FINAL EVALUATION REPORT FOR PEATLAND MANAGEMENT AND MAPPING

MCC INDONESIA GREEN PROSPERITY EVALUATION

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FINAL EVALUATION OF PEATLAND MANAGEMENT AND MAPPING

MCC Indonesia Green Prosperity Evaluation

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ACRONYMS

BAPPENAS	National Development Planning Agency
BGPP	Berbak Green Prosperity Partnership (EMM grant)
BIG	Indonesia Geospatial-Mapping Agency / *Badan Informasi Geospasial*
BLHD	Regional Environmental Agency / *Badan Lingkungan Hidup Daerah*
BMP	Best Management Practices
BRG	Indonesia Peatland Restoration Agency / *Badan Restorasi Gambut*
CBA	Cost-Benefit Analysis
CBNRM	Community-based Natural Resources Management
CCFPI	Climate Change Forests and Peatlands in Indonesia
CKPP	Central Kalimantan Peatland Project
CPO	Crude Palm Oil
CSCC	Country Social Cost of Carbon
EMM	Euroconsult Mott MacDonald
ENPV	Economic Net Present Value
ERR	Economic Rate of Return
ESMP	Environmental and Social Management System
EWS	Early Warning System
FGD	Focus Group Discussions
GHG	Greenhouse Gas
GIS	Geographic Information System
GK	Green Knowledge
GoI	Government of Indonesia
GP	Green Prosperity
GPF	Green Prosperity Facility
GSCC	Global Social Cost of Carbon
ISCC	International Sustainability & Carbon Certification
KII	Key Informant Interview
KPH	Forest Management Unit / *Kesatuan Pengelolaan Hutan*
LiDAR	Light Detection and Ranging (Spatial Data)
MoA	Ministry of Agriculture
MCA-I	Millennium Challenge Account - Indonesia
MCC	Millennium Challenge Corporation

NDC	Nationally Determined Contributions
NDVI	Normalized Difference Vegetation Index
NREL	National Renewable Energy Laboratory
NRM	Natural Resource Management
PE	Performance Evaluation
PLUP	Participatory Land Use Planning
PMIS	Procurement Management Information System
POME	Palm Oil Mill Effluent
PSDABM	Community Based Natural Resource Management / *Pengelolaan Sumber Daya Alam Berbasis Masyarakat* (Mitra Aksi grant)
RE	Renewable Energy
SCC	Social Cost of Carbon
SPPL	Environmental Management Statement / Surat Pernyataan Pengelolaan Lingkungan
TAHURA	Grand Forest Park / *Taman Hutan Raya*
TAPP	Technical Assistance Project Preparation
TAO	Technical Assistance and Oversight
USD	United States Dollar
w	Denotes “with project” scenario
w/o	Denotes “without project” scenario, usually referred to as the counterfactual in this report
WWF	Worldwide Fund for Nature

EXECUTIVE SUMMARY

INTRODUCTION

In 2011, the Millennium Challenge Corporation (MCC) entered into a five-year, $600 million Compact with the Government of Indonesia (GoI), which entered into force in April 2013. As part of this agreement, the Millennium Challenge Account Indonesia (MCA-I) was established and three multimillion-dollar facilities were implemented to support the GoI's priority of sustainable economic growth for the country focused on community-based health and nutrition, procurement modernization, and a green economy.

Under the Green Prosperity (GP) Project, the Compact aimed to increase productivity, reduce reliance on fossil fuels by expanding renewable energy, and reduce land-based greenhouse gas (GHG) emissions by improving land use practices and improving natural resources management. Peatland rewetting was an important component of the GP Project, both for improving the health and safety of Indonesians exposed to fire and smoke risk and for reducing GHG emissions through improvements in peatland management as well as through the implementation of low emissions development strategies.

This report evaluates the mapping, design, effectiveness, implementation, and sustainability of the GP Project peatland grants and presents a subset of lessons learned specific to this cluster of grants.

EVALUATION TYPE, QUESTIONS, METHODOLOGY

This report is an independent, ex post performance evaluation (PE) of the GP Project peatland grants to determine the validity of the program logic and its assumptions project design, the extent to which planned activities were implemented and factors that affected implementation (project implementation), and the extent to which expected outcomes were achieved as well as lessons that can be learned from project implementation (outcomes, sustainability and lessons learned). There are no known conflicts of interest on the part of Integra Government Services International LLC or the evaluation team, and the results contained herein are based on an independent assessment by the authors.

The relevant peatland activities were implemented through the two grants from MCA-I completed under Window 1 and one grant from MCA-I completed under Window 2. These were evaluated focusing on the following four central questions:

1. Were the activities in the peatland grants designed to achieve the GP Project objectives?
2. What lessons can be learned from grant implementation?
3. What was the effectiveness and impact of the grants?
4. How sustainable are the outputs of the grants?

The evaluation used an *ex-post* mixed-methods approach combining qualitative and quantitative information. Qualitative information was obtained through literature review, key informant interviews (KII), and focus group discussions (FGDs). Quantitative data includes financial data, data measuring specific outputs from the project (e.g., the number of canal blockages produced), and satellite remote sensing data.

As a part of this PE, the team was asked to conduct an independent evaluation-based cost-benefit analysis (CBA) following the end of the compact. MCC is exploring the range of possible gains in quality, accuracy, and efficiency for the CBA effort if combined with evaluation. Such integration

between the economic analysis and monitoring and analysis is unique among the development finance institutions. The approach to the CBA of peatlands follows the integrated approach developed by Harberger and Jenkins[1] and is in line with MCC's general guidelines for economic and beneficiary analysis and considers the ex-ante CBAs performed for the peatland grants.

