices. The main driving forces of forest loss were the increasing need for settlement/infrastructure development (e.g., buildings, houses) and widespread policies and assistance to support agriculture/rural livelihoods. Increase in forested area was attributed to the absence of humans (abandoned land); government regulations, including restrictions on logging; fewer forest fires due to strict regulations on the use of fire within forests; reforestation and conservation projects; natural regeneration: tree planting in gardens; and difficult access. The main driving forces of increased forest cover were government regulations regarding forest protection, forest fires, and logging, along with government regulations prohibiting rattan exports in one of the intervention villages. Based on the survey responses, conservation projects, including REDD+, were the reason for the increase in forested area in the intervention villages. The REDD+ project proponent implemented restrictions on forest access and/or conversion and forest enhancement, which reduced forest clearance and increased forested area around the villages. The responses of local people may have been biased by their expectation that REDD+ would prevent forest clearance and increase forest cover. After all, the objectives of REDD+ are to reduce deforestation and forest degradation and promote conservation, restoration, as well as rehabilitation of forests (Jagger et al., 2011; Visseren-Hamakers et al., 2012). As the holder of an ecosystem restoration concession, the Katingan Mentaya Project perhaps did effectively conserve its concession by preventing any activities that could damage the forest.

However, local perceptions about forest area change were different from the forest area change based on satellite data, especially in REDD+ villages. The locals believed that there were some increases in forested area in their village while based in the satellite data, there were only

decreases or stable forest cover. These different results might be due to different definitions of the village boundaries or of forest, even though during the focus group discussion, the facilitators explained how forest was defined by the researchers. Another possible explanation is the resolution of the satellite images used to construct national land cover data (30 m x 30 m). Further, the land cover classes in the satellite images were digitized on screen, which may have omitted areas with mixed vegetation that the villagers classified as forest or non-forest.

Residents of the control villages also reported a decrease in forest quality. As forests are converted to agricultural land (palm oil, rattan) or rubber gardens, the number of trees decreases dramatically, and barren land increases due to forest fires. Based on the village survey, the decrease in forest quality made it difficult to collect forest products such as timber, firewood, or gemor bark (Alseodaphne sp.). The quality changes that villagers reported included hot weather, flooding, decreased flora and fauna biodiversity, and increased pests. The reasons that they cited included agro-industrial firms (palm oil), sedentary farming, villagers and people from neighboring villages, small-scale loggers, small-scale miners, forest fires, more deforestation, establishment/expansion of settlements and infrastructure projects, overhunting, increased poaching, illegal mining, logging out of economic necessity, logging for own needs, flooding, heat, increased financial need, and agricultural land expansion. The main driving forces in these forest quality changes were government policies and assistance to support agriculture/rural livelihoods, land use policies that favor a decrease in forest cover, decreased sanctions/law enforcement, mining activities leading to increased deforestation/degradation, high prices for timber and gold, and the village area being included in the private company concession, which limited villagers' access to those areas.

The REDD+ project also expected to be able to affect people's behavior in managing forested areas to sustain their lives. The restrictions on forest access and/or conversion applied in the REDD+ project pressured the local community to also conserve the forest and manage it in a sustainable way. Hence, the household-level survey included a series of questions about local community changes in forest use. Restrictions were most effective for restraining forest clearing (Duchelle et al., 2018). Based on these findings, after REDD+ implemented in 2014, both control and REDD+ villages experienced a decrease in forest clearance. This decrease was due to the establishment of a 2-year moratorium through Presidential Instruction no.10/2011. The moratorium prohibits the issuance of forest use licenses in peat lands and primary forests for 2 years (Murdiyarso et al., 2011). The decree was part of the Letter of Intention (LoI) with the Norwegian government to support Indonesia for REDD+ mechanism implementation. The decree was then extended in 2013 by the new President. In 2018, the percentage of households clearing forest was increased in both control and REDD+ villages. However, the trend in the last 2 years prior to the fieldwork was that households in the REDD+ villages that conducted forest clearance decreased at 44%, which was 4% higher than in control villages which decreased at 40%. The findings show that there are no significant differences in local community behavior in clearing forest, household patterns in forest products consumption for both control and REDD+ villages. Therefore, the impact of the REDD+ initiative on people's behavior regarding forest use at these sites has also been minimal. To conclude, the behavior of the local community in terms of forest use was mostly affected by law enforcement by the national government: At the beginning of the moratorium, there was intensive monitoring of any activities in the forested area (Oliver, Roggenbuck, & Watson, 1985). Many people were afraid to face the legal consequences of any activities that damaged the forest.

