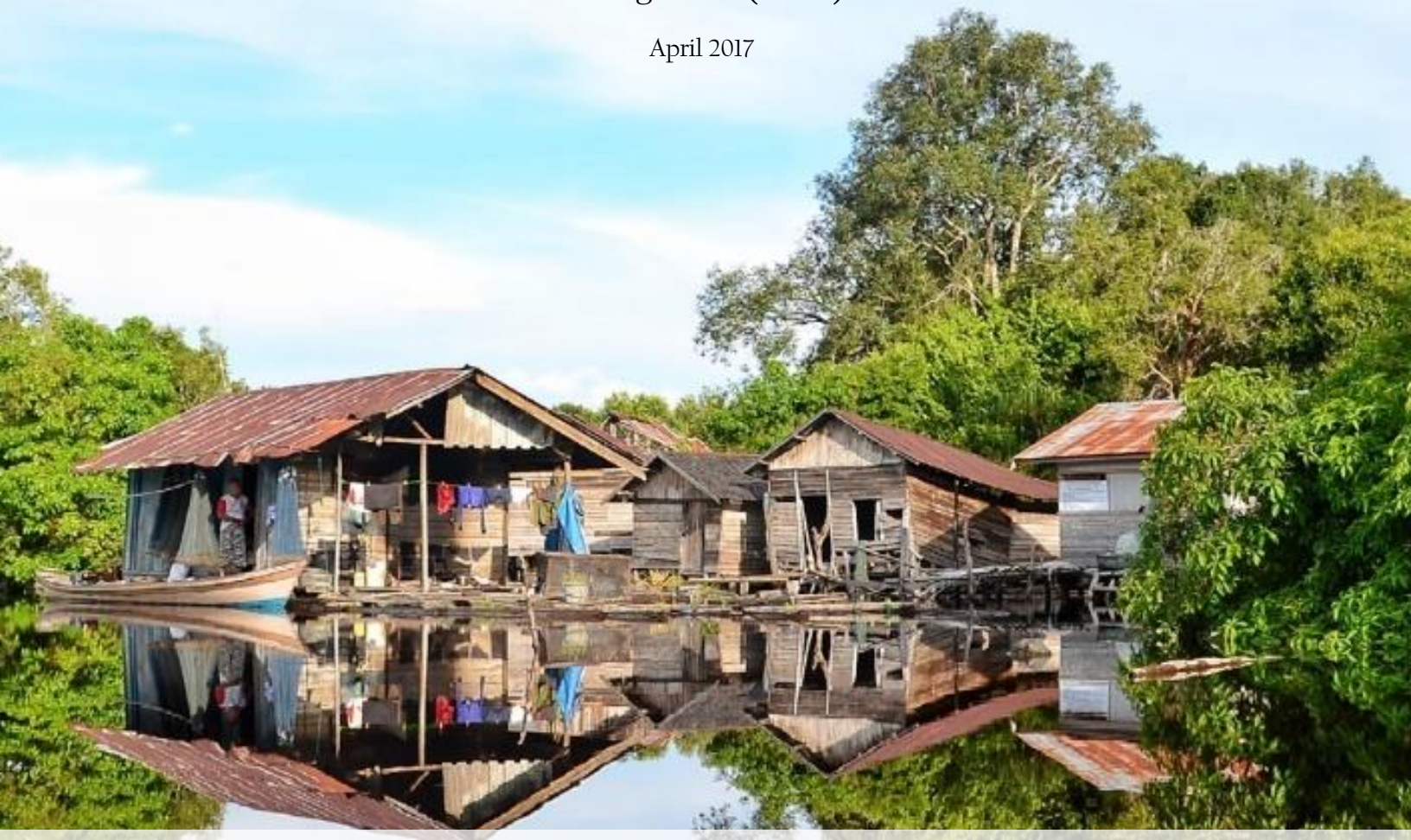
HOW ECOSYSTEM RESTORATION AFFECTS LOCAL COMMUNITIES' WELL-BEING IN THE CENTRAL KALIMANTAN KATINGAN AND KOTAWARINGIN TIMUR DISTRICT IN INDONESIA.

Ika Rachmawati Suratno

MSc Thesis in Urban Environmental Management (MUE)

April 2017



Supervised by : **Dr. RS (Dolf) de Groot**
Course Code : ESA-80436

Environment System Analysis Group

WAGENINGEN
UNIVERSITY & RESEARCH

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2) Prof. dr. R. (Rik) Leemans
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Preface and Acknowledgement

One of the frustrations in development is the 'natural resources curse' phenomenon. This phenomenon is also known as the 'paradox of plenty'. This is a hypothesis that states that resource-wealthy areas tend to have slower economic growth than natural resource- poor area because ownership natural resources lead to worse development outcomes. I found this correlation's evidence in several cases while doing research in my previous job. I witnessed a community that lives in the area with abundant of natural resources such as oil, coal, and forest are marginalised and suffer because of the negative impact on resources exploitation. The communities are aggrieved from the toxic waste from coal mining, landslide because of the degraded upstream mining area, and from respiratory disease due to a forest fire. This is one of the compelling reasons to choose this topic. I hope that my research can be a contribution to make sure the local community in the rich natural resources area (in this case peatland forest) to be able to savour the benefit of the resource richness.

This thesis is part of my master study at Wageningen University and Research, the Netherlands. In this thesis, I focus on ecosystem services, ecosystem restoration and its impact on the well-being of local communities. This topic only slightly overlaps with my by bachelor degree program in Urban and Regional Planning. However, it is in line with the recent research that I had been done in my previous working experiences. In this two years, I was closely in touch with forest community issues and intend to get involved further in it.

This research took place in Katingan and Kotawaringin Timur Districts, Central Kalimantan that was known as one of the most degraded and deforested provinces in Indonesia. This area was also selected as one of the Reducing Emissions from Deforestation and Forest Degradation Plus (REDD+) pilot provinces in reducing carbon emission in Indonesia. The ecosystem restoration is a suitable effort to cope with deforestation and reduce carbon emission in peatland area. This case is appealing for me because this is the biggest area from 13 Indonesian ecosystem restorations that are initiated by the private sectors. In this seven years investment, the ER Project still faces the absence of turnover due to the fact the carbon market, which was targeted as an income source, it is not yet accessible. It is interesting to learn the dynamic on how the private company manages the revenues absence at the same time performing all obligations, meeting the ecosystem restoration requirements in protecting biodiversity as well as improving the community welfare and dealing with political and social conflicts.

Doing field work in Ecosystem Restoration Project's concession area and its surrounding villages gave me valuable lesson learns from management, ecology and social aspects, yet it was a challenge especially in collecting data. Several villages do not have time series data about demography and livelihood information because the village governments have just been formed recently. I also faced limited information in getting answers about ecosystem services used by communities while doing in-depth interviews. The local communities usually took for granted of ecosystem services in the concession area so that they were not paying attention to some ESs they used. Several respondents also being apprehensive in giving the real number and ecosystem services location mainly related to illegal logging and hunting. They worried if their detail information will make them being limited and stopped

in doing their activities in the future. However, these challenges make this research process meaningful and adding novelty of this research.

I would like to thanks the following people for giving encouragements, useful advice and valuable helps to finish my thesis.

I owe sincere gratitude to my supervisor Dr RS (Dolf) de Groot for offering valuable advice and intellectual directions for my research. He is expert in ecology, ecological economics, ecosystem management and nature conservation. He also writes many publications about ecosystem services and its valuation that indeed in line with my research. I can say without his advice; this thesis would not be materialised in this present form.

I would like to thanks to Prof. Dr R. (Rik) Leemans as the thesis examiner for providing advice to revise and improve my thesis. He is currently the head of the Environmental Systems Analysis Group of Wageningen University. Also, he is an editor-in-chief of the international journal Current Opinion in Environmental Sustainability (Elsevier). He helps me by providing advice to make my thesis more concise and attractive for the reader.

I had a great fortune in making a professional connection with Mr Rezal Kusumaatmadja, COO of PT. Rimba Makmur Utama from my previous job experience. A person who is firmly committed to protect the rainforest and increase the communities' quality of livelihood. He connected me to all of PT. RMU central staffs in Bogor and field teams in Central Kalimantan. The teams involved me in their activities to help me understanding the Ecosystem Restoration project and get in touch with surrounding communities. This company is partnered with Puter Foundation which provides me facilitation in interacting with local people.

I also extend my sincere thanks for Mr Wahyu Mulyana, Executive Director of Urban and Regional Development Institute on helping in the thesis topic selection.

I would also like to thanks, Mr Arief Wicaksono for the inspiring pep talks and meaningful sharing of his extensive experiences in facilitating participatory assessments on community-based natural resources management.

Finally, gratitudes and appreciations for my parents, friends and all members of Indonesia Student Association in Wageningen who are contributing in the accomplishment of this research.

Contents

Summary

Ecological restoration is a strategy to restore the degraded and damaged ecosystems and improves the livelihoods of the inhabitants that live in or near the restoration project. The Indonesian Ecosystem Restoration Project (The ER Project) in the Katingan and Kotawaringin Timur Districts, Central Kalimantan, intends to protect and restore 149,800 hectares peatland ecosystems in production forests. The Project is financed by its performance in avoiding carbon emissions. This project started in 2010 and is one of Indonesia's REDD+ initiatives that are initiated by the private sector. It is financed by its achieved GHG emission reductions and C sequestration against a baseline scenario during the 60 years initial crediting period from 2010 to 2070.

This thesis aims to identify changes in ecosystem services that are used by local communities and to investigate the impacts of the ER Project in Katingan and Kotawaringin Timur Districts on local communities. The ER Project offers both opportunities for and threats to the well-being of the residents. Therefore, knowing these impacts is important for the ecosystem restoration project interim evaluation.

This study focusses on four villages: Telaga, Kampung Melayu, Hantipan and Seragam Jaya Villages, which consist of 301, 143, 175, and 205 households respectively. These villages are representative for four different sub-districts and two districts which have different economic activities. Before ER Project's implementation, the main livelihood in the study area was illegal logging, bird and deer hunting, fishery and farming. The rampant illegal logging and encroaching activities lead to deforestation, forest degradation and overexploitation of hunted species. The ER Project tries to prevent this destruction by obtaining full legal control for the area through an Ecosystem Restoration Concession License. After the ER Project's implementation, changes in livelihoods occurred. Illegal logging and hunting in the concession area are drastically decreasing. As a result, illegal mining occurs, communities migrate to bigger cities for job and the remainders cultivate their land to meet their daily needs.

The study's research questions focus on the changes in ecosystem services after the ER Project was implemented, its stakeholder, its impacts on local communities' well-being. The answer to these questions should provide recommendations for project improvement.

Qualitative and quantitative analysis were combined to answer these research questions. The quantitative analysis valued the key ecosystem services economically before and after the ER Projects' implementation. The qualitative analysis assessed the project's social network and triangulated the data sources that were used to identify the dominant stakeholders, investigate the project's impacts and recommend how to improve the Project.

Data were collected between October 1st – December 15th 2016 by literature review, primary observations, and in-depth interviews. The review assessed statistical reports, the ER Project's technical reports, and village profile documents. In-depth interviews were conducted in Telaga, Kampung Melayu, Hantipan and Seragam Jaya Villageswith 20, 17, 16 and 15 respondents respectively. Respondents were selected with a snowball sampling method. Personal and group in-depth interviews revealed the local

community's perspectives on changes in ecosystem services, the project's impacts and helped to formulate improvements to the ER Project. Observations were necessary to capture critical local communities's behaviours and patterns and validates the key ecosystem services and human well-being components that emerged from the review.

My study provided four main results. First, the observed decrease in quantity and economic value of the community's key ecosystem services (i.e. food, minerals, raw material, resin and fibre and ethical and spiritual values) compared to the pre-project period. This decrease was caused mainly by the mismatch between ER Project's and local communities' priorities and by overexploitation. As the ER Project prioritises carbon sequestration and reduces possible threats, such as logging and encroaching activities. These activities are the local communities' main income sources.

Second, the social network analysis revealed that PT Rimba Makmur Utama is the key stakeholder. They have the highest 'centrality value' and this reflects that they are the most important stakeholder that have the largest social power, ability to spread communication and connect to other stakeholders.

Third, ER Project has not had a substantial influence on local communities' livelihood since the Project is currently in its preparation stage. Notwithstanding this, several positive and negative impacts are still recognised from the changes in key ecosystem services and the Project's activities. Direct impacts include abrupt livelihood changes, income reduction, resource accessibility limitation, forest-fire reduction, alternative jobs provision and tenure conflicts inflliction. The indirect impacts include health problems, biodiversity and ecosystem services destruction, positive externalities from gold mining, and security of life improvement.

The fourth result is the recommendation to improve the ER Project performance. The proposal includes conduct agriculture business that suitable with existing physical condition and link it to the potential market. Some species that are recommended to be planted to provide livelihood alternatives and stable income are Nypa Palm, Cashew Nut, Aloe Vera and Dragon Fruit. The second is law enforcement in mercury usage in gold mining, and conduct an education program to increase pollution awareness of local communities. The third proposal is to undertake the non-litigation approach and involve the national government as the tenurial conflict mediator. The last proposal is to quantify the indirect services value provided by animals to understand their importance for ecosystems and human well-being and to formulate the next protection strategy.

Introduction

1.1 Background and Problem Statement

Ecosystem restoration (ER) is defined as the activity to remove the threat to an ecosystem, recover damaged and degraded ecosystem and reinstate its connectivity within the larger landscape (SER, 2004). ER is also known as a strategy to increase the provision of ecosystem services (Bullock, Aronson, Newton, Pywell, & Rey-Benayas, 2011). Forest restoration project is a long-term commitment designed to integrate ecological functions with broader economic, social and cultural functions (CBD, 2004). ER projects have the potential to generate multiple benefits within REDD+ (Reducing Emissions from Deforestation and Forest Degradation Plus) mechanism (Alexander et al., 2011). ER projects do not only provide opportunities to repair the ecological damage but also to offer economic opportunities and increase local communities participation (SER, 2004). Integration of ecosystem restoration with economic and social frameworks to cover the stakeholders' needs is required to have successful restoration activities (Alexander et al., 2011).

The Ecosystem Restoration Project (the ER Project) in Katingan and Kotawaringin Timur District, Central Kalimantan (see **Figure 1**) is one of ER Projects in Indonesia that intends to protect and restore 149,800 hectares peatland ecosystems in the production forest by sequestering and avoiding carbon emission. The project is expected annually to reduce an average of 7.5 millions tonnes of GHG emissions in a sustainable manner with community-based forest management principles (Katingan Project, 2014). This project is one of the Indonesian REDD+ initiatives that are initiated by the private sector. It is financed by its achieved GHG emission reductions and sequestration against a baseline scenario during the 60 years initial crediting periods (Katingan Project, 2014). Besides the primary role, this project provides a vital contribution in water flows stabilisation, clean water provision, devastating peat fires prevention and enriching nutrients enrichment, biodiversity protection as well as the communities' quality of life improvement (Katingan Project, 2014).

The previous ER Project area's land utilisation was state-designated production forest so that it is likely that it would be logged and converted to industrial timber and oil palm plantations (Katingan Project, 2015). Illegal logging industry was one of the primary causes of deforestation and forest degradation (Katingan Project, 2014). Those activities would be a threat to the forest and peatland ecosystem. This industry would lead to flood, land subsidence, agricultural productivity reduction and high carbon emissions from biomass clearance and the carbonic matter oxidation (Katingan Project, 2015). The ER Project tries to prevent this destruction by obtaining full legal control for this concession area through an Ecosystem Restoration Concession License through Minister of Forestry Decree SK 734/Menhut-II/2013 (Katingan Project, 2015).

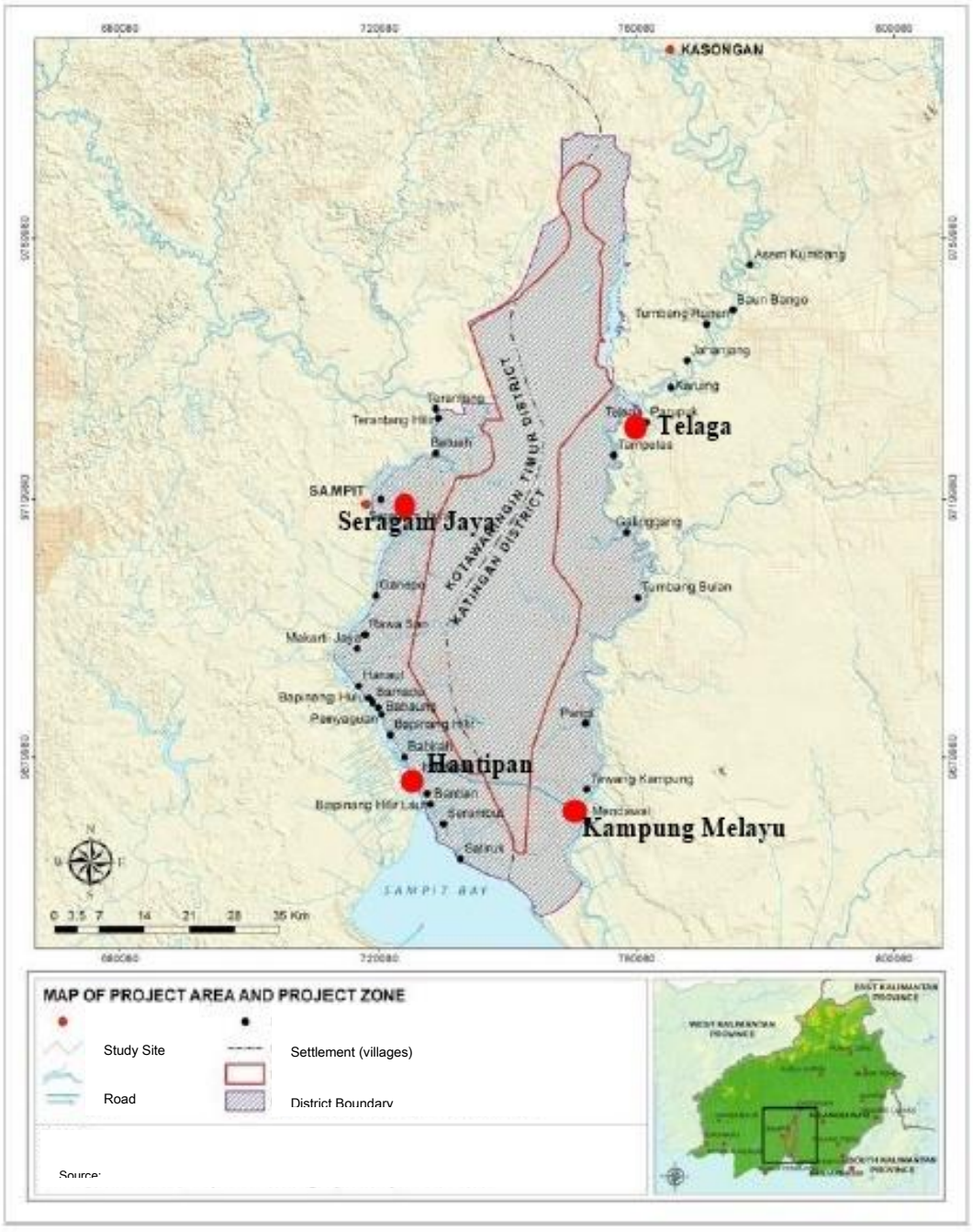


Figure 1 Katingan Restoration Project Zone

(Katingan Project, 2014)

The ER Project is one of the REDD+ efforts to address deforestation and forest degradation. While there is an urgency to mitigate deforestation and forest degradation, the community has suffered injustice within REDD+ schemes (Tacconi, 2010). The avoided deforestation projects to protect propitious carbon storage without considering on livelihood issues could lead to conflict with communities (Griffiths, 2007). Therefore, the implementation of avoided deforestation project, in this case, the ecosystem

restoration is required to ensure that i) Deforestation and degradation targets are achieved and ii) The communities living in and near forests benefits from the initiative (Griffiths, 2007).

Problem statement

The objective of the Ecosystem Restoration Project in Katingan and Kotawaringin Timur District within the REDD+ scheme is expected not only to maintain the ecosystem services to regain ecological integrity but also the social well-being and livelihood security of communities in the project zone. The ER project could be ideally synergic with the current economic activities, but in practice, there may be trade-offs among the ecosystem restoration project with the previous condition. The ER Project could offer both opportunities and threats to the well-being of the community. ER could provide benefit for ecology, but without considering social aspect of the community, it could result in only short-term benefits for a few stakeholders (Skutsch & Mccall, 2010). Knowing the impact on the well-being of the local communities in the project zone will be a major input for the Ecosystem Restoration Project evaluation. Therefore, critically assessing the impact of the ER Project on the well-being of the local communities is essential to ensure the ecosystem restoration project achieves its objectives.

1.2 Research Objectives and Questions

This thesis research aims to assess the local community perceptions of key ecosystem services changes as a result of the implementation of the Ecosystem Restoration Project in Katingan and Kotawaringin Timur Districts. Furthermore, it aims to investigate the impact on the well-being of local communities in the project area from the changes of key ecosystem services and activities of the ER project.

To achieve the objectives, the Research Questions (RQs) are:

RQ1 What are the changes in ecosystem services after the Ecosystem Restoration Project imlemented?

RQ2 Who are the stakeholders that relate to the Ecosystem Restoration Project?

RQ3 What are the impacts of the ER Project on Human well-being of local communities in the project area?

RQ4 What activities improve the Ecosystem Restoration Project?

1.3 Research Sites

This research was conducted in the concession area of the Ecosystem Restoration Project in Katingan and Kotawaringin Timur Districts, Central Kalimantan, Indonesia. The impact of ER Project on local commnities was represented by four selected villages. The selected villages are Telaga, Kampung Melayu, Hantipan and Seragam Jaya Villages. These villages were chosen based on preliminary interviews with PT Rimba Makmur Utama (PT RMU) and the Puter Foundation. PT RMU is the owner and developer of the ER project that responsible to operationalize all of the programs to achieve climate,

community and biodiversity objectives. Puter Foundation is NGO that jointly works on the preparedness of local communities in project area. These four villages were representatives of four different sub-districts in Katingan and Kotawaringin Timur Districts and had a different characteristic of ecosystem services used by communities and livelihood variation. Therefore, these villages provide a different perspective from their inhabitants about the impact of the ER Project.

1.4 Time Frame

This research started in August 2016 and was finished in March 2017. The fieldwork was done during October – December 2016 to do observation and in-depth interviews.

1.5 Structure of The Thesis

Chapter 1-4 are conceptual and descriptive sections which guide this research to achieve its objective. The result of analyses and answers of RQs are provided in Chapter 5-8. Subsequently, discussion and conclusion in chapter 9 and 10.

Following Chapter one, theoretical framework and research methodology are provided in Chapter 2. This chapter explains the theoretical and conceptual framework that guide the research. This chapter also provides a list of relevant ecosystem services that are provided by the forests and that are directly affecting the well-being of local communities. Also, it explains the relevant components of well-being that are confirmed in validating the field work with observations and in-depth interviews. These well-being components are considered in the evaluation of impact from the ER Project and formulation of the recommendation to improve the ER Project. Furthermore, this chapter explains the detailed methods for data collection and data analysis.

Chapter 3 describes the brief summary of the Ecosystem Restoration Project in Katingan and Kotawaringin Timur Districts. It comprises of the objectives and activities that are conducted under the project. The explanation of activities is important to understand the detail actions that are being done by the ER project to achieve its objectives. The knowledge about the ER Project's objectives and activities are the entry point to analyse the impact of the ER Project on the well-being of local communities.

Chapter 4 provides the baseline condition of the geographical, social and economic profile of the Telaga, Kampung Melayu, Hantipan and Seragam Jaya Villages. It is necessary to provide information of study site to understand the particular characteristic of villages that are affected by ER project.

Chapter 5 describes the changes of the key ecosystem services as result of the ER Project implementation in Katingan and Kotawaringin Timur Districts. Secondary and primary data are taken and visualised in graphs. These graphs are used as the basis to evaluate the changes (in quantity and economic value) of the key ecosystem services that are prioritised by local communities. The result of this chapter is taken as input in conducting the impact assessment and formulating the activities to improve the ER Project in the following sections.

Chapter 6 provides the result of Social Network Analysis. This section identifies stakeholder relate to the ER Project. Compiled information about the relationship, interest, and role of stakeholders are used as the basis for stakeholder mapping formulation. This chapter also measures the importance of stakeholder that reflected by centrality value to show their social power and connection with other stakeholders.

The impact of the ER in study site are incorporated in Chapter 7. The formulation of impacts is based on the triangulation of observation and in-depth interview. This chapter explains the impact from the changes of the key ecosystem services used by local communities and from the activities of the ER Project. Coding is used to categorise the answer from in-depth interviews and notes from observation. Impact investigation as part of the ex-nunc evaluation that is an interim project assessment is necessary for ER Project improvement.

Chapter 8 provides recommendations to improve the ER Project in Katingan and Kotawaringin Timur Districts. The recommendations are based on the perspective of local communities, observation and best practices from other projects.

The discussion of the research is provided in Chapter 9. This chapter discusses the finding methods used, including the data collections, data analyses, and results. This section explains assumption and uncertainties faced during my research. In addition, the unexpected result is revealed in this chapter which can be a critical point and lesson learn for other ER Projects.

The last chapter provides the conclusion of the research that highlights the important results that are gained while performing the research.

2. Research Methodology

The research methodology is summarised in the conceptual framework which emphasises the linkage between ecosystem services and human well-being. This framework is built from the theoretical framework of existing theories about ecosystem restoration, ecosystem service, and human well-being (see **Chapter 2.1**). **Chapter 2.2** explains the research methods that consist of data collection and data analysis method.

This research combined quantitative and qualitative approaches. The quantitative approach was used to investigate the changes of the key ecosystem services (ESs) in the study site. A qualitative approach was used to identify stakeholders, investigate the impact of the ER Project and formulate a recommendation to improve the ER Project (detailed information can be seen in **Chapter 3.2).** The conceptual framework explains how this study answers the RQs by applying theory and selected research methods.

2.1 Theoretical Approach

This research applies several theoretical approaches to answer the RQs. The research's idea emerged from the concept that ecosystem restoration that aims to recover the ecosystems affect the ecosystem services which influence the human well-being condition.

2.1.1 Ecosystem Restoration

The ecosystem-restoration concept has some different definitions. The ER Project's definition, which is endorsed by the Society for Ecological Restoration (SER, 2002), states: *"The process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed.".* IPBES (2015) states that *"Restoration is defined as any intentional activity that initiates or accelerates the recovery of an ecosystem from a degraded state."* EC Biodiversity Strategy Impact Assessment (2011) described Ecosystem restoration as *"The return of an ecosystem to its original community structure, natural complement of species, and natural functions."* Furthermore, the ecosystem restoration includes activities that enhance biodiversity, secure the sustainability of ecosystem services, and contribute to climate change adaptation (Kotiaho et al. 2016).

The definition from EC Biodiversity Strategy Impact Assessment describes restoration is the return of an ecosystem to its original natural condition which is a drawback because human could not control the natural system. It is not feasible to return ecosystem service to the entire original natural state (Maron et al. 2012). Contemporary and unpredictable factors may cause the ecosystem to develop along an altered trajectory (SER, 2002). The natural condition itself can be the direction for recover the ecosystem service but does need to be the target of the ecosystem restoration (Kotiaho et al., 2016).

From above definition, it can be concluded that the ultimate aims of Ecosystem Restoration are to recover and restore ecosystems to its pre-degradation condition by enhancing biodiversity, contributing to climate change adaptation and securing the ecosystem services sustainability. This definition can be

used for this research since it does not rely on the success of a specific ER measures and includes a wide array of methods for ecosystem recovery enhancement.

The ecosystems in developing countries mostly are still managed by traditional cultural practices. In the beginning, these cultural practices embraced the harmony between ecological and economic processes. However, many cultural practices have suffered from demographic growth and economic pressures so that it requires to be restored. The restoration of such ecosystems condition would include the recovery of cultural ecological management (SER, 2002). ER projects are dependent upon long-term involvement and participation of local communities. Ecological restoration must encourage new local sustainable practices in managing ecosystems (SER, 2002)

Ecosystem restoration includes long-term commitment to protect and recover an ecosystem. Collective decisions are likely more needed than the sectoral arrangements. Therefore, to initiate and implement an ER Project requires a consensus and collaboration of all stakeholders. Once the decision to implement the ER Project was made, all of the related stakeholders are required to be involved in formulating integrated planning towards progressive ecosystem recovery (SER, 2002).

2.1.2 Ecosystem Services

Human societies rely on the ecosystem services provided by nature, especially food, fuel and fibre (SER, 2002). Ecosystem services are "the benefits provided to humans through the transformations of resources (or environmental assets, including land, water, vegetation, and atmosphere) into a flow of essential goods and services e.g. clean air, water, and food" (Costanza et al., 1998). The ecosystem services concept's introduction by Millennium Ecosystem Assessment on the global agenda bring a necessary bridge between the responsibility in maintaining biodiversity and achieving Millennium Development Goals (MDGs) (De Groot et al., 2010).

The Millennium Ecosystem Assessment identified and categorised ecosystems and their resulting services, identified the links between these services and human, the direct and indirect drivers and feedback loops. The Millennium Ecosystem Assessment framework (see **Figure 2**) identified ecosystem services within four categories among others: provisioning service, regulating service, cultural service and supporting service. Provisioning service is the goods obtained from ecosystems, such as timber, raw food, fibre, and water. Regulating service is the service received from the ability of the ecosystem to control natural processes, such as erosion, pollination, and natural hazards protection. Supporting service is the ability to maintain the other ecosystem services. Cultural service is the non-material benefits such as spiritual values and recreation.