IMPLEMENTATION SUMMARY

For the purpose of this evaluation, only those grants that conducted rewetting activities were considered[2]. Such activities include canal blocking, revegetation/reforestation, and compatible livelihood opportunities for communities in the context of rewetting. Support to the Indonesia Peatland Restoration Agency / *Badan Restorasi Gambut (*BRG) was an additional criterion. Guided by these criteria, three completed[3] grants had peatland rehabilitation components that focused on rewetting and are evaluated under the peatland portfolio. The grants are:

- *No. 2015/Grant/037, awarded to the Yayasan Mitra Aksi* (Mitra Aksi Foundation)*, and referred to henceforth as the Pengelolaan Sumber Daya Alam Berbasis Masyarakat, or Community Based Natural Resource Management activity (**PSDABM**)*
- *No. 2015/Grant/014,* to the consortium led by Worldwide Fund for Nature Indonesia (WWF), henceforth referred to as the **Rimba Corridor Project.**
- *No. 2015/Grant/010 implemented by the Berbak Green Prosperity Partnership (BGPP)* consortium led by Euroconsult Mott MacDonald (EMM), henceforth referred to as **BGPP**.

Overall, the peatland portfolio awards combined material support for peatland rewetting through canal blockages and wellheads with technical assistance to promote compatible alternative livelihood strategies. The purpose of the peatland management activities was to promote more sustainable agricultural and forestry practices that would lead to increased productivity on existing, degraded peatland, as well as improved carbon sequestration in those carbon sinks. The joining of GP Project activities was thereby expected to reduce GHG emissions and increase household income of beneficiaries.

Outcomes included improved watershed management (water retention and flood management), improved or maintained forest cover density, and improved peatland saturation and groundwater level.

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[1] Arnold C. Harberger & Glenn P. Jenkins (ed.), 2002. "Cost–Benefit Analysis," Books, Edward Elgar Publishing, number 1056, December.

[2] [2] This resulted in the inclusion of one grant that was funded under the Community Based Natural Resource Management Window. Throughout this report we refer to these three grants as the peatland grants. The Peatland portfolio is a formal operation term used by the GPF and this is different from the grants evaluated because one of the portfolio grants did not conduct either rewetting or canal blocking, critical elements of the purpose of the peatland activities.

[3] "Completed" indicates that the grant delivered on all components and received final approval on deliverables.

Table 1: Summary of Findings

Thematic Area	Findings
Design	**Question: Were the activities in the peatland grants designed to achieve the GP Project objectives?** The peatland activities were designed to achieve GP Project objectives, and they were based on solid logic that could be expected to lead to desired outcomes. The exceptions to this are the revegetation activities, which were less strongly supported by economics or ecological science. Specifically, whether it made sense in regards to the design, to spend a significant amount of time and resources to plant a 53 ha plot, from an ecological restoration perspective.
Grant Implementation	**Question: What lessons can be learned from grant implementation?** That peatland rewetting can work, provided that mechanisms are in place for maintenance over long periods. While insufficient time has passed to measure real progress, qualitatively the evaluation has established that long-term commitment of the grant recipients to development in the locations where implementation occurred will contribute significantly to successful outcomes.
Effectiveness of Results	**Question: What was the effectiveness and impact of the grants?** Stakeholder attitudes about the peatland activities were broadly positive because the projects targeted community wellbeing through livelihood enhancements, as well as through protection from burning peat. The evaluation team found that comparison of the merits of a particular approach to canal blocking could be potentially misleading, because each approach used is suited to a specific context, and this context limits the range of options that a grantee can select. The grantees selected the method most appropriate for the specific context in which they were working. Methods were not necessarily interchangeable; while some methods were superior to others in the abstract, they would not be effective in all contexts. The team found that each grantee made a sound choice for the context in which they were working, one that optimized rewetting potential.
Sustainability	**Question: How sustainable are the outputs of the grants?** When looking at the evaluation-based CBA from the perspectives of the stakeholders, the communities benefit quite significantly from all grants. They are financially viable, which is an indication that communities might be financially resourced to maintain the investments that benefit them. This outlook was confirmed in the community interviews. However, threats to the sustainability of these benefits (as well as those of the broader public) primarily relate to the question of maintenance and the long-term sustainability of these investments, especially the canal blocks, which represent a financial loss. If the canal blocks or the trees in the revegetated areas are not properly maintained, future benefits from the reduced fire risk, averted greenhouse gas emissions, and alternative livelihoods from wet-tolerant plant species will be jeopardized and the economic viability for each grant will decrease. It is worth pointing out that the trees in the Rimba Corridor are showing signs of stunting, which already suggests that some of the future gains from jelutong production might be optimistic. The evaluation team, while lauding the apparent success of the grantees in achieving rewetting targets under nearly impossible constraints, is concerned that there is no concrete mechanism in place to support ongoing maintenance. This is short-sighted on behalf of all concerned and naïve to the extent that it assumes communities would take up the burden of maintenance of their own volition. The assumption that the Indonesian Peatland Restoration Agency (*Badan Restorasi Gambut*, or BRG), will be

able to finance the dam maintenance for the canal blocking done in the Berbak GP Partnership, is untested.