2.5.2 Local Community Engagement with the REDD+ Project

According to the findings, not all of the REDD+ villages had heard about the REDD+ framework. Only two villages had heard about REDD+ and understood its purpose. The communities in the REDD+ villages heard about the initiative from an NGO and the REDD+ proponent. The NGO was the Puter Foundation, which is the REDD+ proponent's partner. This information, which was collected in 2011, shows that prior to issuance of the proponent's ERC, they had started to publicize the REDD+ framework and its activities to engage local community regarding future implementation of the Katingan Mentaya Project. However, no villagers in the study villages had been involved in deciding whether the Katingan Mentaya Project should be implemented in their village. The engagement was only limited to announcements to inform locals that there would be a REDD+ project near their area.

In 2014, three out of four REDD+ villages had been involved in deciding on implementation of the Katingan Mentaya Project in their villages. They were consulted for consent (Free Prior and Informed Consent, or FPIC) regarding the project in village meetings. The FPIC is a standard REDD+ safeguard to support local community participation in the design and implementation of REDD+ projects in order to yield social benefits (Duchelle et al., 2018).

Some of the REDD+ villages had meetings to explain how the project would be implemented and to get input from villagers on how to implement the project. Villagers were involved in clarifying tenure arrangements and livelihood activities, as well as being asked to participate in (better) enforcement of forest rules. In addition, one of the REDD+ village was asked to participate in community-based monitoring of carbon, and some villagers also took part in an educational or training event related to the Katingan Mentaya Project. Community engagement

provided social benefits, including increased social learning and trust among villagers (Mulyani & Jepson, 2015).

The survey also asked the local community to evaluate some of the activities related to community engagement. Evaluation included how the proponent explained the goals and implementation of the project to the community. The findings show positive response on the way the proponent explain about REDD+ in 2014. However, in 2018, there were no effect on the local community since they already understand REDD+, but in some villages it had caused confusion among villagers which led them to give negative responses. Another evaluation to highlight due to the shift to more negative response is the development of the community's capacity to implement the Katingan Mentaya Project. The development of community's capacity consists of livelihoods improvement and tenure security improvement. There were no reports of the development of the community's capacity to implement the project. As for development of the community's capacity to improve tenure security, villagers worried that the company would take their land or limit their access to the forest, which is their main income source. In contrast, in one REDD+ village the program increased the village's tenure security, because the proponent helped the village map village boundaries. The next evaluation focuses improvement of the community's well-being. After the project implementation (2014), two REDD+ villages reported no effect responses on the improvement of community's well-being, and one positive response. However, in 2018, three of four villages reported negative responses on the community well-being improvement and one still experience no effect. Interventions associated with protection and/or improvement of forested area were not available in 2014 in three REDD+ villages, and only occurred in one REDD+ village with no effect. But shifted to positive responses in two villages even though the other two shows negative responses.

In general, perceptions of local community to the Katingan Mentaya Project/REDD+ initiative has shifted to negative. Villagers confused how the REDD+ mechanism works since this is a new idea for them. Villagers worried that the company would take their land or limit their access to the forest, which is their main income source. Local community expected that they could receive incentive when they protect the forest, but in fact the proponent provided forest intervention which focusing on activity/offered alternative livelihoods. However, sometimes community development program in the villages from the proponent are discontinued or no monitoring in after program implementation which led to unsuccessful program. Furthermore, local community believed that even without the REDD+ program, the forest still can be protected with government law.

The perceptions of the local community in the study villages also might be influence by other company existence near the REDD+ villages. For example, palm oil plantation and timber production. These industries offer job employment for local community as daily labor which can generate immediate income for their household. Whereas, the Katingan Mentaya project only offer a very limited employment for local community.