Another important global initiative that focused on making nature's values visible is The Economics of Ecosystems and Biodiversity (TEEB). TEEB divides 22 ecosystem services typology into four categories. The categories are among others: provisioning, regulating, habitat and cultural services that mainly following the Millenium Ecosystem Assessment classification (De Groot et al., 2010). The TEEB pays more consideration to the ecosystem's economic values and provides a refinement classification based on the Millenium Ecosystem Assessment (De Groot et al., 2010).

The loss of ecosystem services would lead to an enormous aggravating impact on human well-being (Costanza et al., 2014). Moreover, once ecosystem and ecosystem services lost, it would difficult to be recovered (Costanza et al. 2014). Enhancement of particular ecosystem services for economic purposes leads to the ecosystem and biodiversity protection threat. Furthermore, it will result in destruction risk for the underlying ecosystem service-natural functions (Kotiaho et al., 2016). Enhancing one ecosystem service production at the expense of other ecosystem services and biodiversity will disrupt the ecosystem sustainability.

2.1.3 Human Well-Being and Its Linkage to Ecosystem

The Millenium Ecosystem Assessment (MEA) framework uses human perspective while recognising the biodiversity and ecosystems intrinsic value (Millenium Ecosystem Assessment, 2005a). Human well-being and the ecosystem's intrinsic value should be taken into account in decision making (Millenium Ecosystem Assessment, 2005a). There is a dynamic interaction that occurs between human well-being and ecosystems (Millenium Ecosystem Assessment, 2005a). Changes in human condition affect the ecosystems. At the same time, changes in ecosystems establish direct or indirect changes in human well-being.

The constituents of Human well-being consist of the basic material for a good life, health, good social relation, security and freedom of choice and action (Millenium Ecosystem Assessment, 2005a). The basic material of good life includes adequate and secure livelihood such as enough food, clothing, shelter and access to its sources. Health includes having a pleasant physical environment (good access to clean water and air). Good social relation includes having the ability to help and respect other and good social cohesion. Security covers personal safety, security from natural and human-made disasters and secure access to natural and other resources. The last constituent is freedom of choice and action that includes the opportunity to achieve what individual values are doing and being (Millenium Ecosystem Assessment, 2005a).

The human well-being determinant is expressed as commodity inputs that are provided by ecosystem services such as food, fibre, clean water, materials for shelter, marketed crops, livestock, forest products, and minerals (Millenium Ecosystem Assessment, 2003). The components of well-being are experienced and perceived differently across cultures and socioeconomic conditions (Millenium Ecosystem Assessment, 2003). Narayan in his research (Narayan et al., 2000) found the consensus of poor people in 23 countries indicated five linked components on well-being among other: The necessary material for a good life (having enough of food, work and assets), bodily wellbeing (being healthy), security (civil peace, personal safety and secure environment), social well-being (self-respect, gender equity and good social relations) and freedom of choice.

The definition of well-being is context dependent, reflecting local personal and social factors (Prescott-Allen, 2001). In his book (Prescott-Allen, 2001) defined human wellbeing as *"a condition in which all members of society are able to determine and meet their needs and have a large range of choices to meet their potential".* The component of human well-being consists of health (physical & mental health), wealth (income, financial system), knowledge (culture, education, communication system), community

(security, freedoms), equity (benefit distribution, gender equity) (Prescott-Allen, 2001). He also defined ecosystem well-being as *"condition in which the ecosystem maintains its diversity and quality—and thus its capacity to support people and the rest of life—and its potential to adapt to change and provide a wide range of choices and opportunities for the future"* (Prescott-Allen, 2001). A sustainable development objective can only be achieved if both human and ecosystem well-being are fulfilled.

The Millennium Ecosystem Assessment examines how changes in ecosystem services influence human well-being. It posits human as integral parts of ecosystems and cannot be separated from it. Social, cultural and economic factors that do not have direct linkage with ecosystem can alter the human well-being condition that results in influence the ecosystem (Millenium Ecosystem Assessment, 2005a).

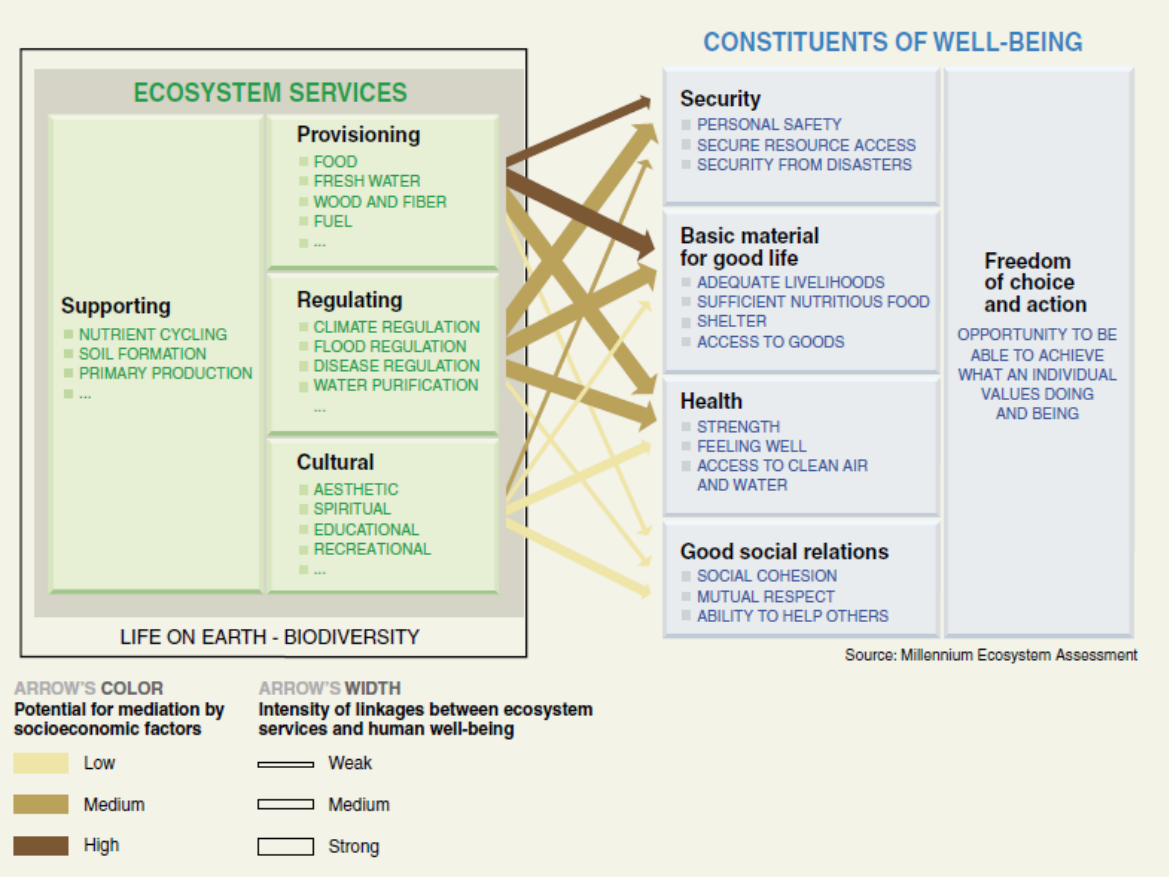


Figure 2 Linkage of Ecosystem Services and Constituent of Well-being
(Millenium Ecosystem Assessment, 2005a)

This figure shows linkages between ecosystem services type and constituents of human well-being. It also reflects the socioeconomic factors to mediate each linkage. The mediation level and the strength of the linkages are varied in different ecosystems and area.

2.2 Conceptual Framework

This study follows the conceptual framework in **Figure 2**. The framework expresses the linkage of ecosystem restoration, ecosystem, ecosystem services and its impact on human well-being. Ecosystem restoration is one of the strategies to increase the ecosystem services provision (Bullock et al., 2011). The ER Project management and activities will affect both ecosystem services' quality and quantity in providing benefit to human. The sustainable and equitable human well-being depends on the linkage of ecosystem services and who is the user and how they use those services (Millenium Ecosystem Assessment, 2005a). Therefore, ecosystem services changes as a result of the ER Project activities in Katingan and Kotawaringin Timur Districts will affect the local communities' well-being. The inhabitants whom their livelihood are dependent on the forest will receive impact on their well-being (i.e. important material for a good life, security, and health). Furthermore, changes in the communities' well-being affect the ER Project's success rate. Social Impact Assessment is used to evaluate the ER Project activities' impact related to the communities' well-being that lives in and near the concession area. This assessment can be input for recommendation formulation to improve the ER Project performance. The detailed research methods are explained in **Chapter 2.3 and 2.4.**

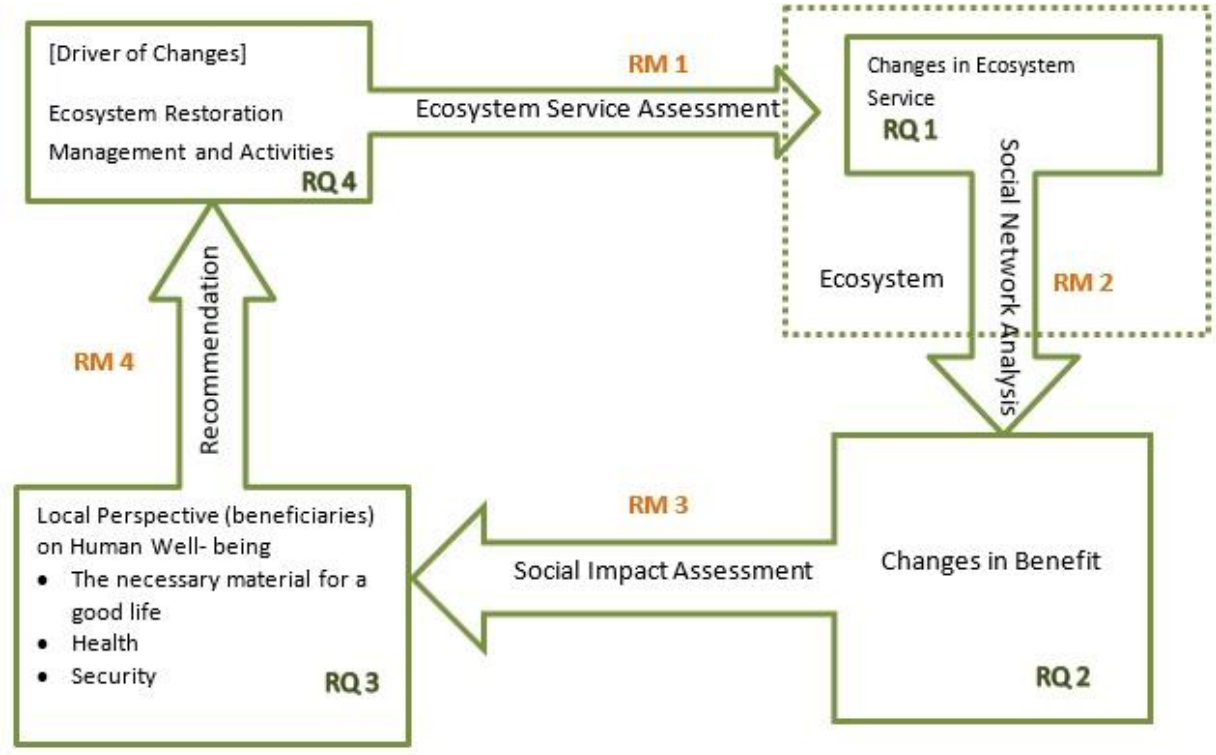


Figure 3. Conceptual Framework of Research. The boxes include the RQs and the arrows consist the methodologies (RMs)

2.3 Data Collection Methods

This research combined primary and secondary data collections which consist of desk reviews, observations and in-depth interviews. The primary and secondary data collection arrangement is described in the subchapters below.

2.3.1 Secondary Data Collection

Secondary data and information were collected from the Katingan and Kotawaringin Timur statistic reports, government documents, villages profile documents and the ER Project's technical reports. This method was helpful to design subsequent primary research and provide ER Project's baseline information such as the study site's social conditions and the ER Project activities.

2.3.2 Primary Data Collection

Observations and in-depth interviews were carried out in the field research from 1st October to 15th December 2016. Before the field research was conducted, the question list for the interview was prepared. The data collection design summary can be seen in **Annexe** I.

Direct Observations

Direct observations were implemented during two and a half month stays in study sites. I stayed for about two weeks in local community houses in each four villages. This method was used to capture critical behaviour and patterns, and ground checked the key ecosystem services (key ESs) and human well-being indicators taken from the literature review. During the observations, important notes were taken and used for further triangulation analyses. I was involved in community activities to fully understand the local communities' living conditions, the changes of key ecosystem services and the ER Project's impacts.

In-depth Interviews

The in-depth interviews used open-ended questions and were being done in informal conversations. The interviews were conducted both individual and group interview. Personal interviews allow respondents to reveal their thought about the key ESs' changes and the impact of the ER Project. Before conducting the interview, the respondents were selected by snowball sampling method that offers practical advantages for explorative and descriptive research. The respondents were selected by doing discussions with local government (the head and secretary of each village) and field staff of Puter Foundation who have a thorough understanding on the local communities' characteristic and know whom would provide the best and complete answer. The respondent's selection were based on their time availability, the length of time in doing particular job related with the key ESs, the depth understanding about their jobs, the ability to express themselves and the openness (to minimise language barrier and conflict while doing an interview). The primary respondents were interviewed and asked their referral to be interviewed to gain a richer and deeper information. The researcher stopped asking reference if the data was sufficient.

2.4 Data Analysis Methods

This chapter explains the detailed data analysis method and tools used in this research.

2.4.1 Valuation of Ecosystem Services

After field research, a transcript was written including important notes from the observations and in-depth interviews. The transcript was not precisely cover the entire field work in detail but emphasised the important messages from the observations and interviews' process. The transcript was used to write villages' baseline condition and answer the research questions.

This research elaborated the key ESs that have strong linkage with human well-being inside the project area (local level) and relatively provide benefit in a short time. The selected key ESs from desk study then being checked by in-depth interviews and observations in the field work.

Table 1. Key Ecosystem Services Used by Communities from The ER Project Concession Area

Services	Sub services	Definition	Example
Provisioning			
Food	Capture fisheries	Wild fish caught through non-farming methods	Fish
	Wild foods	Wild plant and animal species	Deer, Mushroom
Raw Material	Timber and other Wood products	Goods and products that made from trees harvested from natural forest ecosystems, plantations, or non-forested lands	Timber Gemor
	Fibres and resins	Non-wood and non-fuel fibres and resins	Jelutung Damar
Mineral and metal*			Gold*
Cultural & Amenities			
Ethical and spiritual values		Aesthetic values people attach to species	Bird voice

Source: adapted from MA (2005) and De Groot (2006) and ground checked by field work.

Gold is one of the resources provided by ecosystem. Although no categorie from Millenium Ecosystem Assessment mention about minerals and metal, in this research, gold is necessary to be discussed since it is important for communities' livelihoods. The insertion of minerals and metal in this study is elaborated in the discussion chapter (**Chapter 9**).

Triangulation data analysis was done by combining multiple data from different sources to have rich and complete data. Secondary data (The Katingan and Kotawaringin Timur statistic reports, government documents, villages profile documents and the ER Project technical reports), the result of in-depth interviews and observations were combined to gather information about the quantity, the key ESs' price and cost spent by the communities to get them.

In the ES valuation, changes of both quantity (total weight, the number of services) and key ESs' economic value were revealed. It reflected the benefit used by communities. The key ESs' economic value comparison between before and after the ER Project's implementation used the direct market valuation. Direct Market valuation is using exchange value from the actual market of ecosystem services (De Groot, 2006). The key ESs' changes were visualised in the graph. The result of this analysis is an input to analyse the ER Project's impact.

2.4.2 Social Network Analysis (SNA) for Stakeholder Mapping

SNA in formulating stakeholder mapping was used to capture the relationship among actors and understand the key stakeholder that relate to the ER Project. This analysis was also an entry point to Social Impact Assessment (SIA).

The term stakeholder refers to all groups in a society that are connected to one another by mutual needs and values (GTZ, 2007). Stakeholder groups are important to be identified to articulate their interests and power and utilise it to decide the involvement strategy. The engagement types can be dialogues, negotiations and alliances with other stakeholders (GTZ, 2007)

Stakeholder Analysis is an important tool for policy and program analysis. This approach can be used to understand the condition and changes in a system by identifying the actors and assessing their interests (Grimble & Wellard, 1997). Stakeholder analysis has been developed in response to the actors' varies interests and different objectives in one particular policy and program (Grimble & Wellard, 1997). It is relevant to be used in complex situations with compatibility problems between objectives and stakeholders for example in Natural Resource Management (NRM) (Grimble & Wellard, 1997). It is important to use SA in NRM because it is characterized by a complex web of interests and tradeoffs between interacting sets of local people, government departments, the national and international donor (Grimble & Quan, 1993).

Social Network Analysis in formulating stakeholder mapping in this research consisted of several steps, among others:

1. Stakeholder group identification
2. Stakeholder interests and power investigation
3. Centrality value of stakeholder group investigation

The stakeholder identification and selection were taken from a triangulation analysis. Once the stakeholder list, their powers and interests were identified, next step was to visualise their relationship with SNA. SNA is a research technique that analyses the social structure that emerges from the combination of relationships among individual or groups in the system (Wasserman & Faust, 1994). SNA reflect the social relationships regarding network theory that consists of ties and *nodes*. Nodes are the stakeholder/ actors within the networks while ties are the connection between actors. The importance of stakeholder is showed by centrality value. This value roughly indicates the stakeholders' social power based on how they connect to another actor within the network (Wasserman & Faust, 1994).

Three most popular centrality types among others: 'closeness', 'degree' and 'betweenness centralities'. The 'degree centrality' shows the node (stakeholder)'s influence and importance on the network. It reflects the actor who has more connection tend to has more social power. The 'closeness' shows the more central node tends to have a lower distance to other nodes. It reflects the length of time to communicate information from one to another stakeholder. 'Betweenness centrality' shows the frequency of a node being a bridge between two other nodes. It reflects that a stakeholder has a communication control between stakeholders (Freeman, 1977).

This research did not quantify the specific degree, closeness and betweenness centrality. The yEd graphic editor was used to automatically visualise the overall centralities between stakeholders based on the ties that connect to each nodes. The value of the centrality in the stakeholder mapping showed the social power, length of time/ effectivity for communication and bridge from one to other stakeholders related to the ER Project.

2.4.3. Triangulation in Social Impact Assessment (SIA) and Recommendation Formulation

SIA is defined as the process of assessing the social consequences that are caused by specific policy actions or project development (Burdge & Vanclay, 1996). Integrating ecosystem services into impact assessments offers more comprehensive and realistic assessment of a project's immediate and long-term impacts (Henningerr & Venn, 2013). In this research, the SIA was done to investigate the impact on the well-being of the local community from the ER project activities.

The well-being that were addressed in this research among other : the necessary material for a good life (including secure income, food, shelter), health (having a healthy physical environment); and security (natural and other resources secure access, safety of person and possessions, and living in a predictable and controllable environment, natural and human-made disasters security). Other human well-being components such as gender equity and social relation were not be investigated in this research. The impact of human well-being from the ER Project was investigated by doing field research that was carried out during October to December 2016. This result of this assessment can be used as the project ex-nunc evaluatiion. Ex-nunc is interim evaluation of policy, program or project that can provide recommendation for modification.

The combined quantitative and qualitative data can increase complementary aspects of the same topic and reinforce the research finding validity (Patton, 2002). Triangulation can play a beneficial method in monitoring and evaluation since it generates new insights and provides a more comprehensive perspectives on the topic.

The quantitative analysis to investigate the changes in key ecosystem services were explored and combined with the observations and in-depth interviews result to investigate the ER Project's impacts. In-depth interviews investigated thorough information about the key ESs' impacts and the ER Project's activities. The observations were done in field work provided insight that might not be unearthed from the in-depth interviews process.

In this research, coding was used to categorise the impact of the ER project by triangulation data. Coding is the data analysis process by combing and clustering the data and information based on categories. The initial codes were selected in asking the impacts, such as health, necessary material to life and security. However, the respondents were free to mention other impact categories. Each code then described to be the impact of the ER Project.

The recommendation in addressing the impact and improving the ER Project performance was formulated by literature review from the similar cases and best practices of ER in other regions, and local perspective taken by observations and in-depth interviews.

Table 2. Summary of Methods that Have Been Used in This Thesis to Assess The Impact of ER Project on Well-being of Local Communities in Katingan and Kotawaringin Timur Districts.

Research Question	Activities	Data sources or tools used	Tools
What are the changes in Ecosystem Services after the implementation of the Ecosystem Restoration Project in Katingan and Kotawaringin Timur Districts	Quantification of economic value and quantity of key ecosystem services.	Secondary data - Katingan and Kotawaringin Timur statistic reports, - Government document, - Villages profile - Katingan Ecosystem Restoration Project technical reports Primary data collection - Observation - In-depth interview	Open ended questionnaire
Who are the stakeholders of Ecosystem Restoration Project?	Mapping of stakeholder, Measurement of stakeholder centrality		Open-ended questionnaire, yEd Graph Editor
What are the impacts of ER Project on human well-being of local communities in the project zone?	Impact analysis with triangulation – Coding		Microsoft Excel, yEd Graph Editor
What recommendations can be given to improve the Ecosystem Restoration Project in Katingan and Kotawaringin Timur Districts?	Qualitative analysis with triangulation		Microsoft Excel

3. Description of Ecosystem Restoration Project Katingan and Kotawaringin Timur Districts.

The ER Project in Katingan and Kotawaringin Timur Districts is managed by PT. Rimba Makmur Utama (RMU). This project is designed in contributing to emission reduction and remaining peat swamp forests conservation by reducing forest degradation and deforestation within REDD+ scheme (Katingan Project, 2015). This project was initiated in 2008 and officially started in 2010. The operational period started since November 2010 to October 2070. About 149,800 hectares of the production forest of Katingan and 5,000 of Kotawaringin Timur is granted by the Ministry of Forestry to PT RMU to be restored under ER Project (Katingan Project, 2014).

3.1 Project Objectives

The primary goal of ER Project is to implement a sustainable land-use model. This goal is materialised by conducting activities for forest degradation and deforestation reduction, biodiversity conservation, habitat and ecosystem restoration and economic opportunities enhancement for the local people of Katingan and Kotawaringin Timur Districts (Katingan Project, 2014). This goal is divided into climate, community and biodiversity objectives. Climate targets consist of GHG emission reduction by peat drainage and fires prevention; ecological values enhancement, and research and development activities. Community goals include economic opportunities creation to reduce poverty and sustainable livelihoods; community resilience improvement; and ecosystem services enhancement for the overall well-being of the project area. The last is biodiversity objectives by biodiversity conservation and protection, natural habitats and ecological integrity maintenance through ecosystem restoration and the management practices implementation based on the latest science and research and development (R&D) activities' result. The detailed objectives and activities of the ER Project can be seen in **Figure 4** below.

3.2 Project activities

This Project conserves the peat swamp forest area based on science and research, field surveys, community participation and consultation. The activities include avoiding deforestation and peat drainage by obtaining the legal license and preventing the area from being converted to unsustainable land use. Another activity is reforestation programs that consist of community-led agroforestry, fire break plantation and intensive reforestation of total 4,433 ha of non-forest areas within the project area. The new saplings are grown by PT RMU and local communities in on-site nurseries and 100 ha in the Kampung Melayu Village area.

The drained peatlands rewetting and conservation are done to maintain the peatland ecosystem's integrity. Given the highly vulnerable area of fires, the ER Project takes fire prevention and suppression seriously by conducting participatory fire location mapping, early warning systems development, monitoring posts establishment, firefighting teams (Regu Siaga Api or RSA) formulation and awareness building for communities.

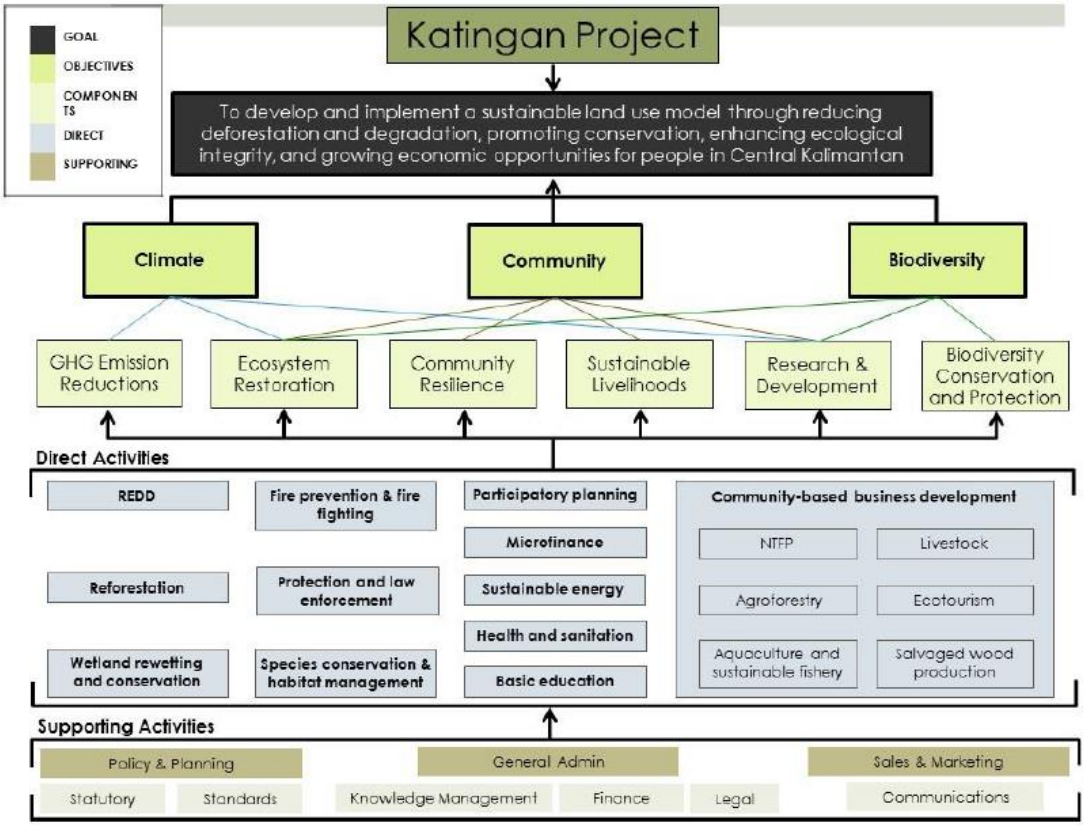


Figure 4 Katingan Project Framework
(Katingan Project, 2014)

Supporting the national law enforcement, the ER Project prevent illegal exploitation (i.e. encroachment, illegal logging, poaching, illegal gold mining, peat drainage), build physical demarcation of the project boundary and build monitoring posts at the forest entrance points. Not only the physical building, but this project will also mobilise participative forest ranger and patrol teams, develop community-led monitoring, conduct awareness programs and provide equipment for forest fire fighting training.

In biodiversity protection, ER Project area will be used to rehabilitate orangutan and protect their habitat as well as prevent them from illegal hunting.

This project conducts participatory community mapping and village planning to agree upon spatial information such as village boundaries and cultivated land owned by community members. All data points are validated together with the communities and recorded by GPS to create a spatial map that approved by communities.

The ER Project not only conducts activities in environment protection but also supports sustainable economic development and land use through promoting identified activities during the participatory planning process. The activities include the development of non-timber forest products, agroforestry, ecotourism, livestock, and sustainable fisheries. This project also assists sustainable local development

by supporting the development of small to medium sized businesses. A variety of mechanisms will be used, including the direct provision of microfinance to facilitate access to government financing schemes and international grants. The project microfinance will likely be channelled through local community groups known as Kelompok Swadaya Masyarakat (KSMs).

The ER Project promotes sustainable and renewable energies using locally available resources. Through the community-based planning process, the project will seek to increase energy efficiency, improve access to cleaner renewable energy while reducing the amount of fuel wood consumption. Initially, the work will focus on some pilot villages, to learn and develop methods, and then will be expanded more widely. Sustainable energy sources that will be considered include biomass cookstoves, biogas, and solar lamps.

This project also try to improve public health and sanitation services including awareness building in proper sanitation in the village, improve access to clean drinking water, and develop waste treatment facilities in each village.

The ER Project supports the local government's efforts to improve the primary education quality and the youth enrolment number and encourage the youth to pursue higher education. This supports will be done by providing scholarship programs for selected students and developing facilities at local schools as well as conducting capacity building training and educational workshops for teachers.

4. Description of Study Site

This chapter describes the study site's baseline profile of this research. The study site consists of four villages among others: Telaga and Kampung Melayu, Hantipan and Seragam Jaya Villages. These four villages are representatives of 4 different sub-districts (Mendawai, Kamipang, Pulau Hanaut and Seranau Sub-Districts) in two different Districts (Katingan and Kotawaringin Timur Districts). These villages were selected by its location, various ES characteristic taken by communities, livelihood variation and the possibility to explore different perspectives from communities about the impact of ER Project. The map of study site can be seen in **Figure 1.**

Population data in study site was not complete. Therefore, linear extrapolation was used to obtain time series data. The equation of linear extrapolation is:

$$\frac{(y - y1)}{(y2 - y1)} = \frac{(x - x1)}{(x2 - x1)} \qquad \textbf{EQ.1}$$

Where, Y = year
X = number of inhabitants

4.1 Telaga Village

Telaga Village is one of the nine villages located in the Kamipang Sub-Districts in the Katingan Watershed. There are many rivers and lake in Telaga Village among others Katingan, Nusa and Raman Rivers and Kalaru Lake which become the heart of the communities' life. The inhabitants use these rivers and lake as transportation medium, mining, fishing, showering and washing.