The UPDT Tahura is the unit of the provincial Forestry Department responsible for maintenance, with financial support from the BRG. In order to secure these funds, the UPDT needs approved zoning and management plans. The BGPP prepared such plans for the UPDT and organized required consultations at the provincial level. However, the BGPP had insufficient time to conduct the two required workshops at the national level before the project closed.

It is important to recognize, however, that EMM conducted its own canal block maintenance in the dry seasons of 2018 and 2019, even without the support of MCA-I or the BRG. This is not sustainable over the long term and it remains unclear what the ultimate dispensation will be for support to the UPDT.

Evaluation-based CBA Results for Grants that had Peatland Components

Question: What is the evaluation-based ERR for the peatland grants?

The CBA of the three grants in this report included both the peatland components (such as investments in rewetting, revegetation, and nearby livelihood activities). It also included other components executed by each grantee such as activities targeting improved productivity and harvesting quality for palm oil and rubber producers, who were not necessarily near the peatland areas. Therefore, the ERR results are for the entire grant rather than just the peatland component.

As far as the overall economic viability of the three grants evaluated in this report, only PSDABM was found to be economically viable in the cost-benefit analysis, regardless of whether GHG emissions were included as a benefit — valued at the country social cost of carbon (CSCC), or not at all including the social cost of carbon (w/o SCC). The BGPP grant was found only viable if reductions in GHG emissions valued at the CSCC are included in the benefit streams. The Rimba Corridor grant is not found to be viable regardless of whether the value of GHG emissions is included in the benefit streams.

The BGPP grant originally underestimated the total benefit for smallholder farmers that would be trained under the grant. Despite this, the economic return to this grant has decreased significantly as a result of the ex-ante CBA's overestimated benefits associated with the fire risk reductions.

The Rimba Corridor grant is no longer an economically viable grant. This grant was likely never viable considering the overestimated ex-ante assumption for the fire risk reduction. In addition, the ex-ante analysis included unrealistic assumptions about the benefits to the smallholder producers (with revenues increasing by as much as 427 percent per year).

The PSDABM is economically viable regardless if GHG emissions are included, and the evaluation-based economic rate of return (ERR) and economic net present value (ENPV) is higher than the ex-ante analysis ERR and ENPV. This improvement is largely attributable to the inclusion of fire risk reduction and revegetation benefits, which were omitted from the ex-ante CBA.

Investment Criteria Results (Ex-Ante and Evaluation-Based CBAs)

Grant	Ex-Ante CBA ERR (%) ENVP ($)	Evaluation-based CBA ERR (%) ENPV ($)	
		W/O SCC	CSCC
BGPP	23.83% $18.29 million	8.63% -$1.09 million	12.76% $2.33 million

	Rimba Corridor	20.74% $12.44 million	1.51% -$3.95 million	7.26% -$1.34 million
	PSDABM	19.96% $0.81 million	24.20% $2.09 million	27.25% $2.40 million

LESSONS LEARNED AND IMPLICATIONS FOR FUTURE GRANT FACILITIES

Several lessons emerge as important from this evaluation in regard to future grant facilities:

1. Peatland restoration is a landscape level intervention, involving a complex system with overlapping jurisdictions, land uses and other socio-economic behavior, and ecology. This kind of intervention requires coordination and effective governance at all levels. The role of the government in coordination within and across landscapes is essential in ensuring interoperability between jurisdictions and providing leadership in creating a shared vision for the resource.
2. Long-term financing mechanisms are essential for peatland restoration because it almost always requires more time (~20 years) than the typical donor-driven project cycle provides. Solutions in the form of mechanisms that mobilize private investment are as important as the actual implementation of peatland management projects because of the potential for private investment to take restoration to scale with improved prospects for the required long-term support.
3. Aversion to fire after the 2015 fire emergency is an important incentive for sustaining the peatland rewetting effort. Women consistently linked fire prevention and rewetting in interviews. In future programming, additional consideration of strengthening the political empowerment of women would potentially improve the sustainability of project outcomes.
4. Ex-ante CBAs prepared by MCA-I and reviewed by MCC were not always accompanied by a narrative, and it was often difficult to understand the models to assess their validity post-compact. This, as well as all aspects of the evaluation, were hampered by the absence of complete records. In the future, MCA-I and/or its Facility Manager should provide a narrative along with the ex-ante CBA that clearly details key assumptions and data (e.g., the final number of beneficiaries reached, changes in implementation, yearly expenditure, etc.). This will not only expedite model development, but it will also encourage transparency as all parties will have access to a core set of data and assumptions.

1. INTRODUCTION AND BACKGROUND

1.1 COUNTRY CONTEXT

Peat forest and swamps in Indonesia account for more than 50 percent of the world's known tropical peatland, and, since the mid-1980s, they have been subjected to extensive deforestation and degradation from logging, draining, and clearing of land for timber and industrial plantation development. Beyond the significant environmental costs associated with this habitat destruction, economic and health costs have also been critical. The large-scale conversion of peatland (namely for industrial palm oil and pulp timber) has resulted in increased water pollution and extensive fires resulting in smoke haze problems across the region and in neighboring countries (i.e., Singapore and Malaysia). The haze caused more than 100,000 premature deaths in 2015 alone (Koplitz et al. 2016), along with mounting pressure on several already threatened species, and it has placed Indonesia among the top GHG emitting countries in the world. Under a "business as usual" scenario the continued drainage and clearing of peatland will eventually result in the land becoming economically unviable—a barren wasteland.