The negative perceptions from the local community to the REDD+ project to the extend that local community publicly refuse any activities associate with the Katingan Mentaya Project in their village. This occurred in one of the REDD+ villages. In the same village, when my team and I conducted a village survey, we faced opposition from one of the villagers. The proponent needs to address this issue first before they can implement community development program. Transparency in REDD+ scheme should be carried in every activities of the program to avoid misunderstanding and conflict between local community and the project proponents.

2.5.3 Impact of REDD+ on Migration

The number of people moving into intervention villages is lower than the number of people moving into control villages. People move into intervention villages mostly for family reasons (e.g., marriage, children), access to land and natural resources, and livelihood opportunities.

In contrast, the number of people moving out of intervention villages is higher that the number of people moving out of control villages. The number of people moving out of intervention villages in 2011 before the implementation of REDD+ was very high, at approximately 437 people. People move out of intervention villages due to lack of livelihood opportunities, to look for jobs, and for family reasons (e.g., marriage, children). After the implementation of the REDD+ project, the number of people move out in intervention villages higher than control villages in 2014. This might happen due to worries in the restriction of forest access as one of the local sources of income. However, the number decreased in 2018, this might happen due to more livelihood options are available in the villages. For example, a new business such as shallow nest or job opportunity from palm oil company.

The number of people moving into control villages is higher than the number moving into intervention villages. People move into control villages to gain access to health care and social services, for family reasons (e.g., marriage, children), livelihood opportunities, to gain access to roads and transportation, and for business opportunities.

In general, the number of people moving out of control villages is lower than the number moving out of intervention villages except in 2018. People move out of control villages for family reasons (e.g., marriage, children), lack of livelihood opportunities, to look for work, continuing

education, and seasonal work. The number of people moving into control villages in 2011 was higher than in the other time period, at about 114 people.

2.5.4 Impact of REDD+ on Local Community Well-being

In both control and REDD+ villages, household income mostly derived from wage, business, and agriculture. In control villages, income was mostly from wage income from 32% up to 40% of total income, followed by business income from 27% up to 35% and agriculture from 9% up to 17%. Environmental income only contributed about 8% up to 11%, livestock and animal product about 0.3% up to 5%, and other income about 3% up to 12%. Meanwhile, in REDD+ villages, wage income also contributed the most to total income—which kept increasing, from 33% in 2011 and 2014 to 59% in 2018. The next largest sources are business income and environmental income. The income received from business constantly decreased over time, from 23% in 2011 to 29% in 2014, and significantly decreased to 5% in 2018. Environmental income increased from 16% in 2011 to 24% in 2014, but decreased in 2018 to 18%. Compared with control villages, household environmental income in REDD+ villages was higher. Agriculture income only contributed about 8% up to 17%, livestock income and animal product 0.7% up to 3%, and other income 3% up to 7%.

Findings show no differences on total income for households in REDD+ and control villages before the implementation of the REDD+ project. However short after the implementation of the REDD+ project in October 2013, the total income of households in control villages was higher compare to REDD+ villages. Furthermore, approximately after 5 years implementation for the REDD+ project, the household total income in the control villages was also higher than the total income of household in the REDD+ villages.

According to the findings, the average total household income without any REDD+ project implementation was higher over time, both in the short term and long term. The average income in control villages increased from 2011 to 2014 was USD 998.70/year, while average income in REDD+ villages only increased by USD 193.89/year. In the long term, from 2011 to 2018, the average income in control villages was increased USD 1,951.11/year while in REDD+ villages it increased USD 1,051.25/year. Whereas, the household environmental income increased over time in both REDD+ and non-REDD+ villages. However, the household environmental income was significantly higher at 5% level in the REDD+ village than the household environmental income in control villages.

The outcome shows that the REDD+ project had no significant influence on the household total income as well as household environmental income, since local residents had not benefited from the program in the early stage of the project implementation. This is possibly due to the decrease in agriculture and business income. Restrictions on forest use and implementation of the conservation project as well as the prohibition of fire use reduced the local community's ability to clear forest for agriculture. REDD+ also may have affected people by increasing their awareness of forest protection and conservation, which might motivate villagers to manage the forest in more sustainable ways. Moreover, people in the REDD+ villages have started to small business such as kiosks, small food stalls, and swallow nests as a livelihood alternative. The new business might affect on the income since the villagers spent money for venture capital of their business, but has not received any profit yet from the new business.