4.1.1 Land Use

The Telaga Village's land use consists of settlements, forest areas, and others. The detail of land use in Telaga Village can be seen in **Figure 5**. The inhabitants only cultivate small part of village since the soils are not suitable for farming due to tidal flood.

Figure 5. Land Use Type in Telaga Village 2014
(Compiled based on BPS, 2014)

4.1.2 Social and Economy Condition

The majority tribe of inhabitants in Telaga Village are Ngaju Dayak, Banjar and Javanese (the largest immigrant groups that were being settled in Telaga Village). The immigrants from Banjarmasin and Java were entering Telaga Village gradually and culminated when logging business and gold mining started in the 1970s and 2006 respectively. The population data of Telaga Village can be seen in **Figure 6**.

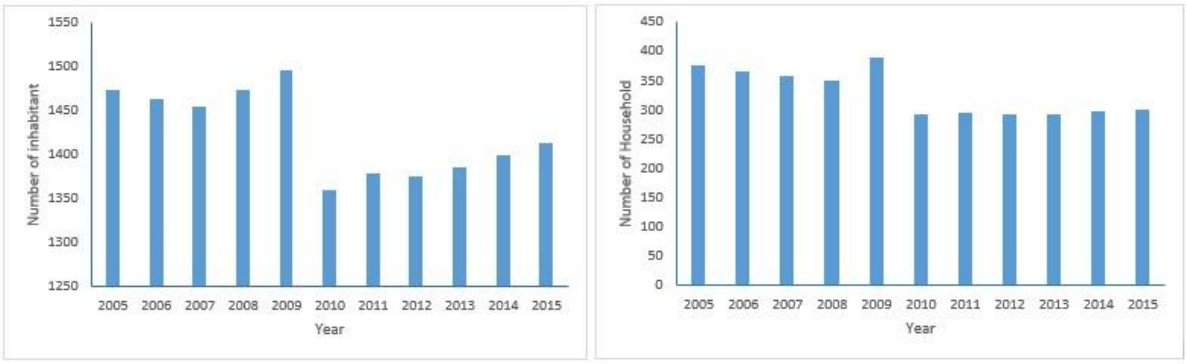


Figure 6a and 6b. Population Dynamic in Telaga Village 2008-2015

(2006- 2008 data are extrapolated from BPS, 2016a, 2009-2015 data are compiled based on BPS, 2016a)

The Telaga Village's soil condition is inappropriate for agriculture because of the tidal flooding, so that difficult to produce a farming product such as rice as a staple food, corn, fruits and vegetables. The inhabitants are entirely dependent on other neighbouring villages to meet their food needs. They buy rice from other villages traders such as Katingan I, II, and III in the Mendawai District, Kasongan, Kereng Pangi and Katingan Kuala Sub-districts. Commodities grown by the communities to earn money are vegetable fruits and root tuber crops such as cassava, spinach, watermelon, corn, and bananas. However, the village productivity is still limited and insufficient for the community's demands.

Before the ER Project started, about 70% of inhabitants worked as an illegal logger. After the project starts, the residents work mainly in gold mining, bird and deer hunting, fishing, owning small shop, water taxi service, non-timber forest production (NTFP) collecting, swiftlet nest business, carpenter (builder), lumberjack, oil palm company labor and civil servants (teachers and health workers).

In Dayak culture, man and women have equal right. Each gender has the same opportunity to inherit a social right and influential position such as shaman (a traditional doctor that cure people using rituals and spells). The majority of women in Telaga Village are housewives and participate in getting additional money for the household (fishing, vegetable gardening, managing a grocery store).

4.2 Kampung Melayu Village

Kampung Melayu Village is one seven villages in Mendawai Sub-District in Katingan District. This village is overlapped with oil palm plantation area of PT Persada Era Argo Kencana (PT. PEAK). The west side of this village is intersected directly with the ER Project Concession area. The distance between the settlement with PT PEAK and ER concession area is about 2km and 5km respectively.

4.2.1. Land Use

Kampung Melayu Village has the total area of 15,000 Ha ((BPS, 2016a)). The land use consists of dry land, settlement, forest, and others. The land use type of Kampung Melayu can be seen in **Figure 7**.

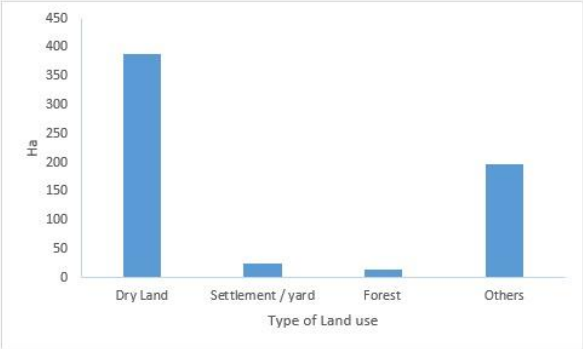


Figure 7. Land Use Type in Kampung Melayu Village 2014
(Compiled based on BPS, 2016a)

4.2.2 Social and Economy Condition

Kampung Melayu Village's inhabitants consist of Dayak, Banjar and Javanese tribes. In 2015 the total of the population in this village was 570 people. Number of the population in Kampung Melayu Village can be seen in **Figure 8 a and b.**

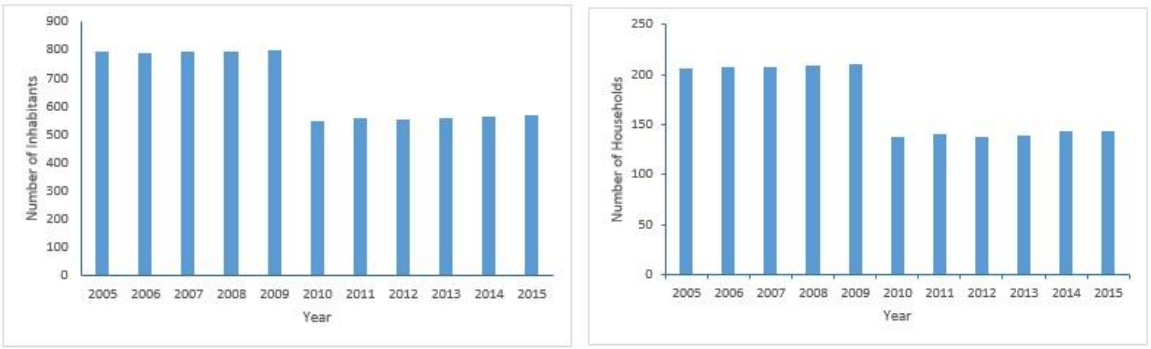


Figure 8a and b. Population Dynamic in Kampung Melayu Village 2009-2015
(2006- 2008 data are extrapolated from BPS, 2016a, 2009-2015 data are compiled based on BPS, 2016a)

From **Figure 8** can be seen, there was a significant population reduction from 2009 to 2010. This depopulation was because of the illegal logging restriction from the national government to reduce deforestation and forest degradation. The communities moved to other villages to find livelihood alternatives such as illegal mining in Telaga Village and oil palm plantation in Kotawaringin Timur District. They also work in the agricultural sector; the commodities are rice, cane, and rubber. Rice planting is being done during October to March in every year. The rice yields are only enough to meet the needs of staple food for one family in a year. Therefore, food security is not fulfilled and the communities will suffer in case of crop failure.

Besides farming, several communities have inherited a rattan plantation. In 2011 Indonesia tended to protect rattan furniture industry by the raw rattan export banning regulation through Permendag No. 35/M-DAG/PER/11/2011. Before the implementation of this regulation, the income from rattan plantation was 21 Euro/ week. After the execution, the rattan price falls significantly so that no communities are depended on rattan plantation anymore. Another livelihood is fishing. Fishing activities are done mostly in the early of the dry season (in July-August). The tools that are used in the fishing activities are *tempirai/ pengilar, bubu*/ traps*, lunta* / nets and fishing rods. The fishery tools' pictures can be seen in **Figure 9-12.** In addition, deer and bird hunting, swiftlet nest business, water taxi driver are still being job alternatives in this village.

Figure 9. Bubu
Source: www.antarabanten.com

Figure 10. Tempirai/ Pengilar
Source: Author

Figure 11. Traditional Fishing Rod
Source: www.*thebamboorodroom.yuku.com*

Figure 12. Lunta
Source: Author

4.3 Hantipan Village

Hantipan Village is one of the 14 villages in Pulau Hanaut Sub- District, Kotawaringin Timur District. It has lowland topography within Mentaya River region. Hantipan has a relatively high potential of natural resources since the major land use is the production forest. About 54% of 2.816 ha is production forest, 18% coconut plantations, 11% paddy fields, 13% rubber and approximately 12% unutilized land (bush). For more land use details can be seen in **Figure 13** below.

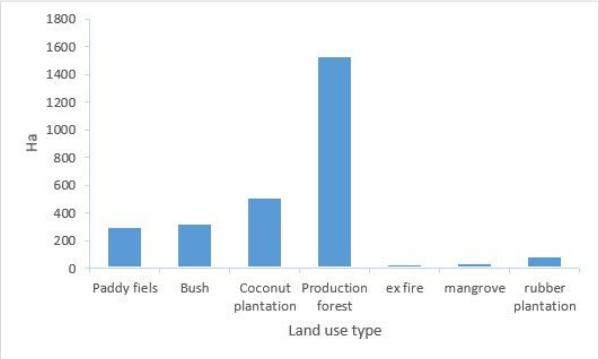
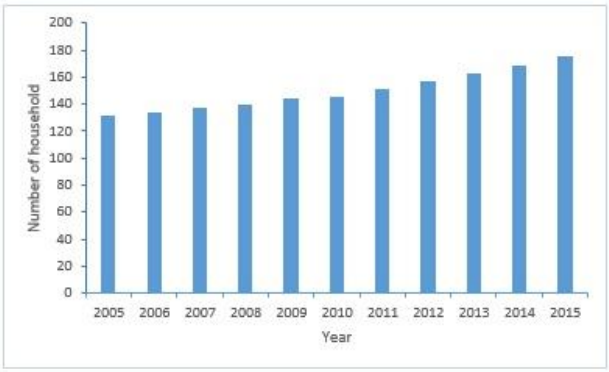


Figure 13. Type of Land Use in Hantipan Village 2014
(Compiled based on BPS, 2016b)

4.3.2 Social and Economy Condition

Hantipan Village community does not have a dominant tribe. The tribes in the community are the mixture of Dayak, Malay, Banjar, Javanese and Madurese. These tribes have inhabited this village since the settlement establishment of this location. Until now the total number of villagers is 640 people (175 households).



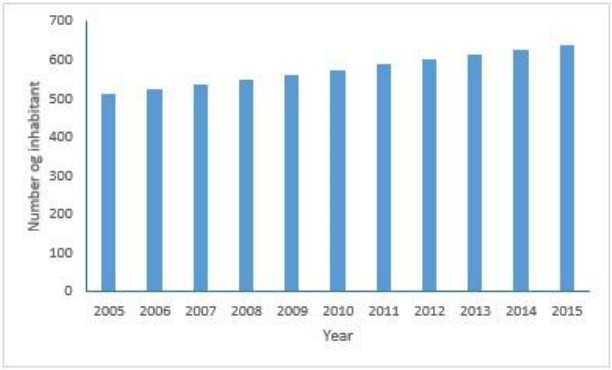


Figure 14a and b. Population Dynamic in Hantipan Village 2009-2015
(2005- 2008 data are extrapolated from BPS, 2016a*, 2009-2015 data are compiled based on* BPS, 2016a)

The major communities work in the coconut plantation and paddy field since this plantation dominated the land use type. About 50% of the communities depend on the coconut plantation that is still productive in the Hantipan Village. Some of the communities have coconut plantation about 0,5 Ha per household. This size is usually consist of four lanes (each lane consist of 35 trees). The owner of the coconut plantation manages the harvesting and distribution process. Sometimes they hire their neighbor to help them harvesting the coconut.

Almost every family own a *sawah* (paddy field). The average size of *sawah* is between 0.5 ha to 1 ha per household. Rice production is enough to cover household consumption for 6-12 months. Rice crop planted are Kapuas and Ciherang Rice varieties. These varieties are widely planted because they can grow in less water field since Hantipan Village does not have a proper irrigation system and still relies on

rain-fed systems. Also, some of the households do fishing and raise livestocks, such as chickens and goats to generate income.

Illegal logging is still being done by communities as the main livelihood, even though the government have prohibited it. The timber from logging is processed to be planks for house and boat materials.

4.4 Seragam Jaya Village

Seragam Jaya Village is one of the six villages in Seranau Sub-District, Kotawaringin Timur District. This village was extended from Mentaya Seberang Village. This village is one of transmigration destination areas in Kalimantan that became a definitive village in 2015.

4.4.1 Land Use

The total of Seragam Jaya area is 1026 Ha that consists of the settlement, public cemetery, village land, soccer field, rubber, laos, oil palm plantation, shrubs and production forest. The detail land use of Seragam Jaya Village can be seen in **Figure 15**

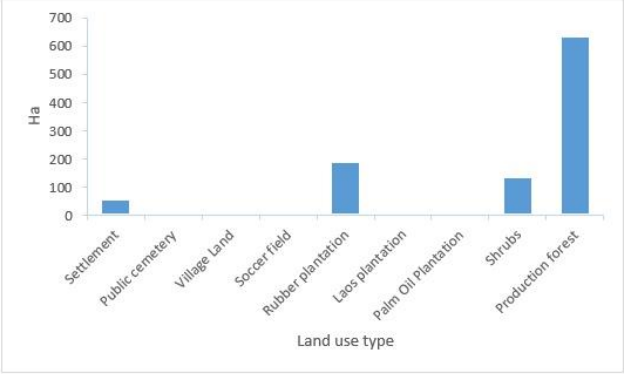


Figure 15. Type of Land Use in Seragam Jaya Village 2013
(Compiled based on Puter, 2013)

4.4.2 Social and Economy Condition

Historically, Seragam Jaya was the transmigration settlements within Mentaya Seberang Village that implemented in the fiscal year 2004. The transmigrants came from the local communities (Kalimantan) and other provinces such as Java and Nusa Tenggara Timur. The details information of population dynamic can be seen in **Figure 16**.

In general, transmigration communities has a dynamic socio-cultural interaction because they tend to be heterogeneous multicultural. Seragam Jaya communities consist of diverse social and economic backgrounds, cultures, occupations, and religions. They are required to be able to interact with fellow citizens and locals with its diversity.

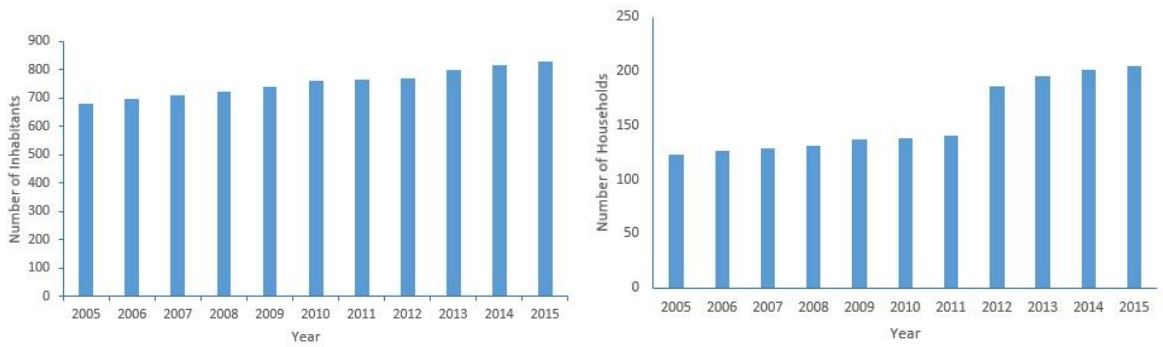


Figure 16a and b. Population Dynamic in Seragam Jaya Village 2005-2015

(2005- 2008 data are extrapolated from BPS, 2016a*, 2009-2015 data are compiled based on* BPS, 2016a)

In 2004, communities depended mainly on Dammar (resin from genera *Shorea*, *Balanocarpus* or *Hopea).* Damar were collected in the fossilised form on the ground that usually occurred after forest file. As an alternatives, they also collected mushroom from forest to sell it within the village.

Recently, the primary livelihood of communities is in the agriculture sector. However, the communities' income level in the Seragam Jaya Village in this sector is still very low. It is because some area of the village is less fertile and have unfavourable topography and because of limitation of communities skill and capital. To cover their daily needs, he communities do the side jobs such as become labour in oil palm plantation, carpenter, plumber, motorcycle taxi driver and worker in the Sampit City. Seragam Jaya soils are peat moss with an average depth of over 3 meters so that it requires time and technique in utilising the land resources. The crops that quite adaptable with the soil condition in Seragam Jaya Village are Lengkuas/ Galanga root (Alpinia galangal), pineapple (Ananas comosus), and rubber (caoutchouc) plants. The picture of the crops can be seen in **Figure 17, 18** and **19.**

Figure 17. Lengkuas/ Galanga root (Alpinia galangal)
Source: Author

Figure 18. Pineapple (Ananas comosus)
Source: Author

Figure 19. Rubber (caoutchouc)
Source: Author

5. Ecosystem Services Changes as Result of The Ecosystem Restoration Project in Katingan and Kotawaringin Timur Districts.

The changes of the key ESs in study site are quantified based on primary data from in-depth interviews and secondary data from village profile reports. The year 2010 is selected as the milestone year to compare the quantity and economic value of the key ESs between before and after ER Project implementation. In 2010 the ER project had started the outreach activities even though the legal license of concession area in Katingan District has been granted in 2013 and Kotawaringin Timur District in 2016. The activities consist of participative mapping and transect survey to calculate carbon sequestration value (Katingan Project, 2014). The key ESs condition before and after the ER Project are represented in 2005-2010 and 2011-2016 data respectively. The changes in its quantity and economic value reflect the impact of the ER project in ecosystem services provision for communities that live in and near the concession area. The economic value is assessed in Euro (1 Euro = 14.000 Indonesian Rupiah).

Based on the in-depth interviews, the key ESs that are important to fulfill the communities' primary needs and significantly being affected by the ER Project consist of provisioning, and ethical and spiritual value services. The provisioning services include raw materials (timber); foods (fish, mushroom, and deer); resin and fibre (Jelutong, Gemor, and Dammar) and minerals and metal (gold). Ethical service includes bird voice (Cucak Hijau, Murai Batu, Kacer, and Beo) (see **Table 1**). These key ESs are quantified to see the changes in result of the ER Project implementation.

The time series and detailed data about the demographic condition, the key ESs' economic value and quantity used by communities are not available. Therefore, to get the closest average number of ecosystem services quantity and economic value per year, estimation and extrapolation are being done. The time series data in the population number are gained by making a linear extrapolation. The average number of population before and after ER Project are multiplied with the average benefit (quantity and economic value) used per year.

The interviews were done to investigate each key ESs estimation used by community per day/ week/ month. The data then are extrapolated to get the total use in a year and multiplied with the total of the user in the village. Each household/ group were assumed to use same amount key ESs since the length of time, area, method and tools used to collect the key ecosystem services and the type of ES were relatively same.

5.1. Raw Material

One of the important raw materials that are provided by forest in the concession area is harvested wood/ timber. Timber is used for domestic purposes (building houses and bridge) and commercial industry (to be processed and exported to other areas).

The abundant forest resources and the low law enforcement caused the rampant of illegal logging activities took place in Katingan and Kotawaringin Timur Districts. Not only local communities but also immigrants from outside the region work in logging business in these Districts. The immigrants began to enter these forest areas when the reform period and regional autonomy in Indonesia were enacted (in 1999). They mostly came from South Kalimantan, Java, and South Sumatera Provinces to be a logger. The local inhabitants and immigrants were given initial capital by *cukong* (financiers) to get as much as timber from the forest. They were financed for conducting logging activities with a revenue sharing system in which the loggers would obtain reimbursement for the logging cost and get paid from the amount of timber they got.

During the years 1999- 2001, Ramin (*Gonystylus)* was an excellent wood for logging industry because of its good market value. Meanwhile, sawmills and bansaws (wood collecting shelters) were mushrooming in Katingan Watershed, especially along Mendawai to Katingan Kuala District. After the Ramin logging moratorium, some loggers started to log another wood's type such as Meranti (*Shorea spp*). The excessive logging in this area led to decrease of wood resources. Previously, they can get the 60 cm diameter size of timber easily, but now they could only found 15-30 cm diameter size.

Before Implementation of The Ecosystem Restoration Project.

Before ER implementation, there were more than 300 bansaws (timber collector shelter) along Katingan and Mentaya River (two big rivers around project area). These bansaws collected the timbers from Katingan and Kotawaringin Timur forests that being logged by communities then sold them to Java (Semarang, Surabaya City), Kalimantan (Banjarmasin City) and Sumatera (Palembang City).

Almost all of communities worked in the logging business. There were about 70% inhabitants of Telaga Village (about 248 households), 90% residents of Kampung Melayu Village (177 households), and 90% residents of Hantipan (about 125 families) worked as a logger. There were no logging activities in Seragam Jaya Village because at that time this village was still a new transmigration area which its inhabitants focused on cutting trees from their land to build houses.

Each household in study site earned about 200 Euro per month in the dry season and up to 700 Euro in the rainy season. This amount was more than enough to cover a standard living cost in Kalimantan. The income that generated from logging business were usually spent for tertiary needs such as for party and entertainment. The communities used to earned lots of money easily from logging business and thought this condition would be last for a long time. Some of them spent money on electronic devices and jewellery but rarely bought some lands for investment. Therefore, after logging was stopped, they should adapt to drastic livelihood changes.

Loggers usually worked in a team; each team consisted of about four people. There were about 62 teams in Telaga Village, 44 teams in Kampung Melayu Village and 29 teams in Hantipan Village. Each team has different sharing calculation of cost and profit and the working system.

In Telaga Village, each team member get about 3m³ per day consisted of about 50% of the result were Meranti Wood and the rest were Belangeran, Jingah, Ramin, Perupuk, and Banditan Wood. Logger teams were usually spent a half month in the forest of the dry season. Each team needed about 10 litres of fuel/day for electric chainsaw and transportation. They spent for about 14 Euro per day The entire groceries supplies such as oil, fish, rice and spices were provided by the bansaw owners. In the dry season, loggers were using *kuda- kuda* (see **Figure 20)** to transport the timbers manually. In the rainy season, the timbers were carried by small canal to the lowland then stacked in the shipyard. The stacked timbers then being sent to the creek and delivered to the collecting shelter.

In Kampung Melayu Village, Each logger team get about 90 m³ of Meranti Mix Wood per month which worth 18 Euro/ m³. The timbers' types taken by communities in Kampung Melayu Village were Meranti, Punak, and Bengkirai Wood. However, only Meranti Mix wood was calculated because of no data available for other timbers types. In one month, each logger team in Kampung Melayu Village spent about 141 Euro and stayed about three weeks in the forest.

In Hantipan village, each team get about 100 m³ Meranti and 20 m³ Ramin Wood per month. Ramin Wood price was 28 Euro, and Meranti Wood was about 14 Euro. The logging activities cost per team in Hantipan Village was about 211 Euro. In the dry season (July- November), loggers in Hantipan villages could not log the trees because the water inside the forest was receded and it was hard to move the timber out from the forest. In this season, almost all of communities in Hantipan Village cultivated their land to fulfil their daily needs.

After Implementation of The Ecosystem Restoration Project.

After ER Project implementation, the illegal logging activities are banned. There are no logging activities in Kampung Melayu and Seragam Jaya Village. On the other hand, logging activities still can be found in Hantipan Village and Telaga Village. The logging location in Hantipan Village more or less unchanged but the loggers must walk farther and got less wood compared to before 2010 condition. The logging location of Telaga Village is not in the concession area anymore but the surrounding forests in the village. The loggers should process the timbers into planks/lumbers because bansaw and sawmill have already gone. Some of Hantipan and Telaga Village's inhabitants work as a lumberjack and earn about 200 to 350 Euro per month.

On the average, a lumberjack in Telaga Village produces about four m³ planks every month. The type of timber are Meranti, Belangeran, Jingah, Perupuk and Banditan Wood. Based on the in-depth interviews, the amount of timber type sold depend on the order, but overall it was almost same percentage for each type. Each m³ of planks in Telaga Village worth 140 Euro. The total cost for each m³ is 56 Euro to hire crafting assistant, food and fuel for transportation and chainsaw. The profit of each m³ timber is about 85 Euro. Currently, after the implementation of the ER Project, 16 people work as lumberjack in Telaga Village. They mostly take the remaining timber that logged in the logging era. The remainig timbers were neglected because the loggers left them to avoid for being arrested by police. Timbers are still needed by communities to build houses and bridge so that the Telaga Village government allows

lumberjacks to take the remaining timbers and sell it to the communities. The figure of timber utilisation to build a bridge in Telaga Village can be seen in **Figure 21.**

Figure 21 Timber for Building Bridge in Telaga Village.
Source : Johransyah

In Hantipan Village, about 30% of inhabitants (42 households) still do the logging activities after the ER Project's implementation and produce planks. The planks are sold to other residents within Telaga Village and to other villages to build houses, bridges, swiftlet buildings, and boats. Each lumberjack household in Hantipan Village gets about 0,2 m^3 Punak Wood (the community prefers this wood for building a house and swiftlet building) and about 0.1 m^3 Bintan Wood per day. The loggers stay for two days in the forest and spend about 35,6 Euro for fuel and food. The loggers spend about 12-liter fuel and walk for about 4 hours to find Punak and Bintan Wood. The quantity of each timber in Hantipan Village calculated based on the number of timber taken from each logging activities multiplied with the total logger teams. The timber's type of before and after ER Project implementation are different because after ER it is hard to find Meranti and Ramin Wood so that these types are not the priority anymore. The calculation of changes in timbers' quantity and economic value of Telaga and Hantipan Village can be seen in **Table 3-5** and **Figure 22-28** in **Annex II**.

The changes of Timber in study sites in quantity and economic value can be seen in **Figure 29** and **30** respectively.

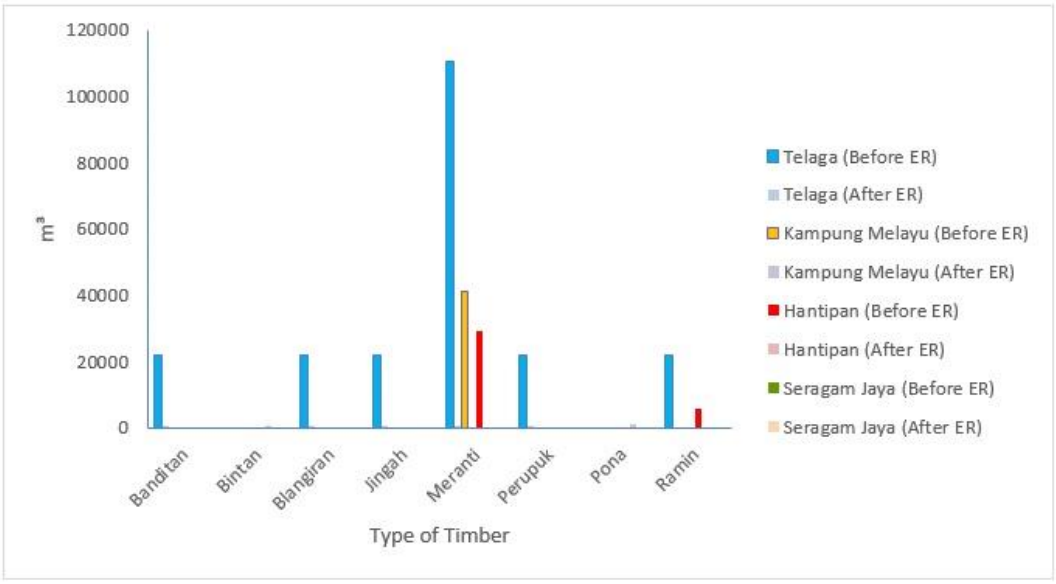


Figure 29. Changes of Timber Quantity in Study Site Before and After ER project

Source: In-Depth Interviews (n: 8)

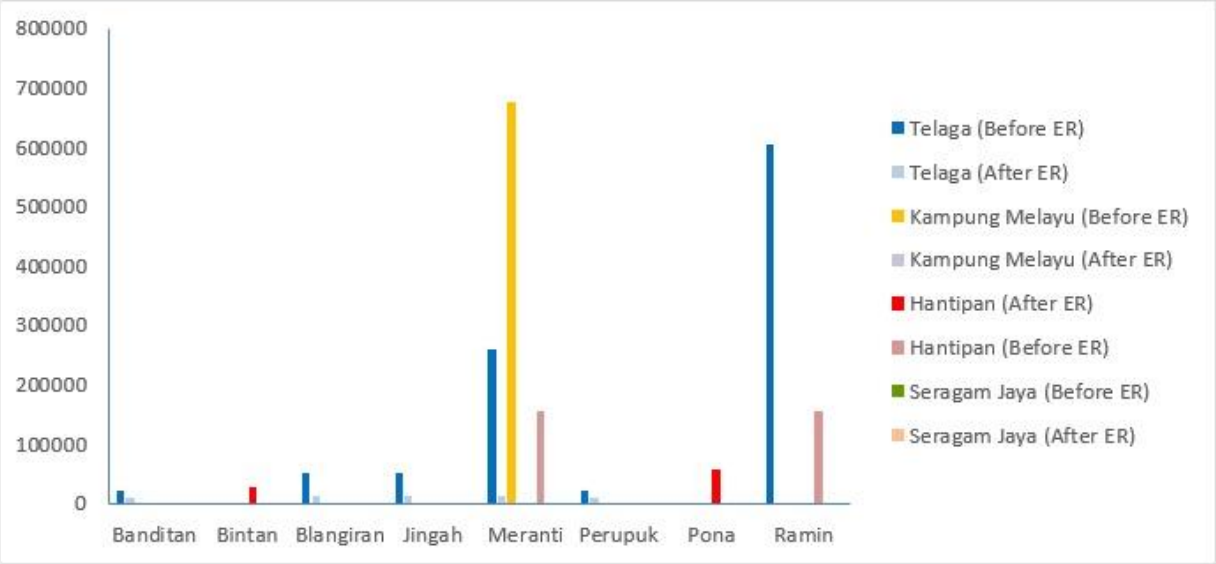


Figure 30. Graph of Changes of Timber Economic Value in Study Site before and after ER project.