Following the disastrous fires of 2015, the GoI launched an initiative to restore more than 2 million hectares (ha) of peatland, cutting 29 percent of GHG emissions by 2030. In alignment with the country's nationally determined contributions, the GoI enacted wide-ranging policies to restore its peatland, including a moratorium on new conversions of primary forest and peat below 3 meters deep.

Government regulations supporting sustainable peatland management include:

- ***Presidential Instruction (Decree) of May 20, 2011*** on primary forest and peatland, to improve governance and to impose a moratorium on new licenses;
- ***Government Regulation No. 71 of 2014*** on the protection and management of peatland ecosystems;
- ***Presidential Instruction No. 8 of 2015,*** a moratorium on the issuance of new licenses for the exploitation of primary forest and peatland; and
- **Presidential Regulation No. 57 of 2016** establishing the National Peatland Agency/Badan Restorasi Gambut (BRG).

President Joko Widodo's ambitious plan to restore vast areas of peatland has focused primarily on hotspots in key provinces. Most rewetting activities to date have been small-scale trials in these targeted provinces that have attempted several initiatives to address peatland degradation, focusing on both direct and indirect barriers to peatland rewetting and rehabilitation. Constraints to effective peatland rewetting in Indonesia include:

- Altered peat topography (biophysical and hydrological);
- Invasive water-intensive ferns and shrub species;
- Recurrent fires;
- Climate change;
- Inconsistent land-use and regulatory policies; and
- Lack of alternative livelihood options.

Peatland rehabilitation activities have primarily focused on integrated fire management, rewetting (canal blocking/infilling), revegetation, and to a lesser extent, alternative livelihoods.

1.2 OBJECTIVES OF THE REPORT

This report evaluates the mapping, design, effectiveness, implementation, and sustainability of the three peatland grants. It provides a subset of lessons learned specific to this cluster of grants. This report also ties in the results from the evaluation-based CBA to update the ex-ante CBA models and provides additional evidence on the cost-effectiveness and economic viability of the GP interventions.

The Executive Summary provides an overview of the objectives and key findings. The body of the report is organized into six sections. This section, Introduction and Background, provides the national context for the Green Prosperity (GP) peatland activities. The second section, the Overview of the GPF, provides additional detail on the subject of the evaluation. The evaluation design is described in Section 3. A review of the literature providing evidence constitutes Section 4. Section 5 describes the findings of the evaluation, organized according to the questions outlined in Section 3, Section 6 discusses the policy implications and next steps. The Annex provides details about the evaluation-based CBA methodology and deviations from the ex-ante CBAs.

2. OVERVIEW OF THE GREEN PROSPERITY FACILITY AND INTERVENTIONS EVALUATED

2.1 OVERVIEW OF THE COMPACT

MCC entered into a five-year, $600 million Compact with the GoI in 2011, which was implemented in April 2013. As part of this agreement, the Millennium Challenge Account Indonesia (MCA-I) was established and three multimillion-dollar facilities were implemented to support the government's priority of sustainable economic growth for the country, focused on community-based health and nutrition to reduce stunting, procurement modernization, and GP. Through these projects, the compact aimed to achieve the results listed below by March 2018:

- **GP:** Increase productivity and reduce reliance on fossil fuels by expanding renewable energy, and reduce land-based greenhouse gas emissions by improving land use practices, and improving management of natural resources;
- **Community-Based Health and Nutrition to Reduce Stunting:** Increase household income through cost saving and productivity growth, and improve health and life expectancy by reducing low birth weight, childhood stunting, and malnourishment of children in project areas; and
- **Procurement Modernization:** Achieve significant government savings and higher quality on procured goods and services to achieve the delivery of public services as planned.

The largest component and flagship project for the compact was the $332.5M GP Project, designed to promote a less carbon-intensive future by investing in renewable energy (RE) and sustainable natural resources management (NRM), aimed at increasing productivity while reducing GHG emissions. The GP Project consisted of four activities:

1. **Participatory Land Use Planning (PLUP) Activity:** This activity focused on investment in administrative boundary setting, the updating and integration of land use inventories, and enhancing spatial plans at the district and provincial levels.
2. **Technical Assistance and Oversight (TAO) Activity:** The TAO provided technical assistance and oversight for grants issued under the compact. Eligible districts, activity sponsors, and community groups were identified and offered assistance in their development of potential investments in sustainable and low-carbon economic growth. Technical assistance in the form of application preparation for submission to the GPF was also offered.
3. **GP Facility (GPF) Activity:** The grant funding facility for the compact, the GPF was responsible for the financing of low-carbon development projects and is the entity under which three funding windows and later thematic portfolios was supported.
4. **Green Knowledge (GK) Activity:** Designed to support knowledge management and capacity building, the GK Activity provided technical assistance and support for strengthening local, provincial, and national capacity to drive forward Indonesia's nationwide low-carbon development strategy within the context of the GP Project.

The GPF is the grant-making and administrative body responsible for funding to RE and NRM (e.g., sustainable agriculture, peatland, social forestry) activities. The original design called for the PLUP and GK to provide a foundation for the GPF grants, and the TAO was designed to support grantees during the application process. For reasons that will be discussed later in this report, the PLUP was ultimately delinked from the GPF grant process.

The first grant agreements were signed in early 2015, and the grants that comprise the peatland portfolio were signed in December 2015, more than two years after entry into force and with less than three years left to fulfill the grant terms.

Support services for the prioritization of GP investments included a strategic environmental assessment and District Readiness Assessments (DRAs). DRAs were conducted to select the provinces and districts best suited for GP investments. DRAs were based on quantitative indicators including poverty levels, governance, and peatland under threat. DRAs also helped to finalize critical analyses of social, environmental, and economic issues, as well as assist in the selection of GP projects.