Although a bundle of interventions is applied at the REDD+ site by the proponent and its affiliate organizations which focus in increasing household environmental income such as fresh water fisheries improvement program, reforestation and nursery development, and rattan craft business

development; those programs have faced challenges in their implementation. For example, the freshwater fisheries improvement that support local fish farmers and create an alternative source of income for the local community discontinued only after a year of its implementation due to lack of monitoring. Furthermore, as the holder of a legal ERC granted by the Indonesian government, the REDD+ project has clear boundaries and intensive monitoring inside their concession area. Hence people acknowledge that the concession area is a protected area that should be free from any activities that can damage the forest. In contrast, the absence of REDD+ creates a space for weak forest law enforcement. As explained previously, income in control villages is generated mainly by wage income from industrial activities, including mining, both small-scale and large-scale.

Another potential reason is the lack of livelihood opportunities in REDD+ villages; this is one reason people migrated out of REDD+ villages in 2014, since the project had just started at the end of 2013. Most activities of the REDD+ proponent focused on forest protection, conservation, restoration, and boundary setting. Community engagement was only limited to distribution information about REDD+ and its activities. The community development program had not been started yet during this time.

2.5.5 Assessment of REDD+ Interventions

In Chapter One the potential of REDD+ intervention was described to assist in the analysis of what type of intervention could benefit both the environment and the local community's well-being. In this chapter, the assessment focused more on the intervention's association with household income. The findings portray that households who involved in more than one forest

intervention program and household involve in only one forest intervention program have no different in their total income.

The results show that most of the forest interventions listed have no significant impact on household income. The reasons might be because implemented interventions were not implemented on the right target. Also, interventions may not have been rolled out at the intensity originally planned (Sunderlin et al., 2015). In this case, the proponent implemented the program intensively in the beginning of the program, however there were no monitoring activity to continuously guide the local community in achieving the project goals. Either no evaluation for the program to identify the challenges in program implementation or to improve the way they implement the community development program. The Katingan Mentaya Project is a performance-based business that they only received funding if they succeed not only in avoiding emission but also maintaining their area ecosystem. Hence, they might face limited source of funding especially during the short-term period of its implementation. According to Bos et al. (2017) short time period combined with limited funding would naturally lead to less positive outcomes, which may explain the underperformance of the program.

There were only two programs that had a positive impact on the local community. Household who participated in Reforestation and Nursery Development and Tenure Security Support for Rattan Farmers had higher average income than nonparticipant households. The Reforestation and Nursery Development was implemented by the REDD+ project proponent. The other program was implemented by an NGO in the villages outside the REDD+ project area. The priority goal of the Reforestation and Nursery development was to improve the forest ecosystem by planting degraded lands within the project area. However, this activity involved the local community, usually in groups of 5-7 daily workers who transported the seeds (Pulai, Jelutung,

Blangeran), laid out planting lines, and planted each area. This activity offer job opportunity to the villages which can increase their wage. As reported above, the income derived from wage contributed the most to total income.

On the other hand, there was also a significant difference in income between participant and nonparticipant households, but in this case the nonparticipant households had higher average income than the participant households. These programs are Rattan Craft Business Development program. This might be due to the low number of people who involved in this program which generated the lower average income. This program was implemented by the REDD+ proponent but then discontinued due to lack of interest from the local community. The lack of interest of the community to this program because in there was a policy which ban rattan export activity (Permendag No 35/2011). However, the Rattan Craft Business Development still on going in other villages inside the project zone which were not the study villages. The Tenure Security Support for Rattan Farmers program ensures that rattan farmers will have clear boundaries for their land, which prevent encroachment activities and deters conflict with others.