Source: In-Depth Interview (n: 8 people)

From the figure above can be concluded that timbers' quantity and economic values used by communities are decreasing. These decreases are because of the illegal logging prohibition to protect the forest integrity. Also, the decline of the benefit used by communities is because of timber overexploitation in logging era. The drastic change of ecosystem services from timber forces communities to do another livelihood alternatives.

5.2 Minerals and Metal

The minerals and metal resources that can be taken and used by communities in study site is gold and zircon. Due to the data limitation of zircon mining, only Gold is analysed in this research.

The artisanal gold mining in Telaga Village opened in Klaru River Watershed with the Katingan's Regent permission in 2006. Even though it was opened in 2006, this sector experienced a peak period in 2010 when the ER Project was implemented and illegal logging was banned. Initially, Telaga Village inhabitants got permission to manage and do extraction activities within 5 ha in Klaru River. In fact, the area was cultivated more than granted permission because of the economic pressure.

The gold miners are not only from the Telaga Village inhabitants who worked and moved to the Klaru River mining site but also residents from other villages. Telaga Village government distributed about 1 ha mining area for every household to response this immigration impact and to protect their inhabitants. The land distribution was intended to improve the economic condition and livelihood security of Telaga Village inhabitants by owning mine plots. However, due to the high operational cost and the uncertainty of gold content in the distributed land, the Telaga Villagers sold their land to immigrants. The price of 1 ha mining plot ranged between 350 - 500 Euro.

The gold mining site spreads in upper Katingan River Watersheds such as Klaru, Bintan, and Bangkurung River. The distance from Telaga Village is about 30km which can be reached by about 3 hours trip boat ride. Currently, the gold mining location is expanding to another village. The gold mining system in Telaga village consists of two methods, traditional open pit mining (hard rock mining) and *lanting* (traditional placer mining). The traditional open pit mining extracts gold from the soil while the placer mining makes use a hydraulic system to take up gold from the river basement. The traditional placer mining in Telaga Village uses a set of equipment (two diesel machines, pump machine, pipes, carpet (to filter the gold from sand)) worth about 2,800 Euro that are installed along Klaru River. Open pit mining usually cleared forest area and dig gold from the ground or rock wall. Open pit mining is a high-risk method because the collapsed stone can crunch the gold miner. The placer mining extracts gold from river baseline with huge pipe and pumps machine. The open pit and placer mining pictures can be seen in **Figure 31** and **32** respectively.

The gold mining in Telaga Village is illegal activities since the mining license was never be renewed by both miners and local government. An informal agreement has been made to temporary authorise the illegal mining. The local government could not prohibit illegal mining because they cannot provide livelihood alternative for their inhabitants. The government cooperates with police to allow the mining to continue running. As the consequences, each gold miner team (that consists of 6- 7 people) has to pay an about 14 Euro annually for informal contribution. This contribution then divided for Police and Telaga Village government.

Figure 31. Open Pit Mining in Telaga Village

Figure 32. Lanting (traditional placer mining) in Telaga Village.

Figure 33. Gold result from Klaru River.

Figure 34. Ex-Mining site

The information about the gold mining revenue and its operational cost are derived from Telaga Village Profile Report 2013. The cost sharing system depends on the agreement of the machine owner with team members. For one working day (07.00 – 15.00) each team can get the average 5g of gold. The revenue is divided, 60% of it for the workers and 40% of it for the machine owner. The gold's price is 30 Euro so that total of revenue is about 150 Euro. The operational cost for one day is for diesel fuel about 60-70 litre (0.85 Euro/ litre). The machine owner's income is about 59.6 Euro while for workers are 89.5 Euro. Each team consists of about 7 people (one machine owner and six employees) so that each worker earns about 15 Euro/ day. The result is usually sold to the gold collector then it is delivered to the gold store in Kereng Pangi Village. The gold price in Klaru River 35 Euro/gram. From the in-depth interview, there were 300 gold miner teams in 2010 and 2016 is decreasing to 30 miner teams. There were no time series data of the total miners in 2011-2015 so that the total the miner teams is estimated by linear extrapolation from 2010 and 2016 data **with EQ 1**.

Table 6 Number of Gold Miner Teams 2010-2016

Year	2010	2011	2012	2013	2014	2015	2016
Number of gold miner teams	300	255	210	165	120	75	30

(Extrapolated from 2010 and 2016 data)

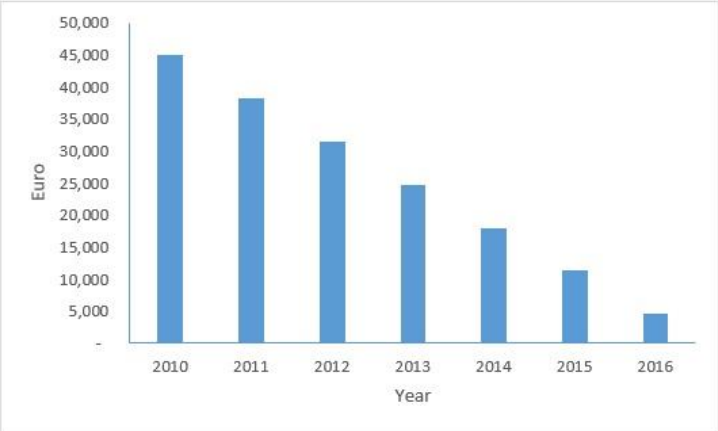


Figure 35. Changes of Gold's Economic Value in Telaga Village.

Source: In-Depth Interviews (n: 3) and extrapolation of 2010 and 2016 data.

From the figure above can be concluded that gold used by communities are decreasing. The decrease is because of the huge operational cost and the uncertainty of gold mining sector so that a lot of communities stop doing mining business and looking for another livelihood alternatives.

5.3 Food

Food services that are provided by forest in the concession area and used by communities in study site are deer, mushroom, and fish. Even though these foods are not the staple food of local communities but these food are important in generating income.

5.3.1 Deer

The endemic deer that being hunted in study site is *Cervus unicolor* (see **Figure 36**). There were two methods of deer hunting in the study site: trapping and hunting with a shotgun. The deer hunting can only being done in the dry season because in the rainy season the hunter dogs cannot sniff the deer's smell. The deer trappers do the initial survey to investigate the deer footprints, as deer hordes typically pass through the same path every day. After knowing the deer path, they make holes in the ground then cover it with a rope trap that is connected to the top of the tree. Once a week, they check the trap location whether if there is any deer is caught.

Figure 36. Cervus unicolor
Source. www.alamendah.org

Before Implementation of The Ecosystem Restoration Project.

Before ER, In Telaga Village there were two deer trappers and four hunter teams with shotgun (each team consists of 2-6 people). With trapping method, a hunter could get four deer while hunting with the shotgun they could get about 16 deer in a month. Hunting with the shotgun process is relatively more quickly than trapping. In one week (3 hunting times) this method could get about two deer in each hunting time. The weight of one deer was about 30-80 kg. The price of each deer was 280 Euro. The cost was 82 Euro per month for trapping method and 170 Euro for hunting with a shotgun.

In Kampung Melayu Village, deer hunting was a primary livelihood for several inhabitants after logging. Each deer worth 212.7 Euro. There were about five hunters in a team. In one month, the team could get seven deer. The cost needed for hunting was about 53 Euro per month.

Deer hunting in Hantipan Village was one of the alternative livelihoods because logging could not be done in the dry season. There were 20 hunters (5 teams) in Hantipan Village. They could get about 20 deer per year. Each deer worth about 212.6 Euro. Each hunting times the hunter spent about 14 Euro for fuel and food. The intensity of hunting was about twice a week.

After Implementation of The Ecosystem Restoration Project.

After ER Project is implemented, about three hunter teams are still hunting in Telaga Village. In a year they can catch only three deer which worth 285 Euro each deer. The hunter should walk about 5km away into the forest to hunt. The hunting result is sold to Samuda Village. The operational cost for each hunting times is about 14 Euro for fuel and food.

Deer hunting in Kampung Melayu becomes difficult because the deer is getting rare. The hunting result is only enough for the family consumption. Only one people still hunt as a hobby. The hunter can get

only one deer per month. The hunting cost is about 21 Euro per month to feed dogs that usually taken for hunting and the transportation cost.

In Hantipan Village, there are two people still trapping deer as a side job. Based on the in-depth interview, they can only get one deer in a month. This deer is worth about 397 Euro. The comparison of quantity and economic value of deer in Telaga, Kampung Melayu, and Hantipan Village can be seen in **Table 7, 8** and **9** respectively in **Annex II**. The graph that visualizes the quantity and economic value of deer can be seen in **Figure 42 and 43.**

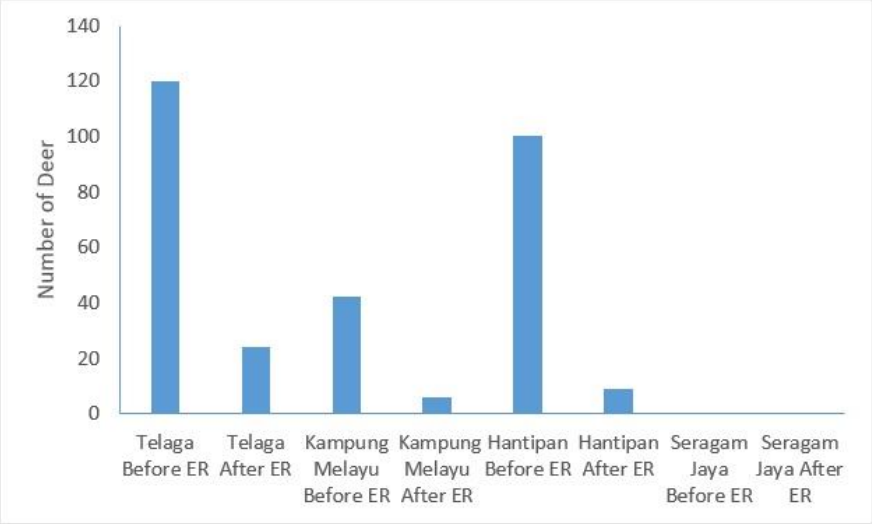


Figure 42. Changes in Quantity of Deer in Study Site

Source: In-Depth Interviews (n: 5)

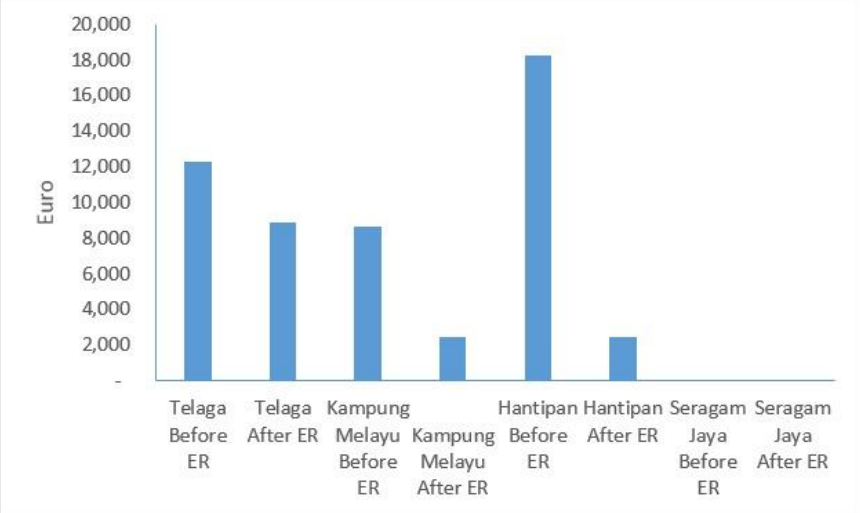


Figure 43. Changes in Economic Value of Deer in Study Site

Source: In-Depth Interviews (n: 5)

5.3.2 Mushroom (Auricularia auricular)

Figure 44. Mushroom (Auricularia auricular)
Source: www.bibitbunga.com

From four villages in the study site, only Seragam Jaya Villagers that used food benefit from mushroom (**Figure 44**). There were five households collected mushroom from the forest. They could get about 5kg Per day of mushroom in the dry season. The mushroom collector could earn 7 Euro per week without spending any cost. After 2010, the mushroom is still available in the forest but community afraid to collect it because the remaining burnt timber sometimes collapses and endanger the mushroom collector. Now there are only three mushroom collectors in Seragam Jaya Village. The comparison of quantity and economic value change of mushroom can be seen in **Figure 45 and 46** below.

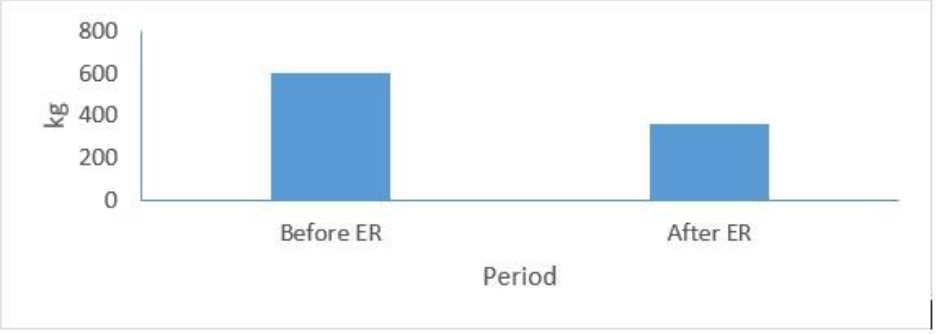


Figure 45. Changes in Mushroom Quantity in Seragam Jaya Village
Source: In-Depth Interviews (n: 2)

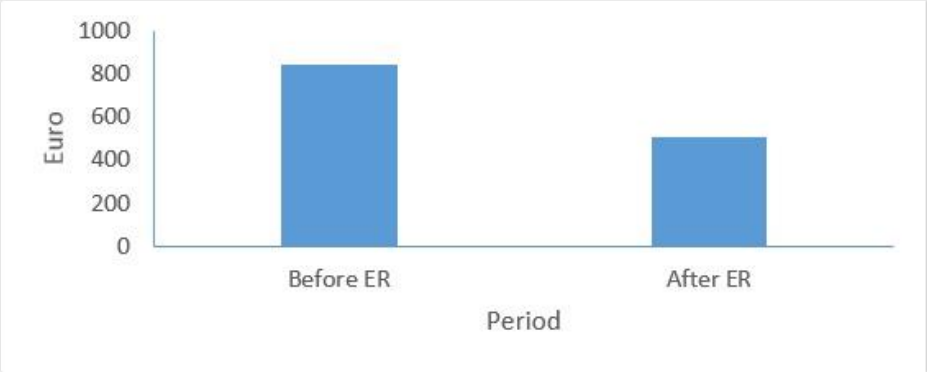


Figure 46. Changes in Mushroom Economic Value in Seragam Jaya Village
Source: In-Depth Interviews (n: 2)

5.3.2 Fish

In an average day, Telaga Village communities can get 1kg -10 kg depend on their tools. The communities which have a lot of fishing equipments (pengilar and tempirai) got more fish than others. In the dry season, the fisher can get 10kg/ day. In this productive season, almost everyone does fishing activities and can earn about 3.5 – 5 Euros/ person/ day (see **Figure 47**). In this village, four people are being fish collectors. The collectors gather the fresh fish from communities then deliver about 80kg- 1 quintals per day to Kereng Pekahi Village and Palangkaraya City. At the beginning of the dry season, communities could earn about be 106 Euro / day but this condition only last for about ten days.

Before the implementation of ER Project, the Kampung Melayu Village residents burned the peatland to make "*landungan*." *Landungan* is an artificial lake that is filled with water and used for a breeding ground for fish. After seven months, the fish can be harvested. Communities could catch 2kg to 1 quintal fish per day depending on the equipment. After ER, communities in Kampung Melayu Village is prohibited for

burning the forest because it can cause forest fire so that now the community have to manually catch the fish in the river. The fish type that exist in this location are Gabus, Kapar, Pepuyu, and Sepat. The fishing tools are pengilar and tempirai. The fishing result is used for the daily consumption and the remaining is sold to their neighbors.

Figure 47. Fisher in Telaga Village
Source: Rudi Mulyadi

Seragam Jaya communities are usually fishing in the small creeks in the forest because this village does not have a river to do the fishing activities. The fish type in this village is catfish (*pentet*). The fishing results usually only enough for daily consumption. Before 2010 there were about ten people who were fishing regularly and got about 2kg during the week. There were two months in the season transition in a year when they could catch up to 15kg in a day. The fish price is around 1.4 Euro per kg. Recently, only five people do fishing activities.

Due to the limited data, it is difficult to make an earning estimation and uncertainty of the amount of fish in each season. Therefore, only Seragam Jaya Village earning is quantified. The comparison benefit from fish between before and after the ER Project can be seen in **Table 10, Figure 48 and 49** below.

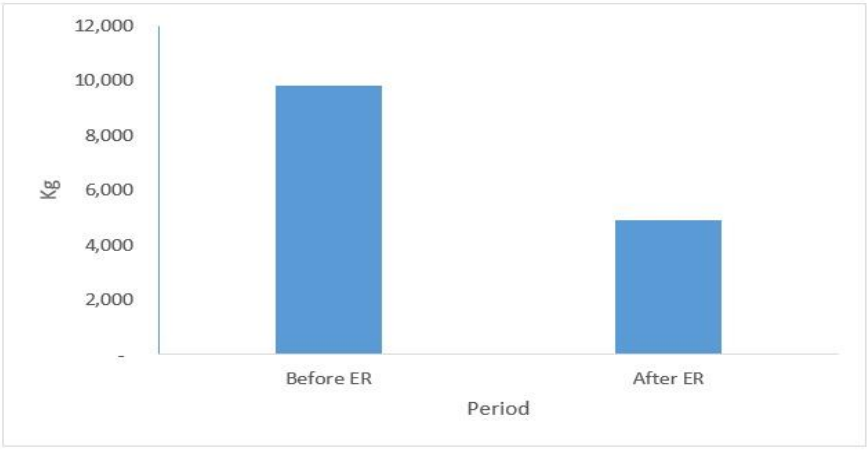


Figure 48. Changes in Fish Quantity in Seragam Jaya Village

Source: In-Depth Interviews (n: 2)

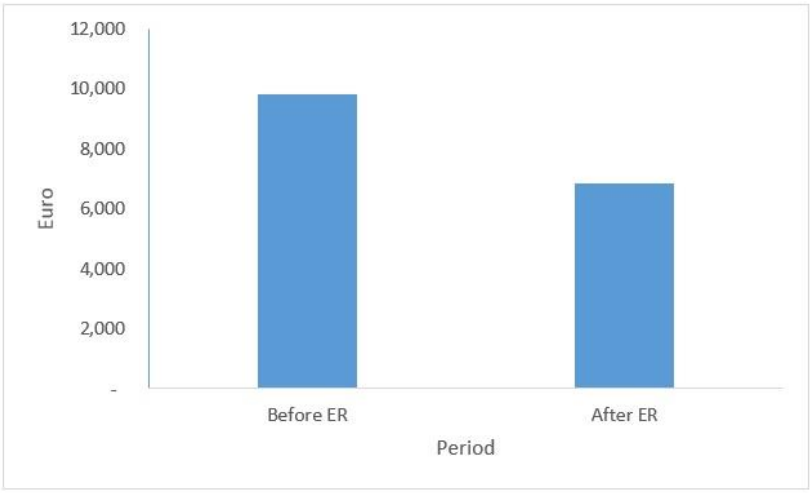


Figure 49. Changes in Fish Economic Value in Seragam Jaya Village

Source: In-Depth Interviews (n: 2)

From the **Figures 42-29** above can be concluded that the food benefits people used from the concession area are decreasing. The decrease of the benefits is because of several reasons. The decreasing income from fish and mushroom cannot be ascertained relate with the ER project or not. Fishing activities are done in the sidelines of the river and are not affected by accessibility restriction of the concession area. The benefit decrease can be caused by the natural changes or because of the gold mining pollution in the Klaru River upper stream. The mushroom is still available in the forest, but the mushroom collectors find it dangerous due to the collapse of the remaining burnt tree.

The quantity and economic values of deer used by communities are also reducing. From the in-depth interviews, this is because of the monitoring posts establishment in the forest entrances. These posts were mainly build to protect the forest from the fire as well as to create a forest user database for

research purpose. Some of the hunters feel uncomfortable to pass these posts. Moreover, they worry that will be accused of being a culprit if there are forest fire that happened at the same time they are hunting deer in the forest. Also, the decreasing amount of hunted deer is because of the fewer the number of deer due to overexploitation.

5.4 Resin and Fibre

Resin and fibre are non- timber forest production that supports the local economy apart from timber. The resin and fibre that are used by the community are Gemor, Jelutong, and Dammar.

Before Implementation of Ecosystem Restoration Project.

Resin and fibre that were taken by communities of study site from the ER concession area among others: Gemor (Nothaphoebe coriacea (Kosterm)), Jelutong (Dyera costulata Hook), and Dammar (Resin from trees, usually from Shorea jovonica, *Agathis dammara*) (see **Figure 50, 51** and **52)**

Figure 50: Gemora (Nothaphoebe coriacea (Kosterm).
Source: www.wahyukdephut.wordpress.com

Figure 51: Jelutong (Dyera consulate Hook
Source: www.baltyra.com

Before the ER Project implementation, gemor and Jelutong were the main and side job after logging. Collecting Jelutong was easier than gemor because the Jelutong collector only needed to slice the tree and collected the sap in a bowl. The Jelutong sap was placed into a large container to be cooked and mixed with thickener and terusi (vinegar). After being cooked, the Jelutong sap then was placed in a tin, tied and transported via river to the village. Some of the results were sold to Banjarmasin City.

Figure 52. Dammar (Resin from trees, usually from Shorea jovonica,* Agathis dammara*)
Source: www.indonesian.alibaba.com

About 5% of inhabitants of Telaga Villages (20 households) worked as Gemor and Jelutong collectors because the majority of communities were worked in illegal logging. The collector of Gemor and

Jelutong were usually the elderly. The price was 43- 56 Euro per quintal. In a half month, each Jelutong and Gemor collectors could earn around eight quintals and two tons respectively.

About 30% of inhabitants of Kampung Melayu (64 households) were gemor collectors. The gemor and Jelutong collector team usually consist of 2-4 people. The team should stay for a half month in the forest to collect Jelutong and gemor. Each household could get three quintals per month. Gemor price was about 0.35 Euro/kg.

In Hantipan Village, Gemor and Jelutong collectors were about 20 people respectively. Gemor and Jelutong collectors could get 0.5 tons per month 12 quintals of gemor and Jelutong respectively. 1kg of Gemor worth 0.21 Euro. To collect gemor, they should cut down the gemor trees, and peel the bark. Within a month, collecting gemor spent about 35 Euro. The collecting jelutong cost per households was 35 Euro for 20 days.

Resin and fibre that could be taken from the Seragam Jaya forest were Dammar. Dammar was usually found after a forest fire in Seragam Jaya. About 80% of inhabitants (114 households) were collecting Damar as the main job and could earn about 15kg per day of Damar in the dry season. The price per kg was 0.07 Euro. No cost needed in collecting dammar since the location was relative near from the village.

After Implementation of The Ecosystem Restoration Project.

The remaining Jelutong and Gemor Collector in Telaga Village are five people. Jelutung and Gemor worth 75 and 88 Euros per quintal respectively. In a half month, they can get 7-8 quintals Jelutong. They are collecting Jelutong in the dry season in the Rama, Bengamat, Kijang and Bintan River. However, collecting gemor is not economically feasible anymore because the collector should go further into the forest. The cost (for gasoline and food) are higher and discrepant with the revenue so that they stop collecting it even though the demand is still available for example from Perigi village, Sampit and Banjarmasin City.

After the ER Project implementation, Hantipan and Kampung Melayu Villages communities can still collect Jelutong normally (about 30 to 40kg in a day), but the market is limited. Only about eight people are still collecting the Jelutong. They work about twice a week in dry season. Meanwhile, the gemor trees are getting far and scarce so that to collect gemor, they should spend more money for fuel (2 hours boat ride or about 15km).

In Seragam Jaya Village, there are about 10% of communities (14 households) collect Dammar. However, the Dammar availability becomes uncertain. Now, communities only get about 10 kg per month, because the trees are grown so that the Dammar is covered by trees and soil and hardly visible. In 2014 resin has been mace so that communities try to search other alternatives such as farming. The comparison of quantity and economic value of Jelutong, Gemore and Dammar in telaga, Kampung Melayu, Hantipan and Seragam Jaya Village can be seen in **Table 11-14** and **Figure 53-60** in **Annex II**. The

benefit comparison of Jelutong, Gemor and Dammar in Telaga, Kampung Melayu, Hantipan and Seragam Jaya Village can be seen in **Figure 61** and **62.**

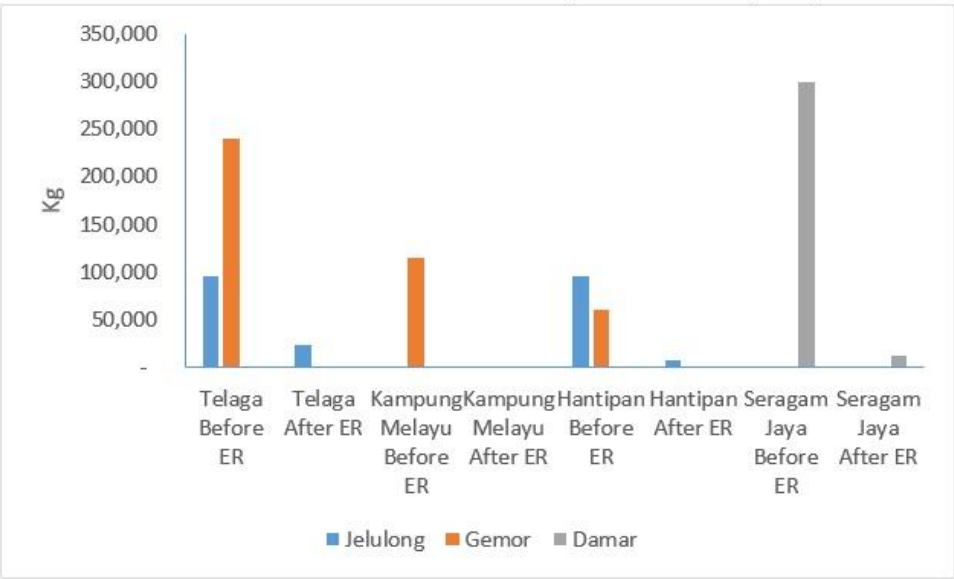


Figure 61 Changes of Resin and Fiber Quantity in Study Site Before and After the ER Project

Source: in-Depth Interview (n: 12)

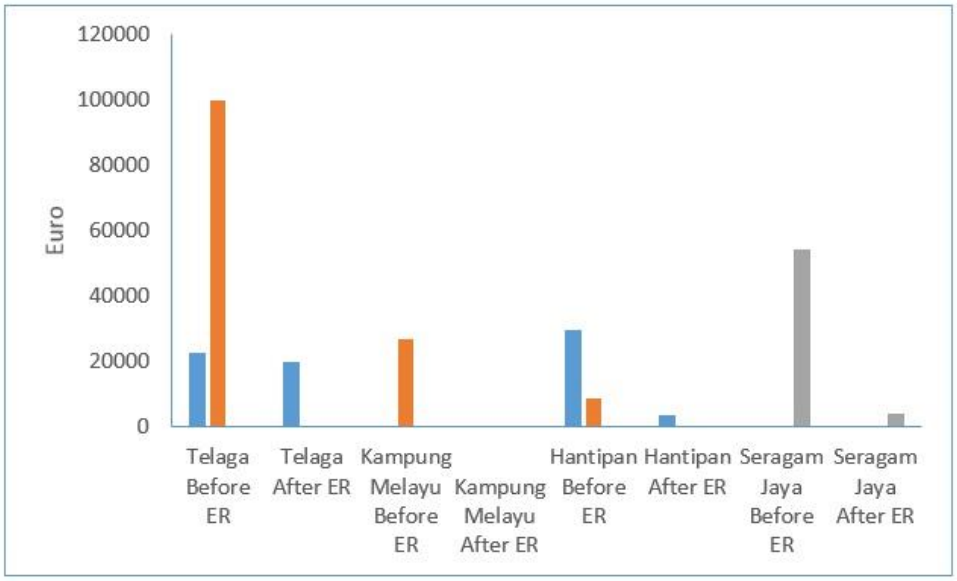


Figure 62. Changes of Resin and Fiber Economic Value in Study Site Before and After the ER Project.

Source: in-Depth Interviews (n: 12)

This can be concluded from the **Figure 61** and **62** that the quantity and economic value of Jelutong, Gemor, and Dammar used by the community are decreasing. Gemor is prohibited to be harvested because to peel the Gemor skin; people should cut the Gemor tree which exacerbates the forest

destruction. Jelutong and Dammar are decreasing due to the difficulty in collecting them. Dammar and Jelutong collector have to walk far into the forest and spend more resources.