These initiatives and the preparatory analysis undertaken to advance them were intended to foster smarter, greener, and more sustainable low-carbon growth for Indonesia while informing policy and documenting knowledge gained. The TAO activity also supported the facility by assisting eligible grantees in the identification, development, and submission of applications for funding to the GPF through Technical Assistance for Project Preparation (TAPP) grants, which applied to the partnership, community, and commercial RE grants (e.g., feasibility studies, landscape and lifescape analysis). The GPF provided grants to mobilize private sector investment and community participation in RE and sustainable land use practices. Figure 1 below presents the structure of the GP Project. Table 2 provides some key facts about the three grants evaluated for this report.

The GPF was designed to reduce poverty through low-carbon economic growth by funding renewable energy and sustainable NRM activities and providing technical assistance to complete grant requirements (such as the IFC safeguards) and activity preparation through a TAPP grant[4]. The TAPP grant paid for the preparation of activity documents such as engineering designs; feasibility studies; environmental, social, and gender compliance plans; and risk analysis. The GPF contractor did not provide technical assistance directly but did participate in the process by reviewing deliverables and identifying problems such as inadequate design measures or insufficient hydrological evidence.

[4] Only Window 1 and Window 3 grant applicants were eligible for Technical Assistance and Project Preparation (TAPP) grants. The GPF contractor for Window 3 did not supply direct technical assistance. Moreover, not all grant applicants received a TAPP grant.

Table 2: Grants that Include Peatland Restoration

Grant	RIMBA Corridor	Berbak GP Partnership	PSDABM***
Window	1b	1b	2
Lead	WWF	EMM	Mitra Aksi[5]
GPF budgeted (USD)	5,250,000	12,348,785	857,699
GPF expended (USD)	4,314,649	9,124,874	520,443
Co-financing budgeted (USD)	4,750,000	2,233,182	
Co-financing expended (USD)	1,616,756	2,233,182	
GPF budgeted for peatlands restoration (USD)	2,525,652*	4,096,676**	133,515
Co-financing budgeted for peatlands restoration (USD)	874,891*	110,103**	
GFP actual for peatlands restoration (USD)	2,087,221*	1,749,125**	
Co-financing actual for peatlands restoration (USD)	794,949*	92,734**	
Canal barriers built	80	134	15
Hydrant wells installed			30
Hectares rehabilitated[6]	9,420	18,000	
Hectares replanted/number of plants	212/225,000	53.6/58,474	
Early warning sensors	10	5	
*** For component 2 only (source Q9 financial report)** ** Source- Final Report GBPP, 31 March 2018 *** Converted from Rupiah at an exchange rate of 13,761 to 1 USD based on April 1, 2018 end of the grant.			

2.2 GREEN PROSPERITY PROJECT LOGIC

The GP Project combined technical assistance, grants, and commercial financing to help communities protect critical ecosystem services and enhance livelihoods.

Other activities, such as PLUP Activity, District Readiness Assessments (DRAs), and the GK Activity were designed to guide and provide the underpinnings to maximize the benefits of individual grants.

The logical framework presented in Figure 1 outlines the hypothesized linkages between GP inputs and higher order impacts, addressing some of the most critical Indonesian development priorities, including increasing access to clean and reliable energy and improving the stewardship of natural assets. The framework also presents defined linkages between GP Project inputs and the goal of reducing poverty through low-carbon economic growth. Specifically, improved land use practices and management of natural resources to (a) increase productivity and (b) reduce land-based GHG emissions.

[5] Mitra Aksi figures are reported in Indonesian Rupiah, and converted based upon 07/2019 rates.

[6] Figures are self-reported, not independently verified, and may not disaggregate peatland rewetting and rehabilitation through other means

2.3 PEATLAND MANAGEMENT AND MAPPING LOGIC

The overall theory of change applied to each GPF window or grant is shown in the logical framework given in Figure 1. Overall, the peatland grant awards combined material support for peatland rewetting through canal blockages and wellheads, material support for revegetation, and technical assistance to promote compatible alternative livelihood strategies. The logic of the peatland management activities stipulated that the promotion of more sustainable agricultural and forestry practices would lead to increased productivity on existing, degraded peatland, as well as the improvement of carbon sequestration in these carbon sinks. The confluence of GP activities was thereby expected to reduce GHG emissions and increase the household income of beneficiaries.

Intended outcomes included improved watershed management (water retention and flood management), improved or maintained forest cover density, and improved peatland saturation and groundwater level. Short-term outcomes refer to results that were achieved within the timeframe of the project and within one year after completion of implementation. Long-term outcomes refer to results achievable (or likely to be achieved) one year or more beyond completion. The final goal follows in line with that of the overall GP logic as shown in Figure 1, to reduce poverty and GHG emissions.