The local communities also expressed their opinions about the REDD+ project and made some recommendations. Since the local community also plays an important role in successfully implementing REDD+ projects, their opinions on how the REDD+ project should be implemented matter. Villagers hoped that the proponent could provide proof that REDD+ can yield income. Villagers also hoped that the proponent would fulfill its promises, increase project activities or expand their scope (e.g., to handicrafts, animal husbandry), improve/provide educational services/infrastructure, improve/provide access to energy (e.g., electricity), improve/provide roads & transport services, improve/support communal activities and infrastructures (e.g., community halls, office buildings), support animal husbandry/fishery, and

provide or create jobs/employment. Villagers hoped that the proponent would make written agreements with the community and felt that the proponent should understand local contexts (e.g., culture, needs); consider existing land uses as part of REDD+ (e.g., cocoa/rubber plantations); support alternative livelihoods; provide support for agricultural production and farm management (e.g., training, production inputs); provide technical assistance in the processing/marketing of products sold by households; support the improvement of well-being or income in general; and increase tenure clarity (e.g., boundary mapping).

CONCLUSION

The Katingan Mentaya Project is demonstrating the feasibility of implementing REDD+ initiatives based on the ERC option provided under the Indonesian REDD+ framework. The Katingan Mentaya project has avoided deforestation of carbon rich peatlands by large actors such as oil palm plantation companies, timber production companies, and mining industries. The ERC offers various business opportunities based on carbon financing, payments for ecosystem services, and forest production such as harvesting NTFPs. The ERC mechanisms ensures the

long-term implementation of a REDD+ project. Through this business model, project proponents can secure funding as well as securing the project area from deforestation and forest degradation. Securing continued funding will be critical to the success of the REDD+ initiatives and thus ERC offers a great opportunity for REDD+ in Indonesia. The drawbacks of the ERC mehcnaism can be mitigated with support from central and local governments and shared responsibility among stakeholders (proponents, partners, investors, and affiliated organizations).

The experience of Katingan Mentaya Project suggests that REDD+ project "crowd out" other funding. The government only implemented programs outside the REDD+ project zone after the project began in late 2013. On the other hand, key informants in each village stated that the villages did not gain any additional development support because of the REDD+ project. Thus, REDD+ could cause villages to miss out on other development support. Further investigation with local and national government and other stakeholders such as non-governmental organization is needed to determine whether there really is a "crowding out phenomenon" with REDD+.

The impact of the REDD+ initiative on people's behavior regarding forest use at these sites appears to be minimal based on the household survey. Forest use has been more affected by law enforcement by the national government, which made people afraid to face the legal consequences of any activities that damaged the forest.

In terms of local community well-being, the REDD+ project appears to have dampened the upward trend in household income in this region. This is perhaps not surprising, because the REDD+ project is restricting access and use of natural resources that have been the basis of local livelihoods. The REDD+ interventions do appear to have increased environmental income at

least in the short term. It is also worth noting that business income was most negatively affected by REDD+, and this may actually reflect large investments encouraged by the REDD+ project that reduced net income in the year of the survey but are expected over the long run to lead to sustainable alternative livelihoods. This is consistent with the long time-horizon of economic development projects. However, it is also consistent with dissatisfaction with the project reported by local people, who expected the project to deliver concrete benefits in the short term.

The findings also show no difference in total income between households involved in more than one forest intervention and households involved in only one forest intervention. Out of 18 forest interventions, only two individual interventions appear to have a significant positive impact on household income. This could be because those interventions did not involve the right households or because they were not carried out as planned. Continuous monitoring is required to achieve the project goals.

These challenges in the implementation of the Katingan Mentaya Project have led to a shift in local community perceptions of the REDD+ project. Confusion about the REDD+ mechanism had worried the local community about how it would affect their well-being. The expectations of local communities and the international logic of REDD+ often seem to point in different directions. Greater transparency about all aspects of the REDD+ project could help avoid misunderstanding and conflict between local community and the project proponents.

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APPENDICES

Appendix A. Survey acitivites

Village survey

Participatory mapping during village survey

Women survey

Household survey

Appendix B. Community Livelihoods

Community rattan business

Copra for coconut oil

Rubber Garden

Rubber resin

Swallow nest buildings in the village

Swallow nest

Appendix C. The village conditions

The village located between REDD+ project and National Park

Boat seller passing through the village

Forest fire near the village