5.5 Ethical and Spiritual Value

The benefit that local communities can use from bird that directly linked with their livelihood is the cultural service. The Millennium Ecosystem Assessment (2005) defined the cultural services as *''the nonmaterial benefits people obtain from ecosystems.''* The cultural services include aesthetic experiences, inspiration, spiritual enrichment from the ecosystems (Millennium Ecosystem Assessment 2005). It can be comprehended as a contribution to support human experiences related to human perception (Satterfield et al. 2013). However, ethical and spiritual values from bird sound may have some intangible benefits, for example, emotional attachment and character that associated with nature. The benefit and experience used from the bird sound in the study site are quantified by direct market value.

5.5.1 Bird

In study site, the type of bird that can be found and are quantified in this research are Cucak Hijau / Tangkarawen (*Chloropsis Sonnerati),* Murai Batu/ Tinjau Karang (*Copsychus Malabaricus) and Kacer/Kajajau (Copsychus Saularis) and Tiung/ Beo (*Gracula religiosa). Picture of Bird species can be seen in the **Figure 62-65** below.

Figure 62. Kacer
Source: www.ilyedaa.blogspot.com

Figure 63. Murai Batu
Source: www.budidayakenari.com

Figure 64. Cucak Hijau
Source: www.ruparupaburung.blogspot.com

Figure 65.Beo
Source: www.wikipedia.org

Cucak Hijau and Kacer types are more often to be hunted because they can be maintained easily. Their foods are easily found such as bananas and apples. Cucak Hijau and Kacer usually live on the riverbanks and basically in any place with the trees so that they relatively easy to be seen. Murai foods are worms, caterpillars, and *kroto* (a nutritious feed for birds and fish from a weaver ant eggs) that are harder to provide. To catch the Murai, the hunter should go to plateau and have to walk farther than to hunt other birds. Beo is more difficult to find because the hunters have to climb about 30-meter high wooden pit trees to find the Beo habitat. Usually, they live in the ex-nest of Woodpeckers.

Figure 66. Bird Cage for Hunting
Source: Author

Bird hunters specify the type of bird that they want to hunt because each bird type requires a different kind of *pemarit* (decoy), sound to attract birds and bird cage (see **Figure 66**). The bait (usually a female bird) is released in around a tree that has been given *sembulut* (special glue for bird hunting). If a bird is caught, the hunter removed the bird from the tree by gasoline. The hunter usually hunts in the fruit harvesting season; it is usually six months in one year. The price of birds are varied on the type and the sex. The male bird more expensive than female.

Before Implementation of The Ecosystem Restoration Project.

The process for bird hunting in Telaga Village area took one week. There were three birds hunters in this village. The total cost in one week was about 98 Euro. In two months, each hunter spent four weeks in the forest to catch each bird type respectively. To hunt the bird, the hunter must ride a small boat and walk for about 2- 3km. The cost includes transport, food cost, and bird food. Each hunter only needs simple tools for hunting such as bird cage, hornet (bird decoy, either male or female), glue or sap, and a hand phone that has a sound to attract birds.

In Kampung Melayu Village, bird hunting was a side job after logging and farming. Before implementation of the ER Project, there were about 15 hunters. Based on the group interviews of 3 bird hunter, they could get about 20 Cucak Hijau, 20 Kacer, and 5 Murai Birds and spent about 105.7 Euro per month.

The hunting time in Hantipan Village depended on the weather. In the good weather, bird hunter went for hunting and stayed for three days in the forest. In one month they usually did 6-7 hunting times. There were about six bird hunter teams. The total cost for one month per hunter team was about 99 Euro for food, gasoline, batteries for cell phones to attract the birds. In one month, a team could get about 30 Cucak Hijau, 5-7 Kacer, and 4-5 Murai Batu Birds.

After Implementation of Ecosystem Restoration Project.

After the ER Project, the remaining bird hunters in Kampung Melayu Village are about ten hunters. Now it is hard to catch birds. In one year the hunter can only get about 5 Cucak Hijau and 3 Kacer and 1 Murai Birds. They hunt four times a month and spend about 71 Euro. Because the bird are more difficult to find compared to before ER, the bird hunters train the birds' voice to increase its price. They can sell the good-voice bird for up to 43 Euro.

About ten bird hunter teams from other villages are hunting bird in Hantipan Village because it is hard to find the bird in other areas after ER. In 2015 to 2016 the price was decreased, so that bird hunting just becomes a side job. The hunting activity is being done once a month without having to spend a night in the forest. Each hunter can only catch about 2 Cucak Hijau, 2 Kacer, and 1 Murai Birds within a year. It costs about 7 Euro per hunting session. In this recent years, the bird hunting results are declining because of the increase of hunters so that the birds are afraid to be approached. Since it is hard to catch the bird, the hunter train the birds' sound so that the bird have a higher value. As an alternative job, the hunter looking for another job such as fishing and working in oil palm plantation in another village. The comparison of birds' quantity and economic value of each village can be seen in **Table 15-17** and **Figure 67-72** in **Annex II**. The comparison of quantity and economic value of study site can be seen in **Figure 73** and **74** below.

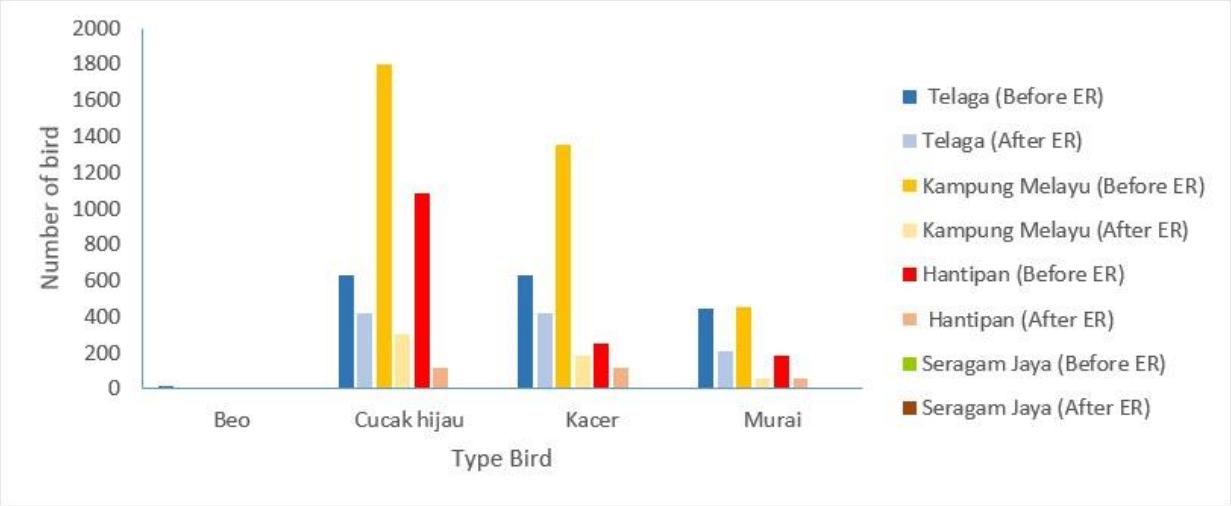


Figure 73. Changes in Bird's Quantity in Study Site

Source: In-Depth Interviews (n: 8)

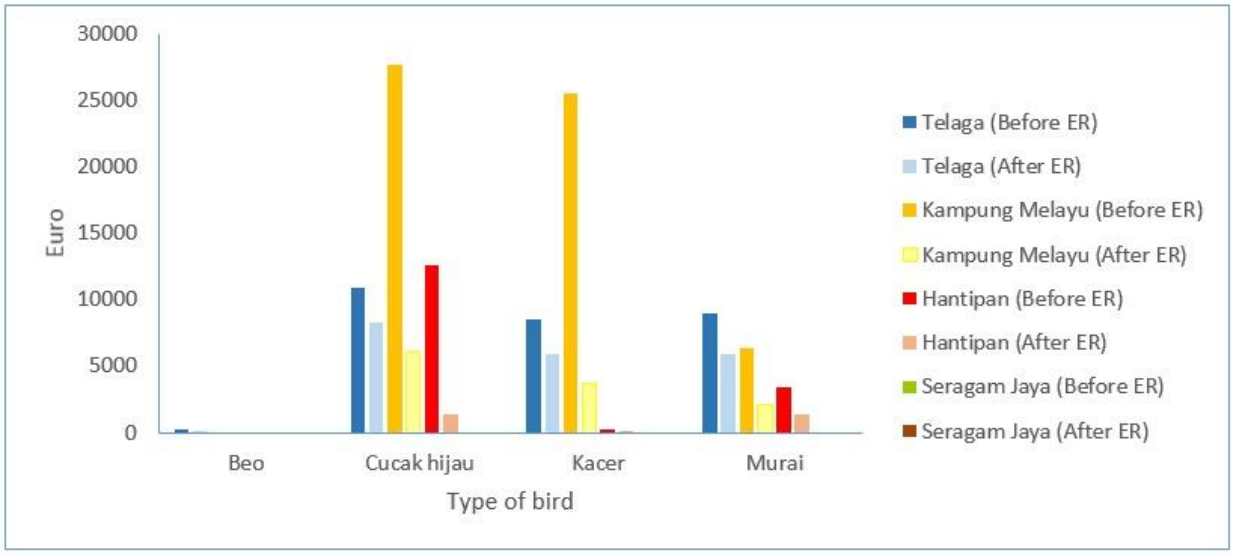


Figure 74. Changes in Bird's Economic Value in Study Site

Source: In- Depth Interviews (n: 8)

This can be concluded from the **Figure 73 and 74** that the changes in quantity and economic value from the birds are decreasing. The birds overexploitation mainly caused the decreasing trends. Another reason is that the ER Project establish several monitoring posts in the concession forest entrances. These posts are built to protect the forest from the fire and create a forest user database for research purpose. Some of the hunters feel uncomfortable to pass these posts. Moreover, they worry that would being accused of being a culprit if there is forest fire that happened at the same time they are hunting birds in the forest.

6. Social Network Analysis (SNA)

SNA in stakeholder identification and mapping are conducted based on snowball sampling with in-depth interviews, observations and desk studies. The initial information are taken from stakeholder identification from PT RMU reports; the stakeholder list, its power, and interest are cross-checked by the in-depth interviews with the PT RMU and Puter Foundation operational staffs. The table of stakeholder groups that are involved and to be impacted by the ER Project activities and by the changes of key ESs can be seen in **Annex III (Table 20**).

Once stakeholder groups that being impacted by changes in key ESs and the ER Project activities (**Table 18**), their interest and role are identified (**Table 20**), a social network map is drawn using yEd Graph Editor to know each stakeholder's centrality value. Centrality value shows the most central and the most important stakeholder of the networks. The centrality number indicates of the social power of a node (stakeholder) (Wasserman & Faust, 1994). This value is based on how they connect to other stakeholders within the networks (Wasserman & Faust, 1994).

From the **Table 18** can be seen the stakeholder groups that can receive potential impact from the changes of key ecosystem services and the ER Project activities. This list of the stakeholder group can be input for the formulation of recommendation in **Chapter 8**. Following **Table 18** and table of stakeholders' interest and role in the **Annexe I,** a relationship map of stakeholder group can be seen in **Figure 75**.

Table 18. Stakeholder Groups of ER activities

Changes in ES and ER activities	Stakeholder Groups	Impact
Banning of illegal logging	Illegal Logger	Decreasing income
	Fuel Seller	Decreasing income
	Middlemen, bansau and sawmill operator	Decreasing income
	Timber company	
Opening of Gold Mining in Telaga Village	Gold miner	Leaving home to get closer to the mining. Negative health impact of from mercury Uncertainty of income
	School-aged children of Gold miner	Drop out from school and floor their parents to the mining site
	Household stuff and fuel seller.	Generating income by selling fuel in the mining site.
Limited accessibility to the forest	Logger Bird, Deer Hunter, Gemor collector,	Decreasing income
Microfinance development	Farmer, fishermen	Being helped by the project in initial start-up capital for farming

Changes in ES and ER activities	Stakeholder Groups	Impact
		and fish cultivation
	Women's KSM groups	Being helped by the project in managing money for saving and loan for communities.
Protection and law enforcement, Establishment of monitoring posts at main entry-exit points to the forest	Illegal Logger, Bird, deer hunter	Limited their accessibility to forest
Fire prevention and suppression, Development of firefighting teams (Regu Siaga Api or RSA) staffed by local communities members and provision of fire extinguishing equipment and training;	RSA team	Generating income
	All communities	Reducing risk of forest and land fire
Restriction of land clearing with fire	Farmer	Reduce profit because they have to spend more for land clearing.
Reforestation	Communities that involved in reforestation	Get temporary income in helping reforestation
Community-based business development	Coconut owner, fishermen group	Being helped by the project in developing business model in coconut processing and fish cultivation
Participatory community mapping and village planning.	Village government	Being helped by ER project in making Village map and planning
Recruitment of PT RMU staff	Selected communities	Generating stable income.

Source: Compiled from the technical documents and in-depth interviews.

The stakeholder that have the highest value of centrality (1) is PT RMU. The second highest centrality is Puter Foundation (0.53). The higher value of centrality shows the higher social power of stakeholder. It explains that PT RMU as a key stakeholder that connect almost all of stakeholder in this figure. PT RMU plays a significant role in the ER Project. The highest centrality value also shows the lower distance to other stakeholders. It reflects that PT RMU can spread and communicate information effectively from one to other stakeholders. Also, it shows the high intensity of PT RMU become a bridge that connects communication links between stakeholders. It connects the communication chain between international, national to the local stakeholder. The more connection can result in more conflict, on the other hand, it reflects more supporter to achieve ER objective. Several of stakeholder groups are not included in this map because of no significant connection.

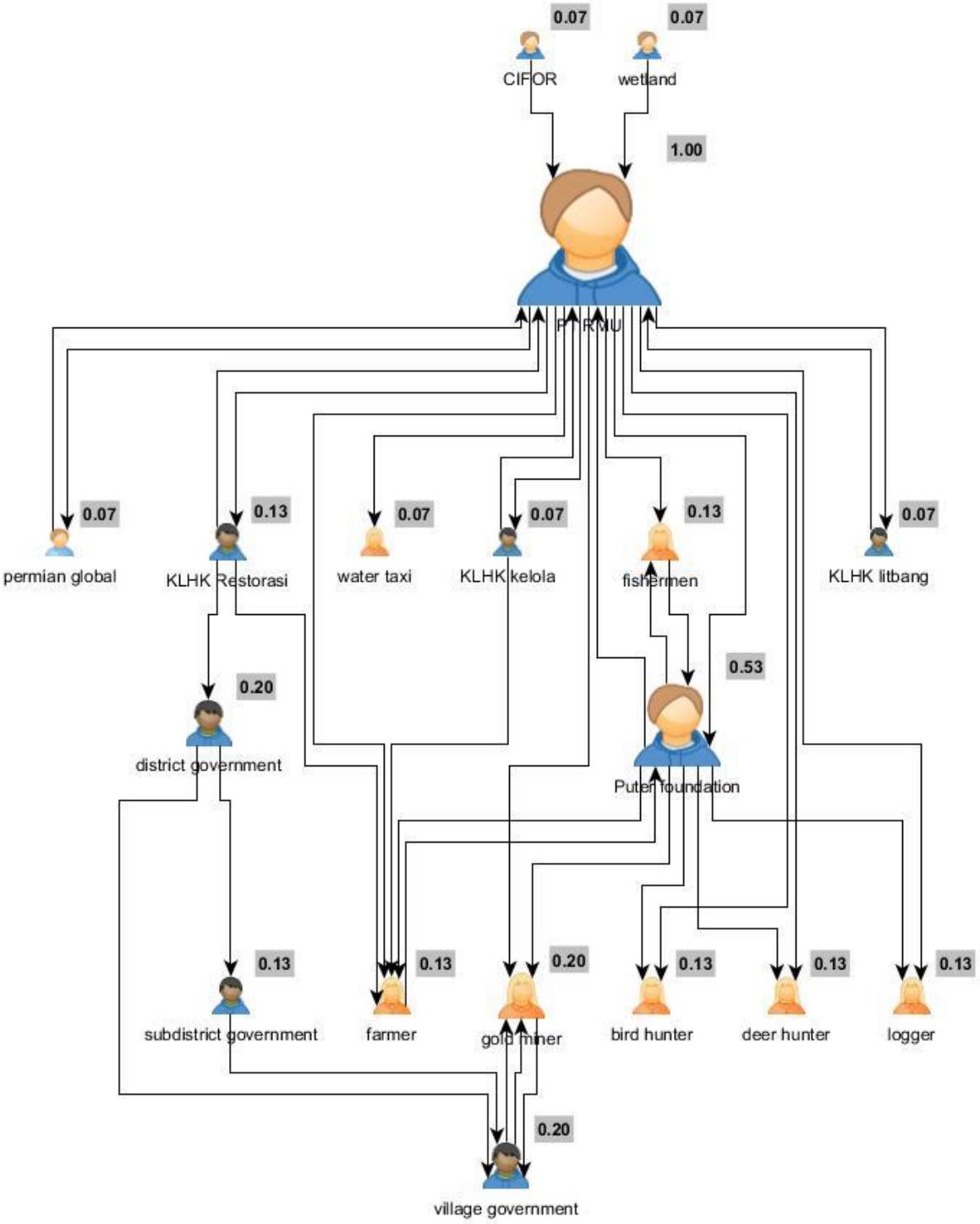


Figure 75 Stakeholder Mapping in ER Project.

PT RMU is the key stakeholder who manages and controls every program and activities of ER Project. Therefore, forest-dependent communities are likely to receive more management control over the forests which have been part of their life. It can be a positive connection if the local community aware that their previous activities such as illegal logging and hunting harm the environment which also a threat to carbon trading business of ER Project. In addition, PT RMU should maintain collaborative involvement and make the community as a subject even though PT RMU as the central stakeholder can formulate any program to protect forest and restrict community to access the concession area.

In ER Project implementation, collective decisions are more needed than sectoral arrangement. Therefore, it requires a consensus of all stakeholders initiate and implement an ecosystem restoration project. PT RMU as the owner and developer of ER Project play a central role in ER project and have a positive social network which maintains good communication and connect and involve each stakeholder in formulating systematic and integrated planning and monitoring towards ecosystem recovery.

7. Impact of Ecosystem Restoration on Well-Being of Local Communities

Changes in human condition result in changes the ecosystems. At the same time, changes in ecosystems cause direct or indirect changes in human well-being. The linkage of the ecosystem and human well-being is influencing each other. The changes in ecosystem services as a result of the Ecosystem Restoration activities in Katingan and Kotawaringin Timur Districst affect the local communities' well-being. The local communities whom their livelihood are dependent on the forest where ER Project concession is located receive the most significant impacts. This chapter elaborates those impacts as the input for the recommendation formulation for the ER Project improvement. The overall impact from the changes of key ESs and the ER Project activities can be seen in **Figure 76**.

Before the ER Project's implementation, people living in the area around the concession earned income from illegal logging business. The heydey of illegal logging era also attracted immigrants from another province to earn money from this logging business. Every family member joined in this logging business. The man did the hard tasks such as saw off and cut down the tree and transport them to the sawmills. The woman and children were also helped to maximise the logging result. The rampant of illegal logging activities led to the harmful impacts on the environment. The welfare of communities by doing illegal logging activities inversely proportional to the condition of the forest. Deforestation, forest degradation, and the forest fire were increasing because of these activities.

The ER Project in Katingan and Kotawaringin Timur Districts was one of the initiatives to reduce deforestation, forest degradation and avoid carbon dioxide emission. The ER Project within REDD+ mechanism implements market-based GHG emission reductions and sequestration against a baseline scenario during the 60 years initial crediting periods (Katingan Project, 2014). The ER Project prioritises several Ecosystem Services such as biodiversity, habitat and C sequestration. To achieve its objectives, the ER Project tries to limit communities in taking particular ESs such as timber (illegal logging) that can be a threat to the forest protection and D sequestration programs. This intention was supported and in line with the enactment of the Presidential Decree No. 4 of 2005 on the illegal logging prohibition in the forest areas. Another supporting regulation is "Land, and Forest Moratorium" declared by the 6th President of Indonesia, Susilo Bambang Yudhoyono (SBY), through Presidential Instruction no. 10 the year 2011 regarding the delay of granting new licenses and improving natural forest and peatland governance. This decree applies specifically to 64.2 million hectares of primary forest and peatlands in Indonesia. SBY later extended the policy and strengthened by Jokowi, the recent President of Indonesia. This implementation of illegal logging-prohibition policy started to be enforced in 2010 in Kalimantan. The moratorium enforcement in project area was implemented such as by the banning of timber sawmill in Katingan and Kotawaringin Timur, and arrestment of illegal loggers.

The drastic changes of livelihood (from logging) forced local communities to adapt to the new condition quickly. They should find other livelihoods which are not contrary to the ER project to fulfil their daily needs. The changes of key ESs explained in Chapter 5 influence the communities' well-being since those

services were major income sources of local communities. The implementation of ER Project is undoubtedly positive for the ecosystems but led to both positive and negative impacts for communities.

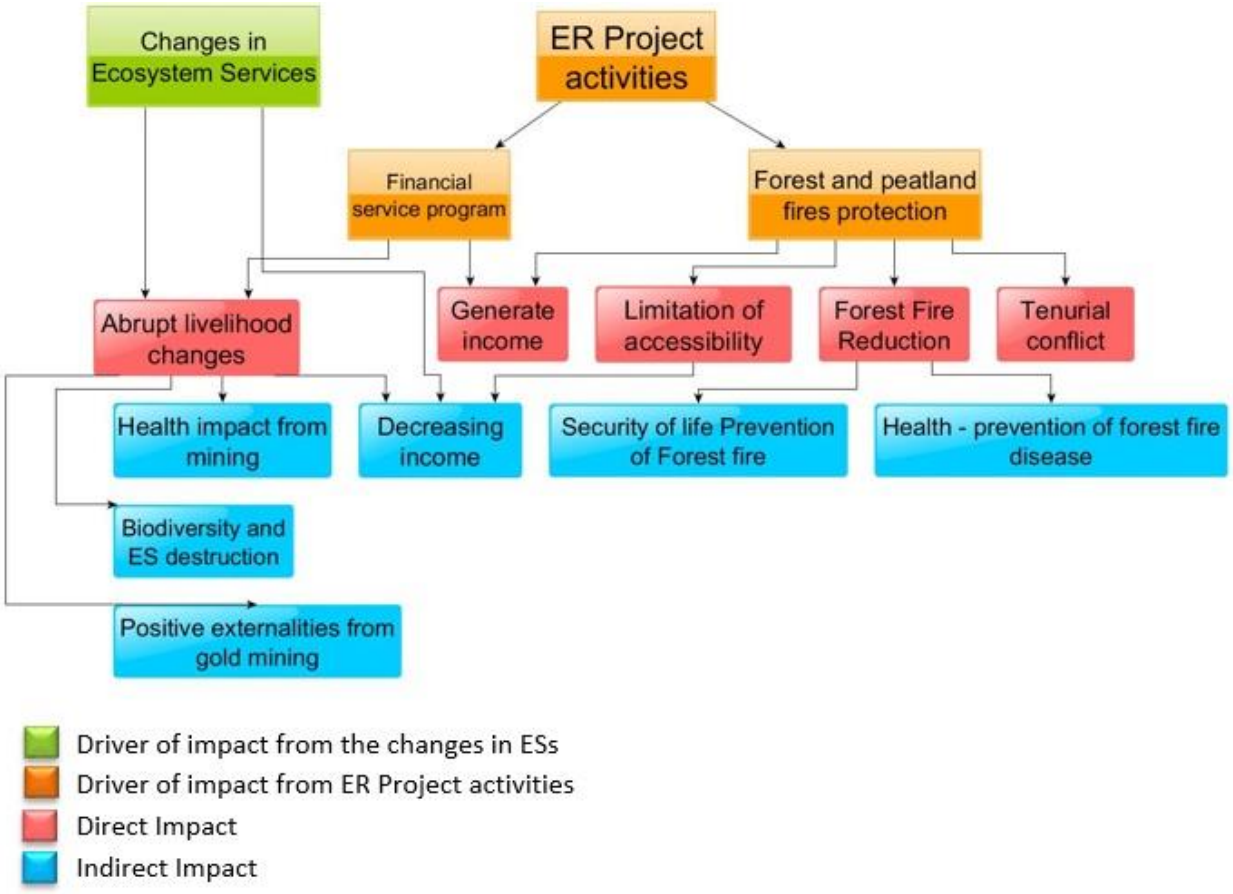


Figure 76 Impact of ER Project on Local Communities Well-being

The detail description of **Figure 76** above are explained in the section below.

7.1 Impacts from Changes in Key Ecosystem Services

This section elaborates the impacts of the key ESs changes on the well-being of local communities. The impacts are categorised in direct and indirect impacts.

7.1.1 Direct Impacts from Changes in Key Ecosystem Services

After the ER Project is implemented, illegal activities such as illegal logging and illegal poaching are banned. The majority of communities that work in those jobs should adapt with other livelihood alternatives. Some of the communities try to utilise their village resources, for example, gardening, paddy farming, and fishing. Other livelihood alternatives such as oil palm plantations and gold mining are located away from the village, causing many communities, especially men, to migrate out of the

village to work. The direct impacts from the changes of the key ESs is the abrupt livelihood changes, income reduction, accessibility limitation to the forest (concession area) and changing of subsistence.

A. Abrupt Livelihood Changes

The communities undergo significant changes because they accustomed to having job that provide instant results, for example, illegal logging. After the illegal logging banning for sustainable forest management, they have to do the new livelihoods (see **Table 19)** which need relatively long time to get the results (farming, plantation). Sometimes, the agriculture result is not enough to cover the basic needs for their family. Therefore, many communities should do double or even triple jobs to fulfill the appropriate family needs.

Table 19 Changes in Livelihood in The Study Site After ER Project's Implementation

Livelihood after ER Project implementation.	Village			
	Telaga Village	Kampung Melayu	Hantipan	Seragam Jaya
Illegal Logging	v		v	
Bird Poaching	v			
Deer Poaching	v	v	v	
Fishing	v	v	v	v
Fibre and resin collecting	v	v	v	v
Gold Mining	v			
Oil palm plantation worker	v	v	v	v
Kelotok Taxi Service	v	v		
Lumberjack	v		v	
Stall owner	v	v	v	
RMU staff	v	v		
RSA team	v	v	v	v
Swiftlet Business	v	v	v	
Farming		v	v	v

Source: Observations and In-Depth interviews.

Nevertheless, some communities are still doing several livelihood types that can be a threat for ecosystem restoration objectives. Illegal logging in Hantipan Village and gold mining in Telaga Village are still being done by communities because of the livelihood alternatives limitation in these villages. These activities are still being done even though they have to bribe some police and bear the risk to be punished by police.

The changes in the key ESs especially timber lead to the population migration in several villages. The number of Kampung Melayu inhabitants was 338 households and decreasing into 232 families after the implementation of the project. The decline of households in several villages were caused by the logging business prohibition as the primary income's source. In the other hand, Telaga Village experienced significant population growth because of the immigration from some villages to be gold miners.

B. Income Reduction.

Almost all of local communities that depend on the forest for their livelihood (wood logger, gold miner, deer hunter) suffer from the sharply falling of income. While doing logging business, the communities almost certainly earnt 200- 400 Euro per month. The market demand for the timber was prodigious so that no matter how much they can cut the tree, the market would inevitably absorb it. Compared to recent condition, the majority of communities in Kampung Melayu, Hantipan, and Seragam Jaya Village depend on agriculture activities to cover their basic food (rice). The rice yields are used for daily consumption, and the remaining can be sold to their neighbours. The average income from agriculture activities per household is 120 Euro per month. However, the result from agriculture activities rarely enough to cover other needs such as education, house, and secondary needs.

The livelihood shifts in Telaga Village from logging to gold mining also result in income uncertainties. Unlike logging, the revenue from gold mining is not stable and cannot be predicted. The gold mining teams can only savour the benefit if they can get more than 5 grammes of gold per day. Otherwise, it is only enough to cover the operational cost in a day.

The banning of farmland clearing by burning is becoming a problem for farmers. The communities used to burning the land because this is the most economical way for preparing the farming land. They believe that the soil becomes more fertile by burning it. Because of this regulation, the community should spend extra money (about 70 Euro) to clear the ground manually (without burning).

7.1.2 Indirect Impact from Changes in Key Ecosystem Services

One of the sectors that emerge after the banning of illegal logging is artisanal gold mining. Artisanal gold mining is a mining activity that uses simple technic and methods and held by manual labour (Limbong, Kumampung, Rimper, & Arai, 2003). The gold mining were previously specialised to accommodate the employment opportunities for Telaga Village communities. Because of the limitation of livelihood opportunities, this mining to become revenue source for the surrounding villages

Gold mining undoubtedly evokes impact on its environment (UNEP, 2014). The impact of gold mining in Telaga Village depends on the extraction methods. Placer mining causes fewer impacts than hard rock mining since this approach doesn't usually use chemicals to extract gold and doesn't blow up the stones (ELAW, 2014). One of the main impacts of placer mining is the sediment release because this method discharge significant amounts of sediment into downstream waterways, which can influence water quality (ELAW, 2014). Another impact is habitat destruction as a result of the disruption of riverbanks and river bottoms (ELAW, 2014).

Hard rock mining results in a larger environmental footprint and chemical contamination than placer mining. This method generates hazardous waste material because the use of mercury which is persistent in the river food chain (ELAW, 2014). Also, this mining disturbs the ecology by producing acid that discharge into water body that needs active and long term treatment (ELAW, 2014). The positive and negative indirect impacts, mainly from artisanal gold mining are explained below.