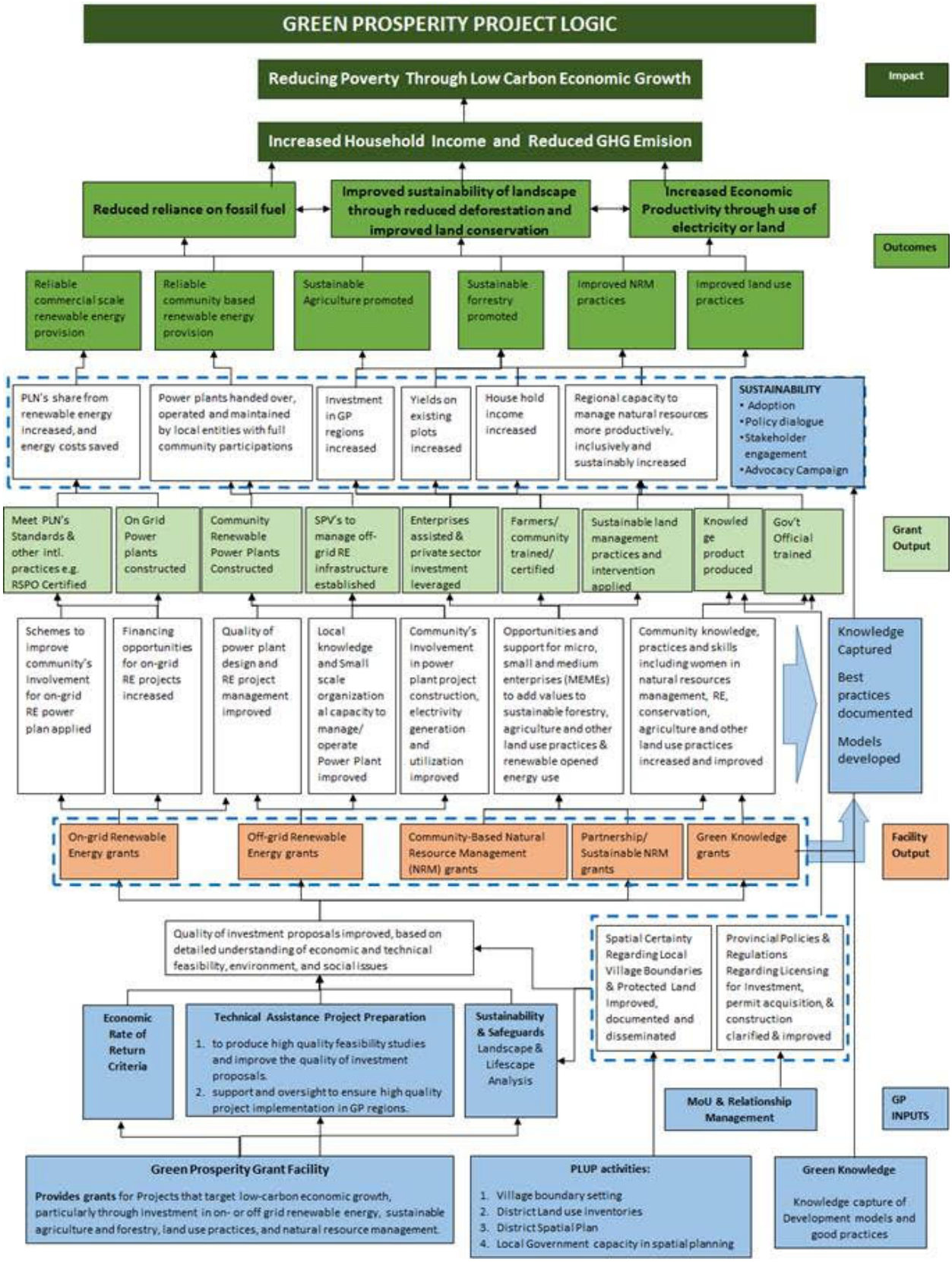
2.4 PEATLAND GRANTS DESCRIPTION

2.4.1 RATIONALE

The rationale for the development and support of sustainable peatland management activities under the GP Project stems from the current state of Indonesia's peat landscape, which is either barren or partially forested due to extensive drainage and clearing, primarily from logging and palm oil expansion. Conversion and poor management of land-use led to increased flooding, the decline of the water table, and increased incidences of fire (including catastrophic fires in 2015) that impact the potential for the production of key commodities such as oil palm and rice. Other challenges that are compounding these management challenges are the lack of reliable data on land resource use and boundaries (tenure) and inaccurate geographic information system (GIS) models for measuring carbon stock needed for peat depth and composition.

As long as the landscape remains drained and clearing continues, significant economic, health, and social costs will be incurred impacting the well-being of people both in the critical areas where peatland exists (i.e., Sumatra and in West Kalimantan) in Indonesia and its neighbors. GP activities were intended to develop a balanced economic growth model to combat these challenges that included effective management of the combined hazards of peat subsidence, floods, and fires following a landscape/lifescape approach to achieve low-carbon economic growth and prosperity that is socially inclusive.

Figure 1: Green Prosperity Project Logic



2.4.2 THE GPF'S APPROACH TO PEATLAND

The peatland grants consisted of activities funded under the Window 1b Partnership Grants and Window 2 community-based natural resources management (CBNRM) grant. These three grants implemented activities in support of low-carbon growth and reduced GHG emissions and entailed sustainable peatland management. Recipients of one of these grants supported the capacity building of the BRG, primarily through the eight functions that the BRG is mandated to oversee (BRG, n.d.). These functions are:

1. Coordination and strengthening of peat restoration implementation policy;
2. Planning, controlling, and cooperation of peat restoration implementation;
3. Mapping of peat hydrology;
4. Determination on the zoning of protected function and cultivation function;
5. Implementation of infrastructure construction for peat wetting (rewetting);
6. Restructuring of burnt peat areas management;
7. Implementation of socialization and education of peat restoration;
8. Implementation of supervision in construction, operation, and maintenance of infrastructure in concession lands.