A Biodiversity and other Ecosystem Services Destruction

Gold mining that depends on ecosystem services such as water supply for mineral processing can influence biodiversity and other ESs. These effects include (UNEP, 2010): Habitat loss and fragmentation; water pollution from toxic tailings that dangerous for natural habitats and water supplies; air pollution in the extraction process; and noise pollution. If the waste of gold mining is acid-generating, the impacts to plants and animals, especially fish, can be dangerous (ELAW, 2014). Many streams affected by acid mine drainage have a pH value of 4 or lower – similar to battery acid which plants and animals are unlikely to survive (ELAW, 2014).

Gold mining in the Klaru River does not implement appropriate ex-mining land rehabilitation. The gold miners left the site without long-term closure management. It can lead to soil pollution and dangerous for the ecosystems.

B. Health Impact from Artisanal Gold Mining

Artisanal gold mining often underestimates the potential health risks of its process. The process uses hazardous substances that pollute water, soil, and air that lead to negative impacts on public health (WHO, 2007). Gold mining in Telaga Village use Mercury (also known as quicksilver) to separate gold from ore. This substance is usually used in the amalgamation process in the small-scale gold production process (UNEP, 2014). The amalgamation process in Telaga village is done with no technical knowledge so that it threat the human and environment health. This mercury is highly toxic and can cause serious illness to human and animal health (WHO, 2007). Mercury also poses a threat to the fetus and increase the potential of miscarriage (WHO, 2007). The health effects from the mercury among others harmful effects for vital organs (CICAD, 2003). The fatal impact can be obtained by absorption, inhalation, ingestion, through the skin and axonal transport (CICAD, 2003). The development of fetus can be disturbed by neurological and neurodevelopmental problems such as mental retardation, memory loss, language disorders and delayed development (WHO, 2007). Health effect to children whom vulnerable and exposed to mercury such as acrodynia (WHO, 2007).

C. Positive Economic Externalities from Gold Mining

Based on in-depth interviews and village profile report, gold mining has generated income for almost 90% of people in Telaga Village immediately after the illegal logging prohibition. About 300 gold miner teams (1 team consist of 6-7 people) that depend on this sector. Recently about 30 gold miner teams still work in Klaru River.

Besides for the gold miners, this sector also indirectly generates money from its activities. This activity creates economic externalities, for example, the communities open grocery stalls and gasoline in the mining site. Also, some people get income from delivering people and goods into and out of mining sites in the Klaru River. This mining sector helps to increase benefits of the communities so that the economic impact of the illegal logging closure is reduced.

Gold mining sector generates additional funds to the local government budget since each miner group should pay about 14 Euro for yearly contribution. This contribution is then divided for security payment for local police and village government. One of concrete developments from this mining contribution is the establishment of a multipurpose building in Telaga Village.

7.1 The Impacts of Activities of The ER Project.

This section elaborates the impacts of the ER Project activities on the well-being of local communities. The impacts are categorised in direct and indirect impacts.

7.2.1 Direct Impact from Activities of The ER Project

The positive direct impacts from the ER Project activities are income generation and peatland and forest fire reduction. The direct negative impacts from the ER Project activities on the well-being of local communities are the limitation of resources accessibility and tenure conflicts.

A. Income Generation

One of the programs under the ER Project is the financial services. This program is implemented in 34 villages within project area. The financial service in study site is KSM-SPP which stand for initial capital credit and act like a local bank for saving and loan for communities. The Puter Foundation facilitates this program to help communities to prepare initial capital for farming, fishing or plantation and cover school costs for children. This program provides a loan amount of 78 Euro with 10% interest in which group members have to pay within three months. The amount of interest each group is based on the agreement within group members. The profit of this mechanism is being rolled to other members.

This financial service helps the communities' needs to address the financial problem to start farming activities (initial cost for land clearing, seeds, and fertiliser). Each household in Kampung Melayu, Hantipan, and Seragam Jaya Village have at least 1 ha paddy farm to fulfil their food needs in a year. Paddy (rice) is the staple food of communities, if communities can harvest it optimally, then the basic of food security is fulfilled. Some of the communities also try to plant rattan and rubber. However, since the market price is not stable so that they decide to save it and will harvest it for emergency reasons.

PT RMU recruits 20-25 communities in each village to be RSA (firefighter team) that protect concession area from a forest fire. In one week, each member can get 50 Euro. The ER Project also recruits local communities to be field staffs. This is a positive impact in giving additional income and providing stable livelihood alternatives in the project area.

B. Forest Fire Reduction

Forest and peatland fires in project area occur during the dry season in almost every year. It spread quickly in the drained peatland and non-forest area. It is a huge threat to communities, biodiversity, and climate in local and national level. The cause of forest and peatland fires in the project area are the combination of natural factors such as extreme drought and human-made factors, for example, using

fire for land clearing (Katingan Project, 2014). Big forest fire event in 2007, 2014 and 2015 have harmed the communities and burnt not only forests but also communities' coffee and rubber plantation.

Starting December 2016, ER Project planted small fire-break plantations consisted of two local fire-resistant species; Galam (Melaleuca spp) and Tumih (Combretocarpus rotundatus) to prevent the fires from outside enter the rehabilitated area (Katingan Project, 2015). These species were planted along the Hantipan canal boundaries (covering Kampung Melayu and Hantipian Village). In the nursery posts, there are three primary species (Pulai (Alstonia spp.), Belangiraan (Shorea belangeran), and Jelutong (Dyera lowii)), and other native peat swamp forest species are being researched and prepared to be planted in the degraded and remaining non-forest area. These species are developed and maintained to have a good growth rate in the planned area. In January to February 2017, ER project and local communities were conducting the first planting activities of about 13 tree species in 100 from 150ha in the ER in Kampung Melayu Village. The remaining 50ha will be planted in the next March. The planted trees will be used to restore the peatland ecosystem integrity so that it will not be harvested for its timber in the future. These activities are not only to conserve the carbon sequestration in the project area but also to prevent the forest fire.

The causal link between the ER project activities and the forest fire event reduction in these recent years cannot be evaluated yet. However, BMKG (Indonesian Agency for Meteorology, Climatology, and Geophysics) will inform as soon as a hotspot emerges in the concession area. In addition, RSA (forest fire extinguisher team) in the observation posts will immediately extinguish the fire so that the fire will be prevented to spread to other areas.

C. Limitation of Resources Accessibility

One of the activities under the ER Project is protection and law enforcement to prevent illegal exploitation, including illegal logging, poaching, encroachment, illegal gold mining, peat drainage and land clearance with fire. This project builds physical demarcation of the project boundary and establishment of monitoring posts at main entry-exit points to the forest. The monitoring posts in the forest entrances are built to record the people who are entering the forest. These activities make communities felt being limited to access the forest. They afraid if they will be blamed if there are forest fire and will be arrested for that reason.

D. Social and Tenure Conflict

The conflict occurred between ER Project and communities varied among the villages. One of the conflicts is the tenure conflict between Kampung Melayu Village inhabitants with ER Project. Communities claimed 2 ha per household in the ER Project with SKT (Surat Keterangan Tanah/ certificate of land) that issued by former village government) which not recognised by the state as a formal ownership of land.

Another conflict is a disagreement of the head of Pulau Hanaut Sub-district (where Hantipan Village is located) and several of his communities about the implementation of the ER Project in their village.

Different perceptions and interests of stakeholders in several sub-districts in Katingan and Kotawaringin Timur Districts lead to this conflict more pointed. In result, some programs under the ER project cannot be run effectively.

7.2.2 Indirect Impact from Activities of The ER Project

The ER Project activities offer the positive impacts on the well-being of local communities among others provides the security of life from natural and human-made disasters and improves health condition by forest fire prevention. On the other hand, this project also causes the income reduction from the resources accessibility limitation.

A. The Security of Life from Natural and Human-Made Disasters Provision.

Based on the community perspectives, one of the positive impacts of the ES Project is provides security of personal safety and security from natural and human-made disasters by forest and peatland fire prevention. The causal link between ER project activities and the forest fire event reduction in these recent years cannot be evaluated yet since there are several variables such as El-Nino event, rainfall intensity, human activities that are affecting the forest fires' scale and intensity. However, the effort to prevent forest fire has been done by ER Project such as forest fire preparedness training for RSA and communities. This project also provide forest fire mitigation equipment such as pipe and water pump; peat water-level protection, and fire patrol that have been conducted under ER Project in cooperation with communities.

B. Health Condition Improvement

Lots of effort to prevent forest fire (patrol, canal blocking) has been implemented by the ER Project and communities. It is likely reduce the health impact of smog from forest fire such as respiratory infection, cardiovascular disease, mental health disorders, birth nuisance and mortality (Reid et al., 2016). The large forest fires in 2007, 2014 and 2015 made the people suffer severely. The preventive action of the ER Project is appreciated as concrete actions in avoiding communities from the diseases caused by forest and peat fires.

8. Recommendation to Improve Ecosystem Restoration Project

The recommendation to improve the ER project are taken from the community perspectives by in-depth interviews, observations and lesson learned from other ecosystem restoration cases.

Considering the result of the in-depth interviews, the communities aware of the damaged and degraded forest condition. They realise that they cannot depend on the forest for fulfilling their needs for a long time. Even though some of the communities still sceptical with ecosystem restoration objectives and activities, they are mindful about the ecosystem protection. Therefore, the communities open for the new programs, willing to try new livelihoods and protect the forest as long as they can generate income and cover their daily needs.

8.1 Provide Livelihood Alternatives by Developing Agriculture Business.

Developing community agriculture business is suitable to address the abrupt livelihood change, income reduction and forest accessibility limitation. This activity focuses on providing livelihood alternatives that offer stable income and can be done in the village without migrating to other areas. With the abundant farming land potential and specific large peat-soil areas characteristic, here are some commodities that are recommended to provide livelihood alternative and stable income at the study site.

Nipa Palm (*Nypa fruticans Wurmb*)

Nypa Palm is known as a multipurpose plant that can be processed for consumption and degraded ecosystem rehabilitation. Picture of Nypa Palm can be seen in **Figure 77**. In Philippine and several areas in Indonesia, Nipa Palm is being used for degraded ecosystem rehabilitation from logging (Field, 1998). The sugary sap from its stalk can be processed to be sugar, vinegar and alcohol beverage (Farid Hossain & Islam, 2015). The medicinal purpose from Nipa Palm ash is used for tooth pain and headache analgesic. It can be processed for fuel and bio-ethanol from its leaves, fruit residues, petiole, and stem wood. In fishing, its rhizomes can be used for floating the fishing net on the water surface. For river ecosystem, it provides regulation services such as soil stabilisation, erosion protection, and cyclone reduction (Farid Hossain & Islam, 2015). It can also be used for roof thatching, wall partitioning and remediation of heavy metal in the polluted sites (Farid Hossain & Islam, 2015). The suitable locations for planting Nypa palm are in the mangrove forests in the river deltas (Murdiyarso et al., 2009) and along intertidal regions of

Figure 77. Nypa Palm
Source: www.article.sciencepublishinggroup.com

stream estuarine zone (Robertson & Alongi, 1986). The market demand for Nipa palm products is increasing in the different countries of the world (Farid Hossain & Islam, 2015).

Dragon Fruit / Pitahaya (Hylocereus polyrhizus)

Dragon fruit is also known as strawberry pear. This is a native fruit from tropical America and grown commercially in South East Asia. The red- magenta flesh and pink peel dragon fruit (Hylocereus polyrhizus) well grew in one of the inhabitant backyards in Seragam Jaya Village. Picture of Red Dragon Fruit grew in Seragam Jaya Village can be seen in **Figure 78**. The plant is suitable for peat soil and adapts to any soil with organic matter and tropical climate with rainfall of 30-40 inches (CCEES, 2011). Also, compared to conventional fruits and vegetables, the management of Dragon Fruit (e.g. transplanting, watering, fertilising and pest spraying) is simple (CCESS, 2011).

Figure 78. Red Dragon Fruit grew in Seragam Jaya
Source: Author

Dragon Fruit can be a very good income source since it has a stable-good price. This fruit is healthy, nutritious and contained in high vitamin C, antioxidants, and fibres. This fruit is used as a diabetes treatment, good for blood circulation and strengthens the human immune system (CCEES, 2011). Therefore, Dragon Fruit can be easily marketed to as a healthy food in Indonesia.

Cashew Nut *(Anacardium occidentale)*

From the discussion and observation in the Kampung Melayu Village, Cashew nut is feasible to be planted in the peat soil. Moreover, Cashew tree is suitable for Kalimantan climate because compared to most food crops, cashew nut trees are more resistant to drought (Martinez, 2011). This tree is not water-intensive plant and can be harvested during the dry season.

Figure 79 Cashew tree
Source: www.balconygardenweb.com

India and Africa dominated the cashew nut world production, processing and export business (ECI Africa, 2003). India is the number one of cashew nut kernel consumers and exporters followed by Vietnam and Brazil (Martinez, 2011). The cashew supply and demand projection can be seen in **Table 20**. Major world markets demand

processed cashew nuts (kernel) such as Japan, Netherlands, UK, USA, and Germany is growing at about 4.9% per year (ECI Africa, 2003).

Furthermore, Cashew Nut can be processed as Cashew Nut Shell Liquid (CNSL) and Cashew Nut Shell Oil (CNSO). The CNSL-based products include brake linings, cement, foundry chemicals, fungicide, insecticide, lacquers, pesticide, paints and primers, coatings and resin. While CNSO is high-value oil that can be used for cooking, cosmetic and aroma essential oil.

Table 20 Cashew Supply/ Demand Matrix, 2013 Projection

	In- shell (tonnes)		Kernels (Cratons		
Country	Production	Export/ Import	Production	Domestic & Carryover	Export
India	600,000	695,000	12,560,000	8,000,000	4,560,000
Vietnam	400,000	200,000	6,000,000	100,000	5,900,000
Brazil	300,000	0	2,700,000	500,000	2,200,000
West Africa	750,000	-720,000	300,000	0	300,000
Indonesia	90,000	-80,000	100,000	50,000	50,000
East Africa	16,500	-95,000	700,000	0	700,000

Sources: Ingredient Sourcing Solution Traded quoted in (Martinez, 2011)

Therefore, start small-scale cashew nut processing in the study site can be a good opportunity for communities. Cashew nut product is high environmental friendly and can play a major role in enhancing local the communities' incomes. ER Project can facilitate training for farmers in processing the cashew nut. ER project can also facilitate the nurseries establishment for obtaining good quality trees and link small holders to the potential markets.

Lidah Buaya (Aloe vera)

Aloe vera is one tropical agricultural commodity that has enormous opportunities to be developed in Indonesia as a promising prospect agribusiness. Aloe vera can be planted with minimal care and can survive with a limited amount of water. This plant requires a lot of the sunshine and high temperature which suitable with Kalimantan's climate. It also can grow in a variety of soil, even those which extremely poor nutrient soil (Sasli, Yahya, & Setiadi, 2008). It contains vitamins, minerals, and amino acid (Sasli et al., 2008). It provides a medicinal function such as purifying the blood, digestion, cell renewable and strengthening immunity (Sasli et al., 2008).

Vast development of Aloe vera plant in the peat soil has been developed in the Pontianak City, West Kalimantan Province. In 2013, Pontianak produced about 7,800 tonnes Aloe vera and exported for about a half of it to Singapore, Hong Kong, and Malaysia. Pontianak City government involved about 115 farmers in this Aloe vera business. The harvesting result is processed to dodol (Aloe vera sticky cake), jelly, beverages, tea, jam, chocolate and syrup (www.pertanian.pontianakkota.go.id).

Communities recommend the ER project to provide a promising and reliable market for their products. They expect ER Project to link their agriculture production to the potential buyer that will absorb the

result from their products. The example of small scale product from non-timber forest production can be seen in **Figure 81**.

Figure 80. Lidah Buaya Farm in Pontianak, West Kalimantan

Source : www.pertanian.pontianakkota.go.id

Figure 81. Example of product from Non-Timber Forest Production

Source : www.fao.org.

8.2 Mitigation of Social and Environment Impact from Artisanal Gold Mining.

Mitigation of negative impacts from gold mining should cover from the preparation, exploration stage, through the life-cycle of its preparation, operation, and the site rehabilitation (UNEP, 2014). A strict regulation to reduce the impact and ban mercury in gold mining are necessary to minimise the chemical matter usage that can pollute the environment and risk the communities' health.

Water pollution is hard to detect because the mine water flows directly to the river. Assessing the possible directions of mine water flows is important. The treatment to reduce water pollution from gold mining can be done by blocking the water flow routes and conduct waste water treatments. PT RMU as the central stakeholder can involve universities, NGOs and governments to conduct biological and chemical treatment of the mine water (UNEP, 2014). The mining sector is expected to compensate the ecological cost.

In addition, land sustainability assessment to use the ex-mining land needs to be developed. PT RMU which has the highest level of centrality (**Figure 75**) can make use its social power and bridge the international agency, government, and miners to have discussion and collaboration in establishing mining reclamation plan based on a risk assessment and include the assessment for the future use (UNEP, 2014). The well-prepared ex-mining site is important to minimise negative social and economic impacts and consideration of local community needs. Reclamation and rehabilitation of the mine area should ensure that the ex-mining area blends in with its surrounding landscape and the biodiversity surround the area are maintained. Mine closure activities should prevent the toxic waste escape into the environment. ER can also facilitate government with the communities to discuss the best method to prevent water seeping into groundwater and river and to reduce ex-mining site erosion.

Communities and gold miner need to be provided with an educational program to inform the health impact and regulation of usage and disposal of mercury and a guideline for cleaning up the mercury. They need to be educated about the dangerous for the program for pregnant and breastfeeding women and children, for example about the consumption of fish taken from the gold mining site.

8.3 Conflict Resolution

To reduce inflicted conflicts, intensive strategies which prioritise negotiation and mediation process (non-litigation) with the collaborative approach are needed (Silalahi, Erwin, & Res, 2015). Building trust between ER Project and communities are important to prevent conflicts. The ER Project's field staffs as the project's ambassador can help to spread the environmental protection mission and education. From the observations and in-depth interviews, several encroachers stop doing their activities because of the respect to the ER Project's field staff.

The national government roles are crucial in solving the tenure conflicts. ER Project in Katingan and Kotawaringin Timur Districts as one of the projects within REDD+ which reduce forest degradation and deforestation and contributes to national target to reduce 29% of GHG emission. The ownership within concession area is regulated by the government which has to be informed to the community. National Government should be a mediator in resolving the conflict, also controller of ER Project to achieve all of the objectives.

8.4 Valuation of Indirect Services.

In this research, key ESs that are provided by animals such as deer, fish, and birds are quantified with direct use valuation (deer and fish for providing food and bird for providing marketable sound). However, these animals provide mostly indirect and supporting other services (Wenny et al., 2011). Birds are highly mobile, respond and sensitive towards environmental change and fill many ecological roles. Bird has more benefit such as pollination, insectivory, seed dispersal, and nutrient cycling benefit, lumber, medicine, flood and erosion control, recreation, and other benefits for human society (Wenny et al., 2011). The declining of animal (deer and bird) services in study site (**Figure 42 and 43**) affects the other services. Therefore, quantifying the indirect services value provided by animals is crucial to understand their importance for ecosystems and human well-being.

9. Discussion

The objective of this research is to assess the local community perception of changes in key ecosystem services as a result of the ER project's implementation in Katingan and Kotawaringin Timur Districts. Furthermore, my thesis aims to investigate the impact on the well-being of communities in the project area from the activities of the ER Project. The purpose of the ER Project in Katingan and Kotawaringin Timur Districts within REDD+ scheme is not only to maintain the ecosystem services to regain ecological integrity but also the communities' social well-being and livelihood security in the project area. Therefore, I critically assess the impacts of the ER Project on the well-being of the local communities in the project area to ensure the ecosystem restoration project achieves its objectives.

This chapter discusses the main results and methods used in this research.

9.1 Discussion of Methods Used

In conducting this research, several limitations are faced, and assumptions are used. This section discusses some assumptions and limitations of the methods used in this research.

1) Data Availability

The first challenge is the limitation of time series data on the baseline conditions such as demographic data and the detailed changes of the key ecosystem services (ESs) used by communities. The respondents experienced difficulties to provide complete information about the quantity of key ecosystem services used from the concession forest in a particular period of the year. Therefore, assumptions and extrapolations had to be made to get the time series demographic data and changes of ESs.

The number of the stakeholder groups that benefit from certain ecosystem services and data about the quantity, price, and cost to take particular ecosystem services was taken from the in-depth interviews. To fill the unavailable and incomplete population number time series data from 2005-2010, linear extrapolations with **Equation 1** were done. The number of ESs' users in each village within 2005-2010 (before the ER Project) and 2011-2016 (after the ER Project) were multiplied by the ESs' quantity to get the amount of benefit used from ESs in the study site. The economic valuations were done by multiplying the ESs' users in particular period with quantity and price of each ES and reduce it with the cost.

The assumptions were made to generate a proportion of key ESs types. For example, from the in-depth interviews in Telaga Village noted that each logger got 3m³ per day, about 50% of the logging results were Meranti Wood, and the rest were Belangeran, Jingah, Ramin, Perupuk, and Banditan Wood. It is assumed that the proportion of Belangeran, Jingah, Ramin, Perupuk, and Banditan Wood were same. Therefore, I divided the quantity of Belangeran, Jingah, Ramin, Perupuk, and Banditan Wood evenly from 1.5 m³.

Nevertheless, the key ESs' changes trend will likely remain the same with the result of my research. This study shows the main message that the key ES's are decreasing because of the ER Project's activities and overexploitation that provide impacts for communities. The local communities cannot find and use key ESs which they could before the ER Project implementation. Therefore, the result of this research cogent to acknowledge the impact of ER Project for interim evaluation.

2) Selection of Respondents

The respondents were selected by snowball sampling which offers practical advantages for explorative and descriptive research. The respondents were selected by doing a preliminary discussion with local government and field staff who have a thorough understanding of the communities' socio-economic characteristic of. The respondents' selection was based on their time availability, expertise in doing particular job related with selected ES, the ability to express themselves and openness (to minimise language barrier and conflict while doing an interview). Therefore, the respondents can be the representatives for each village.

This sampling method was suitable to answer the **RQs 2, 3** and **4** since the descriptive and explorative answers were expected to enrich the stakeholder list, the perception of impact and recommendation to improve the ER Project. However, this sampling method faced an obstacle in providing quantitative data. From about 5-7 respondents that being asked about ESs changes, only data from the 1-3 interviewees were selected to be included in the calculation (n sample). Some respondents tended to modestly lower or even exaggerate their answer especially about the amount of ecosystem services taken from the forests and income from particular services. Respondents tended to lower their income information because they were worried would be excluded from the government grant program and companies' CSR (Corporate Social Responsibility) if they admit generating an enough income. The other respondents exaggerated their answer about income in the logging era. Some respondents claimed whether they could earn about 5,000 Euro and catch 15 deer (about 4,200 Euro) every month per person which was hard to be believed seen from their modest living condition.

To validate the data from in-depth interviews, data reliabilities were done by comparing the data with supporting information, for example, statistical reports, and the articles from the internet. Moreover, I rechecke and reconfirmed the compiled data with further discussion with the local government, PT RMU and Puter Foundation field staff. By doing this, the selected data were the closest to actual reality and sufficiently representative for analysis.

3) Services Categorisation.

This research included the minerals (*the chemical compound that is typically crystalline, and that has been formed as a result of geological processes* (Nickel, 1995)) and metal (*chemical element that possesses metallic luster and which, in electrolysis, carries a positive charge that is liberated at the*

cathode)[1] as ecosystem service under the provisioning service. Minerals and metal do not appear in the ES category under Millenium Ecosystem Assessment and TEEB. Gold is non-renewable resources and will be diminished if they are mined. Moreover, the gold extraction is likely to provide the negative impact for the environment which is not in line with the Millennium Ecosystem Assessment's objective.

The minerals and metal inclusion in the ESs calculation is because gold is counted as a resource that can provide economic benefit for the communities. The majority of Telaga Village Inhabitants and several communities from other villages changing their job shortly to be miners after illegal logging was prohibited. This shifting shows the drastic changes in local communities livelihood. Based on its significant contributions for communities, this resource is included in this research to show the changes of benefits that communities used from concession area before and after the ER Project. Also, this resource is necessary to be elaborated because the gold extractions lead to the indirect environment and social impacts that are important to be addressed.

4) Economic Valuation

The key ESs' economic evaluation did not include the cost of initial capital, for example, machine, chainsaw, and boat for logging; excavator, pump machine, carpet for gold mining; and shotgun, rope, and boat for hunting. The cost calculation only consists of the operational cost such as fuel for transportation costs and food.

The ES quantifications were to show the approximate benefit used by the community before and after the ER Project, not the total economic evaluation of each sector. The revenue and operational cost of each activity were able to show the profit and benefit used by the local communities and their income. Therefore, the data were sufficient to do the economic valuation and to compare the benefit changes result in the ER Project implementation.

9.2 Discussion of The Results

1. Negative Effects of Carbon Trading-Based Ecosystem Restoration Project.

The result of this research shows that the majority of key ESs for the well-being of community are decreasing. The main reason is the focus of the ER project on carbon trading. The carbon trading scheme is one of business models to restore the carbon value and sell it in the carbon market. It commoditizes the avoided carbon emission and carbon sequestration from the concession area within REDD+ scheme. This instrument has several advantages over grant payments and subsidy since it empowers private contribution in helping government role to improve forest condition and to achieve Indonesia carbon emission reduction target, 29% by 2030. On the other hand, this instrument is not necessarily more socially efficient. This research found that the carbon trading-based ER project could

[1] This definition is derived from article 'Metal Properties, Characteristics, Uses, and Codes'. The Army Institute For Professional Development. Retrieved from http://www.webpal.org/

lead to negative impacts on the local communities' well-being among others the income reduction, abrupt livelihood changes, limitation of resources accessibility and tenure conflict.

The replanting activities under the ER Project were not intended for restoring the provisioning services (timber) that give a direct impact on communities livelihood since harvesting timber will decrease the carbon sink function of the concession area. One of the implicit aims of this restoration project is to reduce the dependency of local communities to the concession area. It can be seen as a positive and negative approach of forest conservation. ER can be considered as a project to separate forest and its communities. On the other hand, this ER project offers several activities for the community to be self-sustained in the village without having to make an effort to enter the forest and cut tree which will reduce the carbon sequestration value.

The mismatch of priority ESs between communities and ER project point of views and the differences of stakeholders's interest lead to a challenging trade-off process and can evoke the social problems. This finding needs to be highlighted as lesson learns for other carbon trading based- ecosystem restoration projects. This risk should be intensively discussed to prevent social conflict in maintaining sustainable forest management.

2. National Prohibition Policy of Illegal Logging as Another Driver of ESs Changes and Identified Impact on Local Communities Well-being

The starting year of the ER Project in Katingan and Kotawaringin Timur Districts (in 2010) was concurrent with the enforcement of illegal logging banning that regulated through Presidential Decree No. 4 of 2005 on the illegal logging prohibition in the forest area. Even though this regulation was declared in 2005, the execution has just being implemented in Central Kalimantan in 2010 by dispersing sawmills (timber collecting and processing shelter) and arresting the illegal loggers simultaneously. Nevertheless, ER Project would likely prohibit the illegal logging with the different approach even though it was not concurrent with the regulation enforcement since logging will be a threat for forest protection and projects' objectives.

3 The impact of Ecosystem Restoration on Well-Being Cannot Significantly be Captured.

The ER Project impacts on the local communities' well-being till cannot significantly be captured. My research is being done in the early stage of the ER Project. These seven years in ER Project was the challenging period for PT RMU. This project should face complex bureaucracy and corruption in Indonesia that resulted in a licencing process delay. In getting the concession area permit, PT RMU as the owner of this project should wait for several years. The permit finally granted after Harrison Ford, a famous international actor, and environmentalist made a movie titled "years of living dangerously" in 2013 that taken place in the ER Project concession area and showed the corruption that has devastated the Indonesian forests. Another challenge for ER Project was to get trust from the local communities. Being disappointed with Sebangau National Park in forest management and Palm Oil Plantation Company in resource sharing make them sceptic about the ER Project. The ER Project needs time to concretely prove the real result of its program to gain the trust of local communities. Therefore, in 7

years, a lot of preparations have been done but the tangible impacts (especially impact that increasing income) for the local communities still cannot significantly felt by communities.

However, this research can be an 'ex-nunc evaluation' which evaluates the project while it is running. The ex-nunc evaluation is an interim assessment to find which project part that still need to be improved and provide a recommendation for project modification. The finding of impact assessment need to be used as an evaluation, initial warning and recommendation to anticipate a problem before it is getting worse.

9.3 Implications of This Research to Improve Ecosystem Restoration Project

The ER Project implementation in study sites is still under preparation stage so that a lot of activities and programs need to be done to achieve the ecosystem restoration targets. However, a lot of programs have been included in the planning document of ER Project. Therefore, impacts that evaluated from this research are not necessarily a weakness of the ER Project. It can be can also be regarded as unachieved targets but has been prepared at planning ahead. The recommendation formulation to address the impact may not cover all the investigated impacts. Nevertheless, the recommended proposal can be some inputs that can be developed to improve the ER Project activities.

The recommendation of the selected agriculture commodities (Cashew Nut, Aloe Vera, Nypa Palm and Dragon fruit) were several ideas taken from the observations, in-depth interviews and best practices from other projects. This research did not provide the thorough and complete business assessment to develop these commodities. However, these commodities were proven to be advantageous for smallholder business in other areas that have a similar biophysical condition with the project. Therefore, adding this recommendation on the ongoing business development in study site is feasible to be applied in the project area with further business research.

The proposal which addresses the tenure conflict was taken from the REKI's (Restorasi Ekosistem Indonesia) experience in tenure conflict resolution in Jambi Harapan Forest which had more complicated conflicts with encroacher, speculator and the minimum government role. Unlike ER Project in Katingan and Kotawaringin Districts, indigenous people were living inside the REKI concession area so that REKI was facing more complex problems which were still going on until now. The ER Project deals with the different characteristic of communities and bureaucracy system which might not apply the same method in addressing the conflict. However, the approach that was taken by REKI in reducing and solving the project can be a reflection and lesson learn to prevent the further conflicts.

9.4 Unexpected Results

This research uncovers finding which different from an initial hypothesis. From the theory used in this research, Ecosystem Restoration is defined as activities which aim to recover and restore ecosystems to its pre-degradation condition. To achieve the objectives, ecosystem restoration should secure the ecosystem services sustainability. Therefore, the ER Project is expected to maintain and recover Ecosystem Services in the study site but the finding is contrary to the expectations. The result of the

research shows that the key ecosystem services that are important for local communities' livelihood are decreasing and result in negative impacts on the communities' well-being.

One of the issues within carbon trading in forestry is the ' carbon leakage'. This leakage can be caused by preserving an area of forest in one place that results in the migration of loggers to another forest area and abolishing the environmental benefit. To address this leakage, the voluntary market as one of the sources of financing for ER project entails some standard such as WRI GHG Protocols, Plan Vivo, and ISO 14064. To be able to participate in the voluntary carbon market, ecosystem restoration project in Katingan and Kotawaringin Timur Districts use the Climate, Community, and Biodiversity (CCB), Standard. This standard includes a requirement to ensure the welfare of the community that lives near and in the concession area as a precondition of the ER Project to be able to sell its carbon offset. Therefore, even though the priority of ESs of the local communities is different from the ER Project, this company is still required to conduct program and activities to provide livelihood alternatives that can reduce the dependency of communities to the forest and improve the local communities quality of life.

10. Conclusions

The objective of this thesis research is to assess the local community perceptions of the key ecosystem services changes as a result of the implementation of ecosystem restoration in Katingan and Kotawaringin Districts. Furthermore, it aims to investigate the impact on the well-being of communities in the project area from the ER Project activities. This chapter summarises the main conclusions of the four research questions.

1) The community's priority ecosystem services are food, minerals, raw materials and ethical & spiritual values. These are all decreasing because of overexploitation and the mismatch between the need of the local communities and the ER Project objectives in prioritising ESs. As a carbon trading-based ecosystem restoration that is financed by its performance in avoiding carbon emissions, the ER Project prioritising carbon sequestration and reducing possible threats such as logging activities.

2) PT RMU is the key stakeholder that responsible for managing and controlling overall activities in ER Project. As the owner and developer of ER Project, PT RMU plays a central role in ER project and have a positive social network which maintains good communication and connect and involve each stakeholder in formulating systematic and integrated planning and monitoring towards ecosystem recovery.

3) The direct impacts of the changes in key ESs consist of the abrupt livelihood changes, income reduction, and limitation of accessibility. The indirect impacts are biodiversity and other ecosystem service's destruction, and economic benefit. The activities of ER also provide impacts, among others: income generation, security of life provision by reducing forest fire, disease from a forest fire prevention and tenure conflicts.

4) Implications to improve the ER Project are to reduce the direct and indirect impacts of decreasing key ESs and the ER Project activities. The proposal consists of law enforcement in mercury usage of gold mining, education for fish consumption, agriculture business suggestions, for example, Dragon Fruit, Nypa Palm, Cashew Nut and Aloe Vera. The recommendation for solving conflict is to prioritise non-litigation approach.

To address the limitations of this research, more complete and detailed - time series data about ESs utilisation is needed to find out the dynamics of ecosystem services used by communities. Also, a quantitative assessment with Likert scale- questionnaire and mathematical modelling can be used to obtain more detail centrality value in stakeholder mapping and to analyse more complex networks. Furthermore, a larger number of respondents for social network analysis and impact assessment is needed to formulate more elaborated stakeholder mapping and investigate more ER Project's impacts on human and ecosystem well-being. The recommendation to address the impact and to improve the ER Project might not be implemented precisely in the same method since the character of the conflict is different. Nevertheless, it can be used as a prevention strategy to mitigate the further conflicts.

This research contributes to the early stage of Ecosystem Restoration Project evaluation. Also, this can be initial research to investigate the externalities of ER Project. It is also input to strengthen the perspective that the Ecosystem Restoration Project is the intersection where different stakeholders can savour the benefit, learn from the project, provide input and contribute support to develop this project and to address its impact and externalities.

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Annex

Annex I. Observation and Conversational Interview Design

The interview that will be used is a conversational interview. This is a way to explore a topic in a natural manner, as part of a normal flow of discourse (Salmen, 2002). This interview will consist of a direct and indirect question, depend on the topic, socio-cultural condition and timing. Conversational interviews will be created around the impact of the restoration project on human well-being. Below is planned interview topics used in beneficiary assessments in the areas of necessary material for good life, health and security.

i. Ecosystem Services
    1. Benefits and its quantity that is obtained from the forest. The specific forest products such as copra, coffee, rubber, fish, timber, rattan, fuelwood and intensity of natural disaster and erosion will be stated and the respondent will be asked to give a 'yes' or 'no' answer.
    2. Other benefits that are obtained from the forest and the quantity.
    3. The changes (increase or decrease) on the benefit before and during ER Project.
    4. The respondent will be asked about the ecosystem services priority, accessibility and the level of utilization.

ii. Stakeholder Group.
    1. List of stakeholder from literature review
    2. Stakeholder group will be stated such as miner, farmer etc. The respondent will be asked to mention what are their dependency to the forest and other stakeholder relate to the ER Project.
    3. Respondent will be asked to mention the cost of aletrnatives
    4. Respondent will be asked to explain the relationship of each mentioned stakeholder

iii. Impact on Human Well-Being
    1. Necessary material for a good life.
        a. Comparison of income, food, agriculture production, shelter before and after the ER Project.
        b. Dependency to forest to access food, shelter
        c. Accessibility in energy service.
        d. Cost and problem to fulfill the needs
        e. The alternative to getting income and access to food, shelter before and after ER project.
        f. Preferability and satisfactory to access alternative income, food, shelter
    2. Health
        a. Comparison of disease, health condition, physical environment before and after ER project.
        b. Intensity and reason for attendance at health center
    3. Security of life.
        a. Comparison of secure access to natural resources, person, and possessions security, security from natural and human-made disasters before and after project.
        b. The intensity of flood, erosion, forest fire before and after the project
    4. Other impact.

iv. Recommendation to improve the ER Projects

Annex II. Quantification of The Key Ecosystem Services

These tables and figures are the supporting calculation of Chapter 5.

Raw Material

Table 3. Quantification of Quantity and Economic Value of Timber in Telaga Village per year.

Type of Timber	Before ER Project					After ER Project				
	Quantity (248 hh)	Price (Euro)	QxP (Euro)	Cost (Euro)	Value (Euro)	Quantity (16 lumber)	Price / P	QxP	Cost	Value
Meranti	110,565	7	773,955	515,970	257,985	153	141	21,657	8,755	12,902
Blangiran	22,113	7	154,791	103,194	51,597	153	141	21,657	8,755	12,902
Jingah	22,113	7	154,791	103,194	51,597	153	141	21,657	8,755	12,902
Ramin	22,113	32	707,616	103,194	604,422	0	211	0	0	0
Perupuk	22,113	6	123,832	103,194	20,638	153	127	19,507	8,755	10,752
Banditan	22,113	6	123,832	103,194	20,638	153	127	19,507	8,755	10,752

Source: In-Depth Interviews (n : 3)[2]

The graph of changes Timber in Telaga Village in quantity and economic value can be seen in **Figure 23** and **24** respectively.

[2] The data of quantity of Timber was taken from in-depth interviews from 3 people (conversational in group interviews). It was difficult to estimate how many m³e ach household could get in one year so that data of per day (3m³) was multiplied to 30 days in the 6 rainy months and 15 days in the 6 dry month. Blangiran, Jingah, Ramin, Perupuk and Banditan are same in quantity. It was agreed by group interview that logger could get Meranti about a half of the total timber and for another type were almost same percentage.

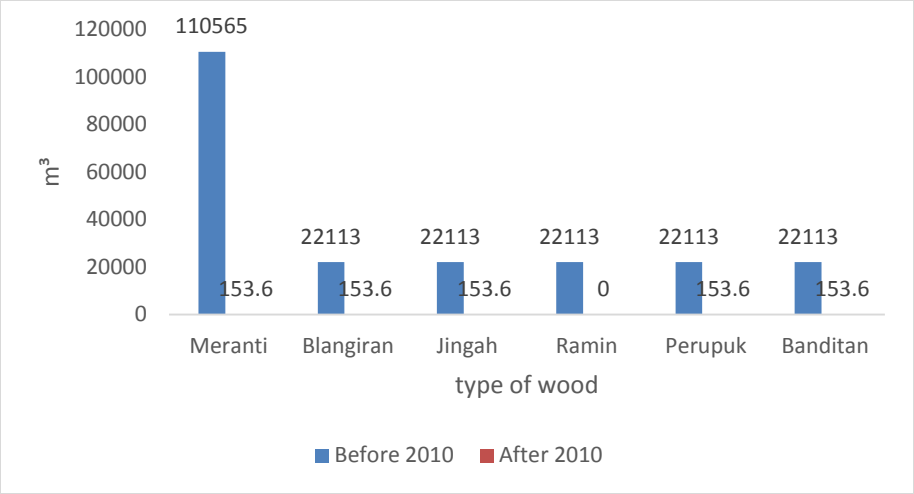

Figure 22. Changes of Timber in Telaga Village before and after ER project in quantity

Source: In-Depth Interviews (n : 3)

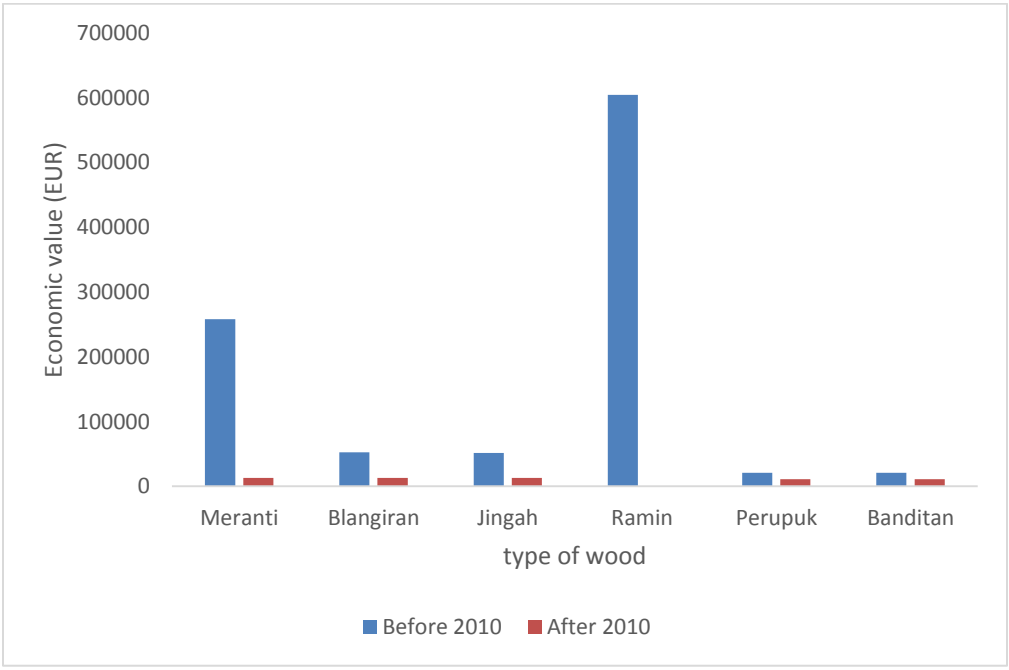

Figure 23. Changes of Timber in Telaga Village before and after ER project in Economic Value

Source: In-Depth Interviews (n: 3)

The calculation of changes in quantity and economic value of Kampung Melayu Village can be seen in **Table 4** below

Table 4. Quantification of Quantity and Economic Value of Timber in Kampung Melayu Village per year.

Type of timber	Before ER					After ER				
	Quantity	Price/P	QxP	Cost (Euro)	Value (Euro)	Q (m^3)	P (Euro)	QxP	Cost (Euro)	Value (Euro)

	/ Q (m^3)	(Euro)								
Meranti mix	41,040	18	738,720	64,296	674,424	0	88	0	0	0

Source: In-Depth Interviews (n: 2)

The Timber in Kampung Melayu Village changes in quantity and economic value can be seen in **Figure 25** and **26** respectively.

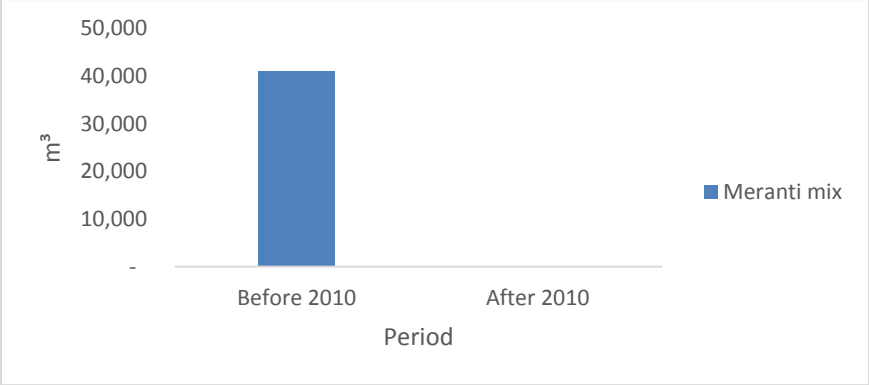

Figure 25. Changes of Timber Quantity in Kampung Melayu Village Before and After ER Project.

Source: In-Depth Interviews (n : 2)

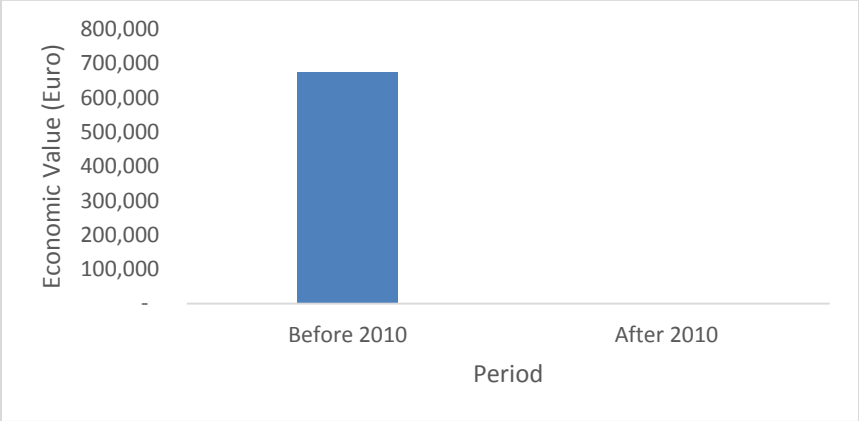

Figure 26. Changes of Timber Economic Value in Kampung Melayu Village Before and After ER Project.

Source: In-Depth Interviews (n: 2)

The changes calculation in quantity and economic value of Hantipan Village can be seen in **Table 5** below.

Table 5. Quantification of Economic Value of Timber in Hantipan Village per year.

Before ER						After ER					
Type of Timber	Q (m^3)	Price (Euro)	QxP	Cost (Euro)	Value (Euro)	Type of Timber	Q (m^3)	Price (Euro)	QxP	Cost (Euro)	Value (Euro)
Meranti	29,400	7	205,800	51,695	154,105	Pona	1,176	106	124,656	68,796	55,860
Ramin	5,880	28	164,640	10,339	154,301	Bintan	588	106	62,328	34,104	28,224

Source: In-Depth Interviews (n : 3)

The graph of changes Timber in Hantipan Village in quantity and economic value can be seen in **Figure 27** and **28** respectively.

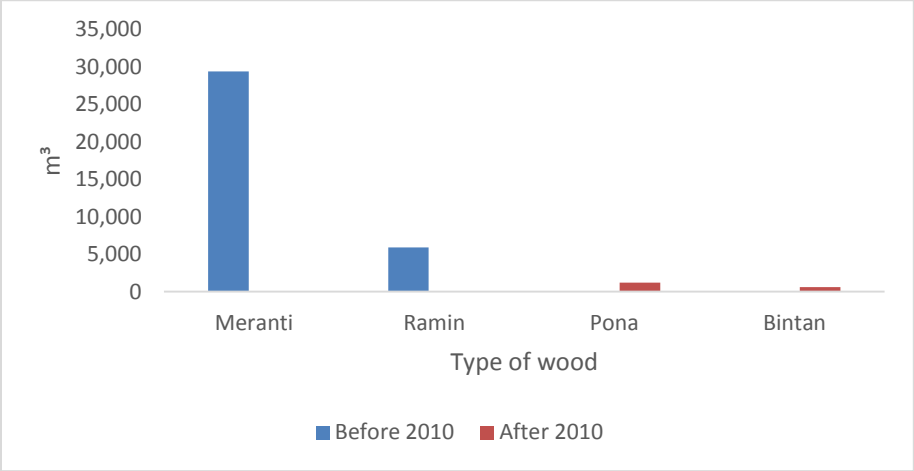

Figure 27. Changes of Timber in Hantipan Village before and after ER project in quantity

Source: In-Depth Interviews (n : 3)

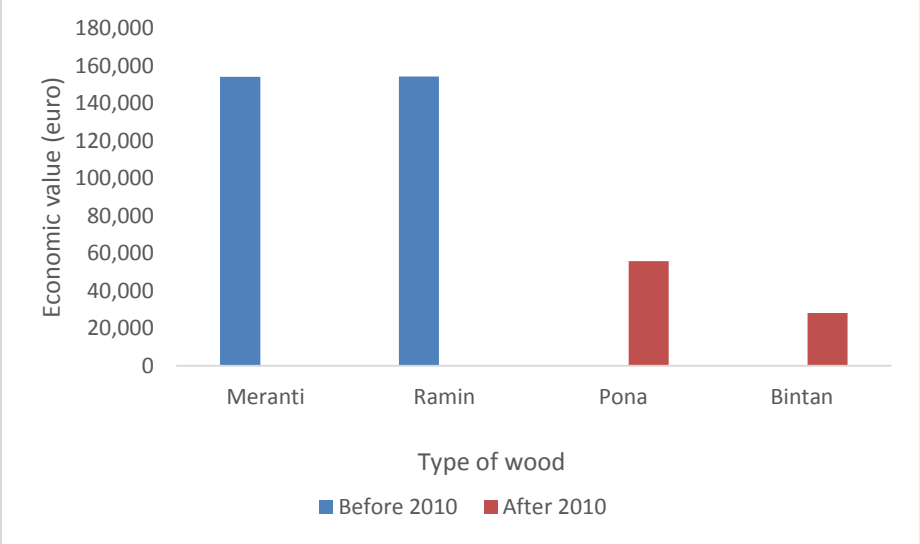

Figure 28 Changes of Timber in Hantipan Village before and after ER project in Economic Value

Source: In-Depth Interviews (n: 3 people)

Food

Deer

Table 7 Comparison of quantity and Economic Value of Deer in Telaga Village per Year.

Type of Hunter tool	Before ER					After ER				
	Quantity	Price (Euro)	QxP (Euro)	Cost (Euro)	Value (Euro)	Q	Price (Euro)	QxP (Euro)	Cost (Euro)	Value (Euro)
Trap (all year)	48	283	13,608	2,040	11,568	24	397	9,528	672	8,856

Rifle (only in dry season)	72	283	20,412	8,160	12,252	-	-	-	-	-
Total	120	567	34,020	10,200	23,820	24	397	9,528	672	8,856

Source: Depth Interview (n: 1)[3]

The comparison graph of deer quantity and economic value in Telaga Village can be seen in **Figure 37** and **38** respectively.

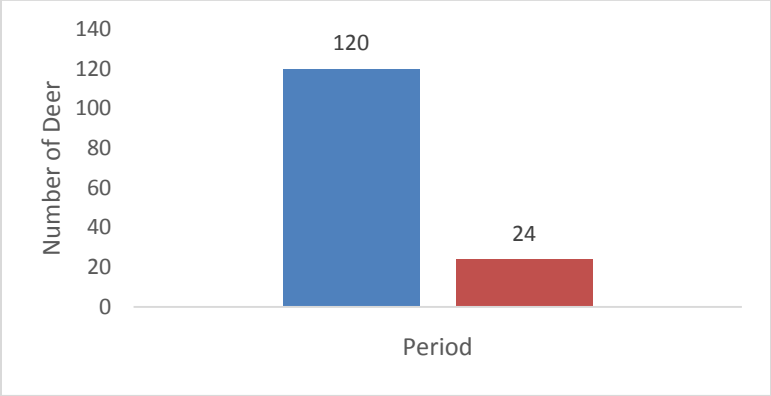

Figure 37. Changes of Quantity of Deer in Telaga Village

Source: In-Depth Interview (n: 1)

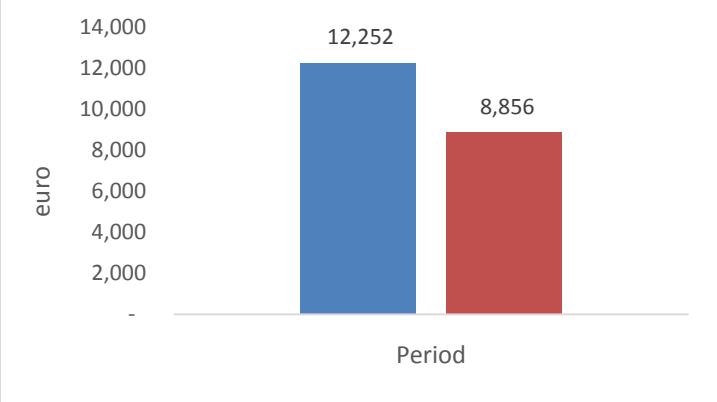

Figure 38. Changes in Deer Economic Value in Telaga Village

Source: In-Depth Interview (n: 1)

Table 8 Comparison of quantity and Economic Value of Deer in Kampung Melayu Village per Year.

	Before ER					After ER				
Type of Bird	Average quantity / Q	Price (Euro)	QxP (Euro)	Cost (Euro)	Value (Euro)	Average quantity / Q	Price (Euro)	QxP (Euro)	Cost (Euro)	Value (Euro)
Deer	42	213	8,946	318	8,628	6	43	258	126	132

Source: In-Depth Interviews (n: 2)[4]

[3] Only one respondent that can be asked about deer hunting activities. The other hunters were hesitate to be interviewed because the deer hunting is an prohibited in the concession area.

Changes of Deer in quantity and economic value in Kampung Melayu Village Before and After ER Project can be seen in **Figure 39 and 40** respectively.

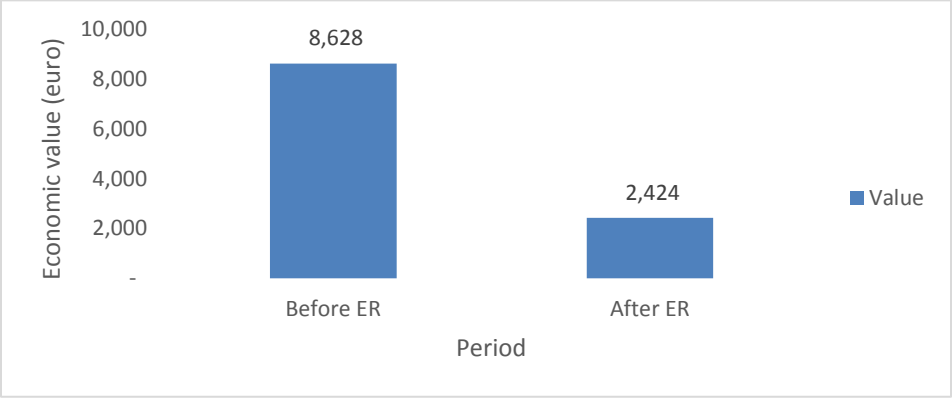

Figure 39. Changes in Economic Value of Deer in Kampung Melayu Village

Source: In-Depth Interviews (n: 2 people)

Table 9. Comparison of quantity and Economic Value of Deer in Hantipan Village per Year.

ES	Before 2010					After 2010				
	Quantity /Q	Price (Euro)	QxP (Euro)	Cost (Euro)	Value (Euro)	Quantity /Q	Price (Euro)	QxP (Euro)	Cost (Euro)	Value (Euro)
Deer	100	191	19,100	850	18,250	9	284	2,552	128	2,424

Source: In-Depth Interviews (n : 2)

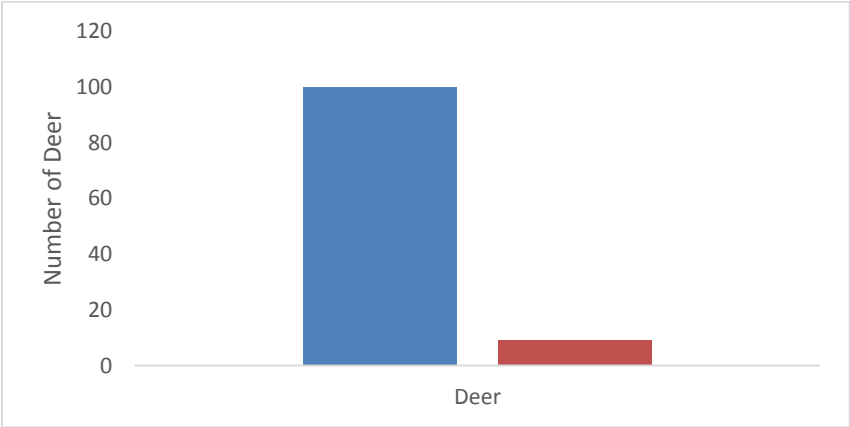

Figure 40. Changes in Deer Quantity in Hantipan Village

Source: In-Depth Interviews (n : 2)

[4] The in-depth interviews were done with 2 deer hunters that had been hunting for long time that usually become the leader of hunter team.

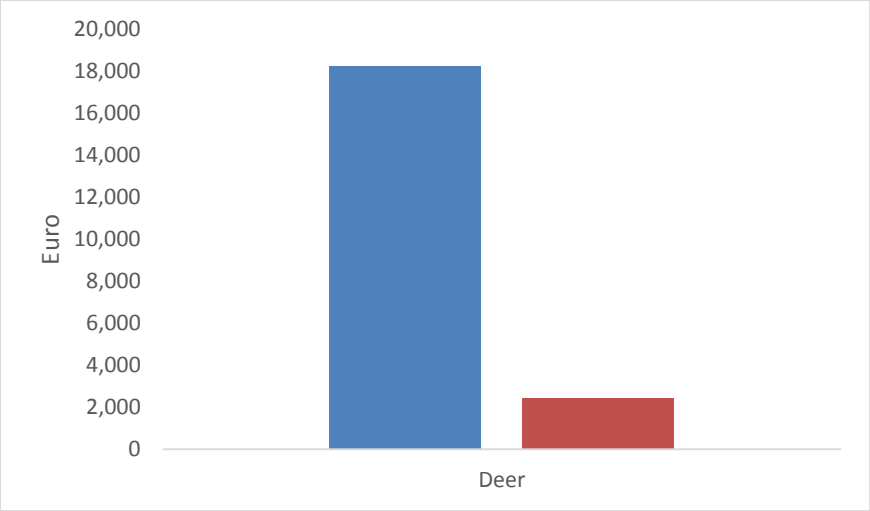

Figure 41. Changes in Deer Economic Value in Hantipan Village

Source: In-Depth Interviews (n : 2)

Fish

Table 10 Quantification of Economic Value of Fish in Seragam Jaya Village per year.

Type of Fish	Before ER					After ER				
	Quantity /Q (kg)	Price (Euro)	QxP	Cost (Euro)	Value (Euro)	Quantity /Q (kg)	Price (Euro)	QxP	Cost (Euro)	Value (Euro)
Pentet/ catfish	9,800	1	9,800	-	9,800	4,900	1.4	6,860	-	6,860

Source: In-Depth Interviews (n: 2)

Resin and Fiber

Table 11 Comparison of Quantity and Economic Value of Resin and Fiber in Telaga Village per year.