2.4.3 OBJECTIVES

In support of the GP Project's overarching goals, activities under the Peatland grants were designed to achieve the following: "…reduce GHG emissions from peatland degradation through peatland restoration activities or encouraging appropriate forms of peatland cultivation." (MCA-I, 2018)

In support of this objective, guiding criteria for inclusion in the portfolio followed a landscape approach that included (1) canal blocking to support hydrological rehabilitation and water management to reverse peatland drainage, subsequently raising the water table; (2) revegetation to support regrowth and zero drainage species for fire management and reduction; (3) alternative livelihood opportunities; and (4) capacity building to institutionalize sustainable peatland management through BRG and the Berbak Landscape Forum. The grants also targeted low-carbon economic growth and avoidance of deforestation by working with smallholders in the surrounding areas to improve agricultural practices. In addition, but not part of this evaluation, the compact funded two contracts that included light detection and ranging (LiDAR) mapping and engineering designs in other critical priority peatland areas with the understanding that BRG would use these resources to expand their activities and support the GoI's objective of rewetting significant areas in 2018 and 2019.

2.4.4 GRANT DESCRIPTION

Grants that included activities/sub-projects focused on rehabilitation of drained and fire-prone peatland have been grouped, for purposes of this evaluation, as a "peatland grant." These activities, sub-projects and associated grants are a subset of GP grants that were selected through a competitive process based upon criteria established in the GP design phase.

As floods and fires regularly affect peatland in wet and dry seasons, respectively, canal construction and peatland drainage are the main drivers of these processes. Thus, hydrological management through the use of canal blocking and infilling for rewetting and reflooding became the key criteria for inclusion under the portfolio. Secondary components included revegetation

replanting, seed dispersal, and building capacity for sustainable peatland management within government institutions (namely BRG). Supporting alternative livelihoods for communities near peatland became the least integrated of the components.

For the purposes of this evaluation, a requirement for inclusion under the portfolio was that a grantee must have conducted rewetting activities as part of its project. This includes canal blocking, revegetation and reforestation, and compatible livelihood opportunities for communities in the context of rewetting. Support to the BRG was an additional criterion. Guided by these criteria, three completed grants had peatland rehabilitation components that focused on rewetting and are evaluated under the peatland grants. These grants are as follows:

Partnership Grants (larger in scale; signed in 2015 but implementation commenced in 2016 after a reassessment of fire damage and revision of target areas).

- *BGPP* (implemented by EMM) – Final Report claims, "134 (phase-1 uncontested) compacted peat dams built".
- *Rimba Corridor grant* (implemented by WWF Indonesia) – Final Report claims, "[83] Canal blocking constructed and functional" (of which 3 were pilots not funded under the Rimba Corridor grant).

CBNRM Grants (shorter scope, began in 2016 and ended in 2017).

- *PSDABM* (implemented by Mitra Aksi Foundation) – Final Report claims, "Critical peatland restoration through the construction of 15 canal blocks and 30 hydrant wells that aim to rewet the peat and prevent fires".

The evaluation did not address any livelihood activities that are not associated with peatlands. However, it is important to note that the CBA does address non-peatland livelihood activities that were promoted as part of each grant listed above. This is to ensure the evaluation-based CBA and the ex-ante CBAs are comparable, since both models look at the entire grant (rather than only the peatland components of each grant). Specific deviations between the scope of the evaluation and the scope of the evaluation-based CBAs are listed below.

WINDOW 1: PARTNERSHIP GRANTS

Berbak Green Prosperity Partnership (BGPP) / Kehujau Berbak grant

Managed by EMM, the BGPP grant's higher-level objectives for the Peatland component of the GPF funded project were to increase household incomes and reduce GHG emissions from deforestation and peatland degradation. Under the BGPP, the consortium comprised of implementing partners and vendors focused on two primary grant components that addressed (1) peatland degradation and (2) sustainable palm oil. Activities evaluated under this grant addressed combined challenges of the Berbak landscape, namely the conservation and restoration of remaining peatlands adjacent to Berbak National Park through rewetting and adaptive community engagement. The palm oil and rubber interventions as part of the GP peatland grants were not part of the scope of the evaluation team, but the decision was made to keep it in scope for the CBA to allow for maximum comparability between the ex-ante CBA analysis and the evaluation-based CBA. Therefore, only the CBA team examined aspects of the grantees' efforts on palm oil and rubber plantations. For the peatland component of the grant (and of import to this evaluation) BGPP's objective was to:

> "Develop an effective demonstration model for peatland restoration that restores the landscape, prevents fires, reduces GHG emissions, and creates alternative livelihood strategies for local communities." (EMM, 2018).

In addition, EMM was to test new technical and regulatory approaches that had not been previously employed by the Indonesian government in peatland management.

Peatland activities under the BGPP occurred along the buffer zone of Berbak National Park, in the *Taman Hutan Raya Orang Kayo Hitam (Taman Hutan Raya* translates to Great Forest Park), referred hereafter by the commonly used acronym "Tahura."

Berbak National Park is the second-largest peat swamp reserve in Southeast Asia (250,000 ha). The grant was designed to increase household incomes and reduce GHG emissions from deforestation and peatland fires. The BGPP prioritized rewetting activities—and unlike other peatland grants used heavy machinery to install compact earth dams— in addition to landscape management (land and water management zoning and fire reduction plans) and sustainable low-carbon livelihoods (e.g., paludiculture). EMM also oversaw the mapping of peatland depth, water table depth, flood maps, and land cover (with financial incentives for conserving peatland) to support canal blocking using LiDAR spatial tools through their vendor Deltares[7] in East Sumatra and West Kalimantan, as well as later capacity building and strengthening of the BRG.