	Before ER					After ER				
Type of NTFP	Quantity /Q (kg)	Price (Euro)	QxP	Cost (Euro)	Value (Euro)	Quantity /Q (kg)	Price (Euro)	QxP	Cost (Euro)	Value (Euro)
Jelutong	6,000	0.25	24,000	1,269	22,731	24,000	0.88	21,120	1,269	19,851
Gemor	240,000	0.42	100,800	1,269	99,531	-	0.70	-		

Source: In-Depth Interviews (n: 4)

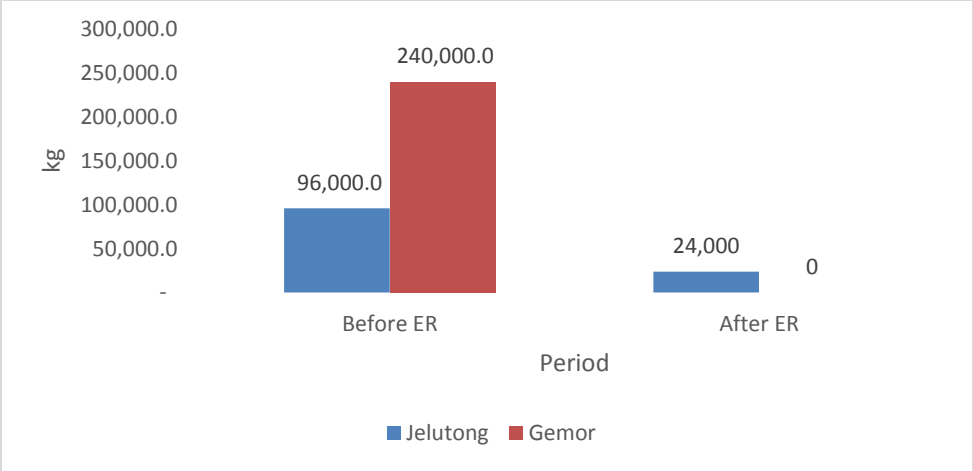

Figure 53 Changes of Resin and Fiber Quantity in Telaga Village Before and After ER Project

Source: In-Depth Interviews (n: 4)

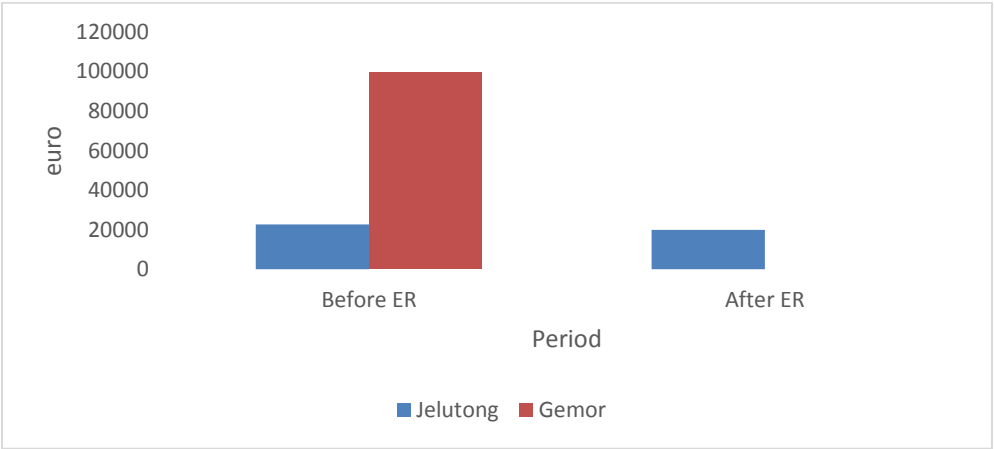

Figure 54 Changes of Resin and Fiber Economic Value in Telaga Village Before and After ER Project

Source: In-Depth Interviews (n: 4)

Table 11 Comparison of Quantity and Economic Value of Gemor in Kampung Melayu Village per year.

	Before ER					After ER				
Type of NTFP	Quantity /Q (kg)	Price (Euro)	QxP	Cost (Euro)	Value (Euro)	Quantity /Q (kg)	Price (Euro)	QxP	Cost (Euro)	Value (Euro)
Gemor	115,200	0.35	40,320	13,440	26,880	0	0.7	0	0	0

Source: In-Depth Interview (n: 1)

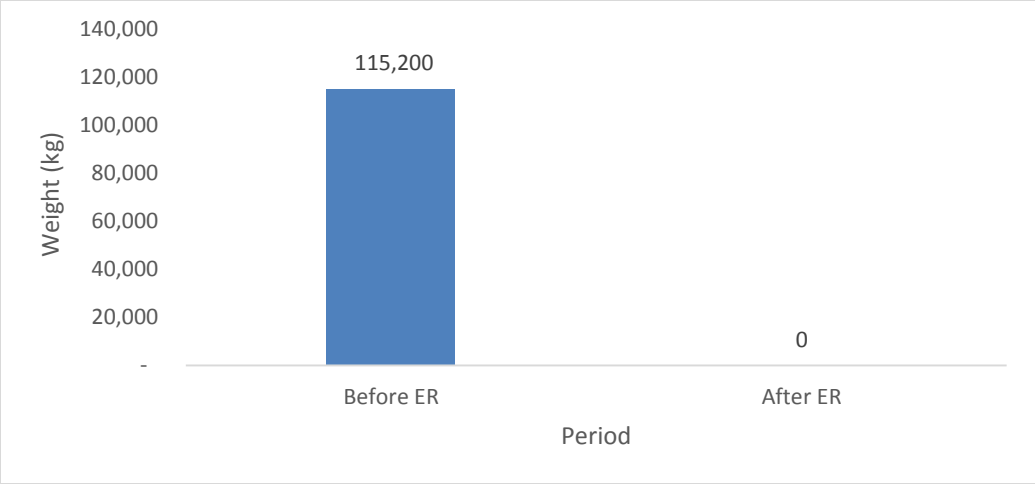

Figure 55 Changes of Gemor Quantity in Kampung Melayu Village Before and After ER Project

Source: In-Depth Interview (n: 1)

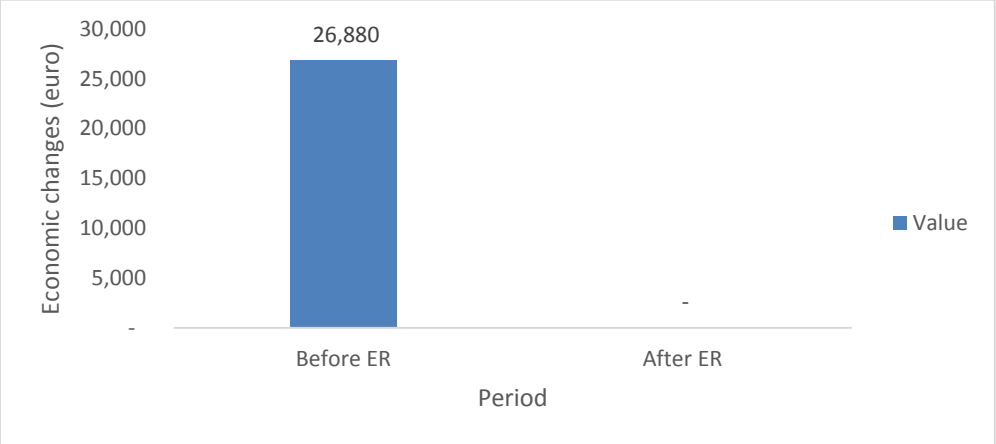

Figure 56 Changes of Gemor Economic Value in Kampung Melayu Village Before and After ER Project

Source: Depth Interview (n: 1)

Table 13 Comparison of Resin and Fiber Quantity and Economic Value in Hantipan Village per year.

	Before ER					After ER				
Type of NTFP	Quantity /Q (kg)	Price (Euro)	QxP	Cost (Euro)	Value (Euro)	Quantity /Q (kg)	Price (Euro)	QxP	Cost (Euro)	Value (Euro)
Gemor	60,000	0.21	12,600	4,200	8,400					
Jelutong	96,000	0.35	33,600	4,200	29,400	7,680	0.56	4,300.8	672	3,628.8

Source: In-Depth Interviews (n: 3)

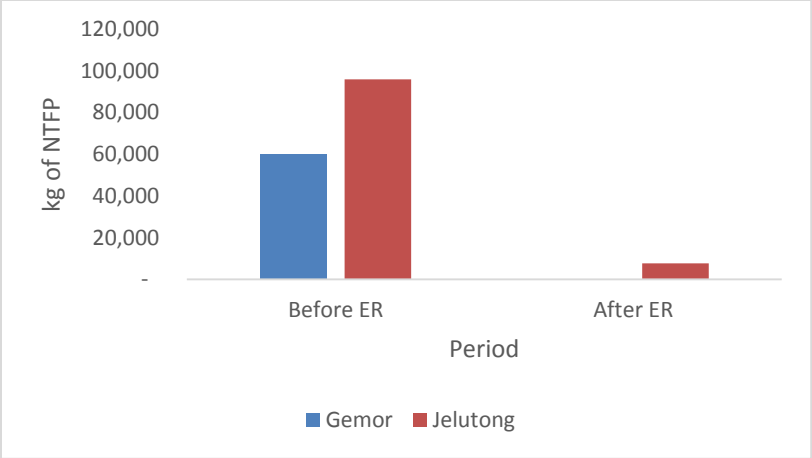

Figure 57 Changes of Gemor and Jelutong Quantity in Hantipan Village Before and After ER Project

Source: In-Depth Interviews (n: 3)

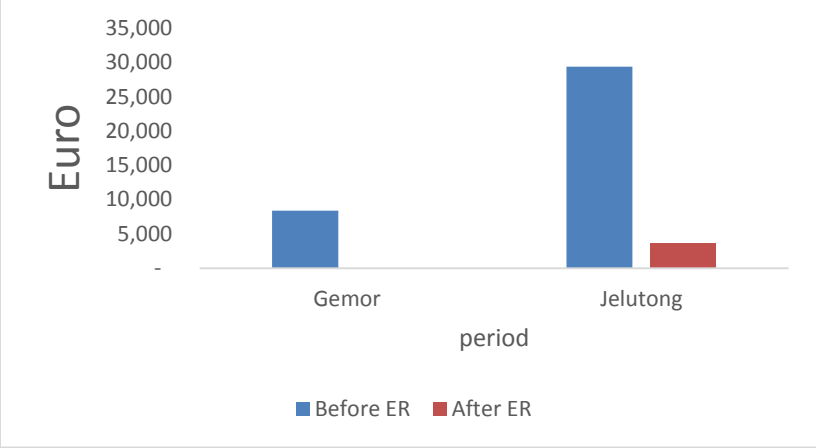

Figure 58 Changes of Gemor and Jelutong Economic Value in Hantipan Village Before and After ER Project

Source: In-Depth Interviews (n: 3)

Table 14 Comparison of Quantity and Economic Value of Damar in Seragam Jaya Village per year.

	Before ER					After ER				
Type of NTFP	Quantity /Q (kg)	Price (Euro)	QxP	Cost (Euro)	Value (Euro)	Quantity /Q (kg)	Price (Euro)	QxP	Cost (Euro)	Value (Euro)
Damar	299,700	0.18	53,946	-	53,946	12,600	0.3	3,780	-	3,780

Source: In-Depth Interviews (n: 4)

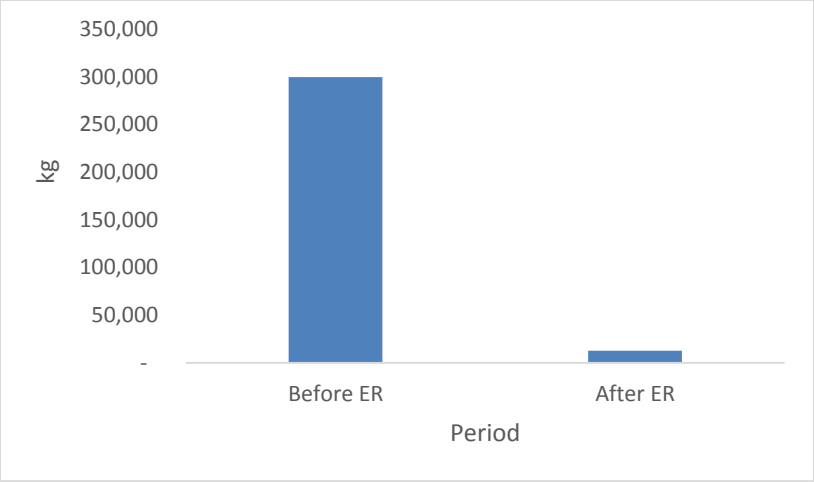

Figure 59 Changes of Damar Quantity in Seragam Jaya Village Before and After ER Project

Source: In-Depth Interviews (n: 4)

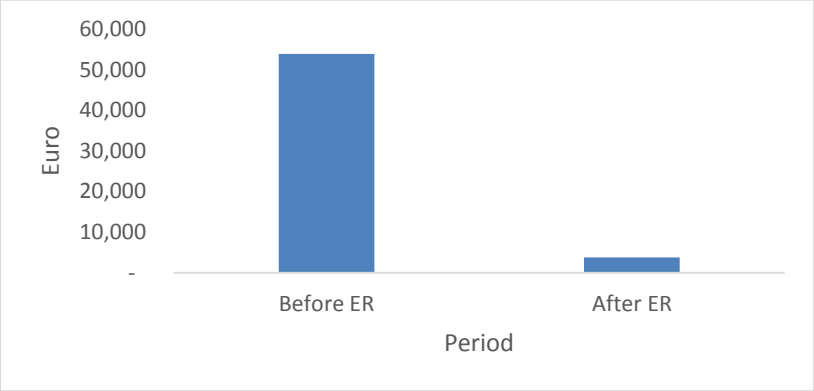

Figure 60 Changes of Damar Economic Value in Seragam Jaya Village Before and After ER Project

Source: In-Depth Interviews (n: 4)

Ethical and Spiritual Value

Table 15 Comparison of Birds Quantity and Economic Value in Telaga Village per year.

Type of birds	Before ER					After ER				
	Q	Price (Euro)	QxP	Cost (Euro)	Value (Euro)	Q	Price (Euro)	QxP	Cost (Euro)	Value (Euro)
Cucak hijau	630	17.7	11,151	297	10,854	420	19.8	8,316	21	8,295
Murai	441	21	9,261	297	8,964	210	28	5,880	21	5,859
Kacer	630	14	8,820	297	8,523	420	14	5,880	21	5,859
Beo	18	28	504	297	207	1	42.5	43	21	22

Source: In-Depth Interviews (n: 2)

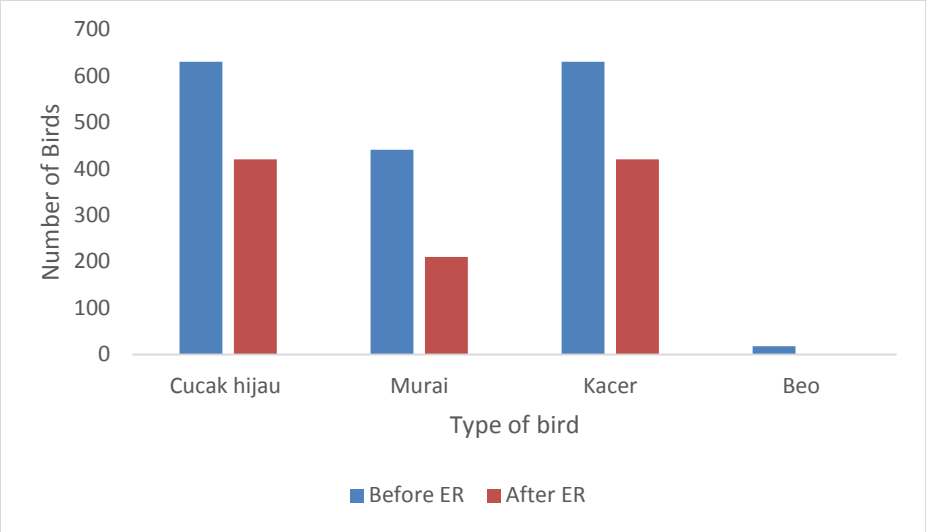

Figure 67. Changes of Birds Quantity in Telaga Village Before and After ER Project

Source: In-Depth Interviews (n: 2)

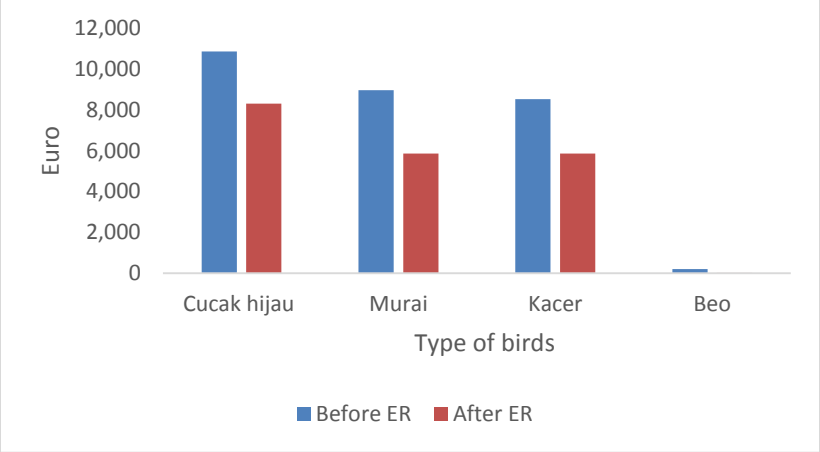

Figure 68. Changes of Birds' Economic Value in Telaga Village Before and After ER Project

Source: In-Depth Interviews (n: 2)

Table 16 Quantification of Economic Value of Birds in Kampung Melayu Village per year.

Type of Birds	Before ER					After ER				
	Q	Price (Euro)	QxP	Cost (Euro)	Value (Euro)	Q	Price (Euro)	QxP	Cost (Euro)	Value (Euro)
Cucak Hijau	1,800	18	31,860	4,240	27,620	300	28	8,400	2,333	6,067
Kacer	1,350	14	18,900	4,240	25,440	180	28	5,040	1,400	3,640
Murai	450	21	9,450	1,060	6,360	60	43	2,550	467	2,083

Source: In-Depth Interviews (n: 3)

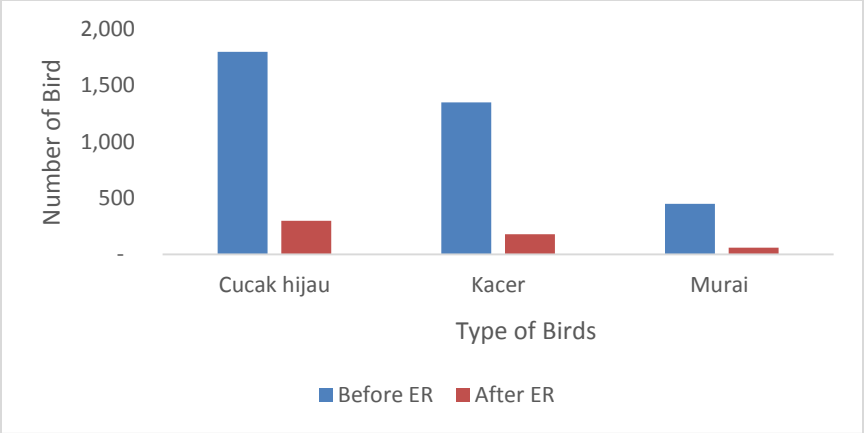

Figure 69. Changes of Birds' Quantity in Kampung Melayu Village Before and After ER Project

Source: In-Depth Interviews (n: 3)

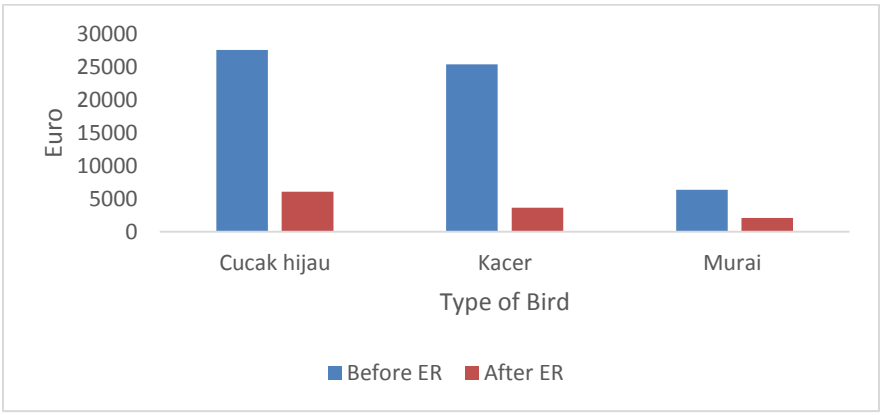

Figure 70. Changes of Birds' Economic Value in Kampung Melayu Village Before and After ER Project

Source: In-Depth Interviews (n: 3)

Table 17. Quantification of Economic Value of Birds in Hantipan Village per year.

Type of Bird	Before ER					After ER				
	Average quantity in 1 year / Q	Price (Euro)	QxP	Cost (Euro)	Value (Euro)	Average quantity of 1 year / Q (2 hunters)	Price (Euro)	QxP	Cost (Euro)	Value (Euro)
Cucak hijau	1080	14	15,120	2,546	12,574	120	17	2,040	672	1,368
Kacer	252	12.7	3,200	594	2,606	120	14	1,680	672	1,008
Murai	180	21	3,780	424	3,356	60	28	1,680	336	1,344

Source: In-Depth Interviews (n: 3)

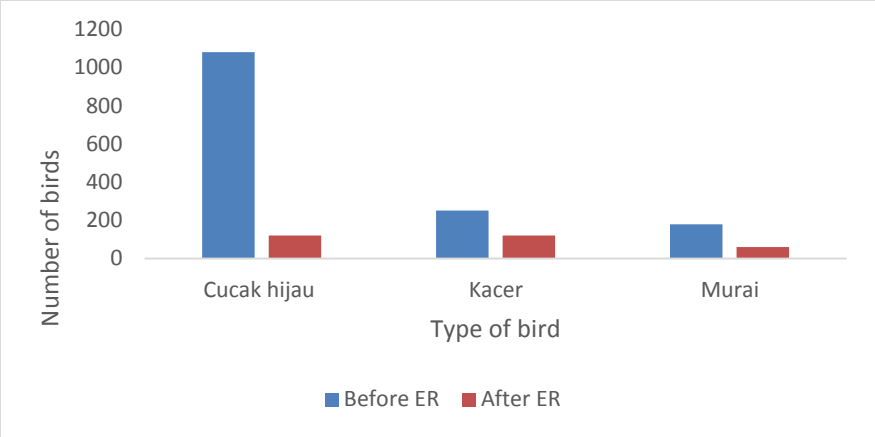

Figure 71. Changes of Birds in Hantipan Village Before and After ER Project in Quantity.

Source: In-Depth Interviews (n: 3)

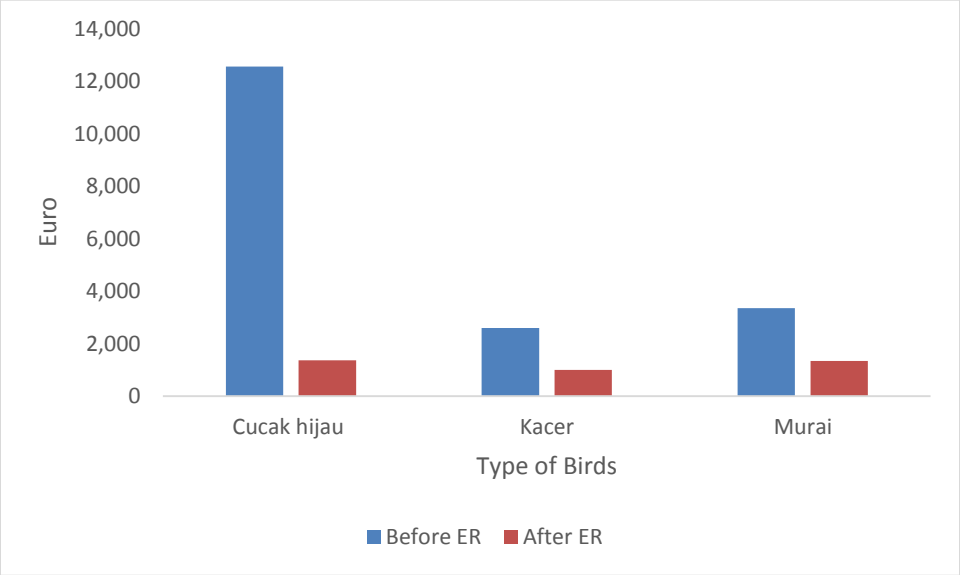

Figure 72. Changes of Birds Economic Value in Hantipan Village Before and After ER Project.

Source: In-Depth Interviews (n: 3)

Annex III. Stakeholder Identification of the ER Project

Table 20. Stakeholder Identification of The ER Project

Stakeholder and Beneficiaries	Description	Power	Interest
International			
Permian Global	An investment company that dedicated to climate change mitigation and the forest protection. This firm commit creating the best possible forest carbon projects and provide positive impact on biodiversity, vulnerable communities and ecosystem (www.permianglobal.com)	• Provide investment opportunity for the ER project. • Control the performance of RE project especially the benefit taken by the community • Provide channel for carbon trading	• Promote forest conservation. • Get profit from carbon trading
Wetland	Wetlands International is an international non-profit Organisation which dedicated to restoring wetlands to provide environmental services to people (www.wetlands.org).	• Provide research to improve ER Project activities (i.e. Carbon Sequestration).	• In line with Wetland vision • Promote their importance, loss and damage to wetlands and their biodiversity.
Global Green Growth Institute	A treaty-based international inter-governmental organisation dedicated to supporting and promoting strong, inclusive and sustainable economic growth in developing countries and emerging economies.	• Provide research to improve ER Project activities.	• Launches technical report on the extensive cost-benefit analysis of Katingan Project are tools developed to measure and compare the Green Growth Performance of investments.
Center for International Forestry Research (CIFOR)	A non-profit research organisation which conduct a study related to forest and landscape management (www.cifor.org)	• Provide research to improve ER Project activities • Support the ER Project to make decisions based on solid science.	• In line with CIFOR vision to develop research for impact, capacity development and outreach and engagement.

National Forestry and Environment Ministry			
Submit Restorasi Ekosistem dan Pemanfaatan Kawasan (Ecosystem Restoration and Forest Regional Usage) under Forestry and Environment Ministry	• As a representative of the national government to operationalize ER. • As facilitator and evaluator of ER performance. • As a mediator between restoration ecosystem operator and community. (Source: interview with the Head of Submit REPK)	Have the power to give sanction if RE operator overset the government rules.	In line with its primary function
Submit Perhutanan Sosial (Social Forestry Division) under Forestry and Environment Ministry	• As a mediator between restoration ecosystem operator and community.	This stakeholder helps RE operator to clarify the conflicted area so that PT RMU and community can utilise the area together. Make sure no limitation of access and fair discussion between RE owner and community.	In line with its primary function
Research and Development under Forestry and Environment Ministry	As an expert in giving recommendation on land use management in project zone.	Provide advise on how to maximise utilisation of peatland with agroforestry	In line with Litbang primary function
PT RMU	Owner and developer of the Ecosystem Restoration Project in Katingan and Kotawaringin Timur.	• Implement ER Project activities • Design and run ER business model	• Get benefit from carbon trading
Puter Foundation	Puter Foundation (Yayasan Puter) is a not-for-profit organisation with aims to implement innovative approaches in people-based planning processes.	Support PT RMU to develop Katingan Project activities that relate to community development.	• In line with Puter vision
The Orangutan	The OuTrop is an organization that protect tropical rainforest	Support PT RMU to develop conservation	In line with OuTrop primary vision.

Tropical Peatland Project (OuTrop)	especially in Borneo, home to the world's largest orangutan population. This organisation carries out biodiversity and forestry research and develop a strategy for conservation (www.outrop.com).	solutions and improve capacity for conservation in the region.	
Local			
District Government (Kabupaten)	A government unit that manages a certain number of municipalities. Supporting Ecosystem Restoration	Give permit for all of the ER activities in the villages in the district area	In line with the mission of local government to improve the welfare of society.
Sub district government (Kecamatan)	A government unit under the district government that manage a certain number of the village. Some of sub-district head support ER project an, and some don't.	Give permit for all of the ER activities in the villages in the Sub-District area	In line with the mission of local government to improve the welfare of society.
Village government (Kelurahan)	The lowest level of government unit that manages a certain number of household.	Give permit for all of the ER activities in the village area	In line with the mission of local government to improve the welfare of society.
Palm oil plantation (PT Arjuna Utama Sawit)	An oil palm plantation company is holding a concession located adjacent to the project zone.	Invest in the production forest in palm oil plantation.	Get profit from palm oil plantation.
Toyota	A business entity that supports local economic in the several villages of project zone (e.g. Support for cow cattle)	Support smallholder business as CSR.	Enhance the company's image as a reliable business partner.
Local Beneficiaries			
Farmer	Local communities live in and near project zone who is making a living from farming (e.g., rice, pineapple, rubber rattan, etc.)	Does not have significant power	Expect that ER Project can link their farming production.
Fishermen	Local communities live in and near project zone who is making a living from farming (e.g., rice, pineapple, rubber rattan, etc.) who is generating income from cultivating fish and traditional fisheries.	Does not have significant power	Expect that ER can protect the forest so that the fish production can be sustained.
Non-timber forest product (NTFP)	Local communities live in and near project zone which is collecting NTFP such as gemor, dammar resin, rattan, Jelutong	Does not have significant power	Expect that ER can protect the forest so that the NTFP production can be

collectors	and Meranti saps, honey.		sustained.
Loggers	Local communities live in and near project zone which is generating income from timber logging and sell it sawmills.	Does not have significant power	Expect that they can still take a tree from the forest and generate income from logging activities.
Poachers	Local communities live in and near project zone which is hunting wild animals (e.g. birds, deer, pig) for commercial purposes.	Does not have significant power	Expect that they can still get bird from the forest and generate income from logging activities
Miners	Local communities live in and near project zone which is making a living by mining gold.	Does not have significant power	Expect that they can still do the mining activities surrounding forest area
Water taxi operators	Individuals that provide water transportation services for goods and people.	Does not have significant power	Expect that the mining and logging still running so that they can get more income.
Middlemen /traders	People who are buying products (e.g. household goods, NTFP, rubber saps, rattan, fish and other crops) from farmers and fishermen and selling them at markets.	Does not have significant power	Expect that they can get raw material from forest so that they can sell it and get income
Women's KSM groups	Groups of women that manage some amount of money to support small scale business in improving the welfare of communities.	Does not have significant power	Expect that they can get CSR or community empowerment from PT RMU.
Sawmill operators	Groups of people that purchasing timber and process it into construction materials	Does not have significant power	Expect that the logging still running so that they can get more income.

Source: Compiled from technical documents and in-depth interviews.