The grant was originally intended to be a payment for the ecosystem services REDD+ grant, but the REDD+ component was dropped when matching private sector funding did not materialize as anticipated as a result of delays. Complications related to the original scope of work and partners, ultimately led to a delayed start for the canal blocking activities (intended for 2015 but not initiated until the fall of 2017) with a period of performance end of March 2018.

RIMBA Corridor grant

The landscape known as the RIMBA Corridor encompasses about 3.8 million ha and falls within the jurisdiction of three provinces in Sumatra—Riau, Jambi, and West Sumatra/*Sumatera Barat* —and spans 19 districts, eight of which collaborated under the RIMBA Corridor grant. WWF Indonesia is the lead implementer for the grant and its overall objective was to protect biodiversity and increase carbon stocks across the corridor's critical landscape by enhancing forest ecosystem connectivity through green economic development.

The three components of the RIMBA Corridor grant are: (1) strengthening of institutional foundations, building human resource capacity, and the enhancing of sustainability of the GP program applied to forest and land-based sectors; (2) investment in green economic development scenarios focused sustainable palm oil, sustainable rubber, peatland rewetting and restoration, and watershed protection related to coffee; and (3) measuring impact of the grant. Component 2 focused on peatland rewetting activities in addition to forest restoration and the development of nontimber forest product business models (Cluster 2). The objective for Cluster 2 was:

> "Increased sustainable natural resources management and conservation, and green economic development in eight districts in the "RIMBA Corridor." (MCA-I 2018)

Peatland activities under the RIMBA Corridor grant were intended to focus on the rehabilitation of peat swamp through the design and installation of drainage canal blocking dams to rewet peatland and initiate revegetation. At the core of these activities was rewetting through the use of hydrological restoration (raising of the water table via block dams and water table monitoring) coupled with the restoration of the area with plants (seedling nurseries) that would generate economic value, as well as prevent fires and rehabilitate lost forests for flood prevention. Early warning systems (EWSs) were revitalized, improved, or put in place for an integrated fire management approach that included incentive activities that balanced enforcement and behavior change efforts to mitigate fires. In addition, this grant also had the objective of strengthening livelihoods in the targeted communities to provide economic benefits apart from replantation

through alternative or nontimber agriculture practices, such as honey and freshwater fish products using gender and social inclusivity practices. The CBA focused on these peatland activities as well as those activities working with palm oil, rubber, and coffee producers.

WINDOW 2: CBNRM GRANT

Grants under Window 2 covered a range of CBNRM activities. With respect to peatland initiatives, several of the grants awarded under this window touched on some aspect of peatland rehabilitation, often overlapping with sustainable agriculture and social forestry activities. Only one grant, however, focused on rewetting as a key component that included the installation of block dams and is, therefore, included under the peatland grants.

Community-Based Natural Resource Management (PSDABM) Grant

The Mitra Aksi Foundation was the only Window 2 peatland grantee to complete a grant. The Mitra Aksi Foundation is a locally based CBO with a long-term commitment to the communities of the Muaro Jambi Regency. It specializes in developing models of empowerment and community organizing in the fields of health, education, women's empowerment, improvement of sustainable livelihoods, and disaster risk reduction from a gender equality perspective.

Mitra Aksi proposed the PSDABM Grant to construct canal blocks in support of sustainable peatland management and agriculture for reducing GHG emissions for poverty reduction. PSDABM's objective was:

> "…to reduce poverty and carbon emissions through improvement and enhancement of the capability of using the agriculture land productively, inclusively, and sustainably." (Mitra Aksi Foundation 2017).

Under the PSDABM Grant, the foundation focused on three core components to achieve its objective: (1) increase farmers' income through improved land use and intercropping cultivation systems, (2) increase value-added low emission agricultural commodities through strengthening farmer organizations and post-harvest improvements to be able to access modern markets, and (3) rehabilitation of critical land managed by the community using an intercropping model.

Component 3 supported peatland rehabilitation through rewetting activities, such as canal blocking and the installation of hydrant wells, revegetation, and integrated water and fire management systems to support an improved cultivation system. The grantee constructed 15 block dams in two priority villages where damage to the peat was severe following the 2015 fires. Thirty hydrant wells for fire prevention and improved cultivation were installed in eight villages. In addition to contributing to fire prevention in shallow peatland, both canal blocking and wells proved useful water sources for agricultural cultivation during the dry season. The CBA focused on the same activities as the broader evaluation.

ADDITIONAL SUPPORT TO BRG

The BRG received $4 million for two support contracts that delivered engineering designs, water table monitoring, and LiDAR mapping to the Agency, as well as mapping support to Indonesia's geospatial-mapping agency or *Badan Informasi Geospasial* (BIG). Institutional support to BRG was later provided under the EMM and WWF Indonesia contracts through targeted technical assistance to BRG and training to the Regional Peat Restoration Teams (TRGs), which spearheaded the implementation of government peat rehabilitation.

This support was addressed in the CBA implicitly, as outlined in the Evaluation Design Report. The costs associated with these efforts were modeled explicitly into the CBA, and the benefits were modeled implicitly by examining the assumption that these benefits from restored peatlands will continue into the future based on evidence that BRG is committed and capable of sustaining

this investment. The CBA does not model the capacity of BRG, but instead looks a scenario that BRG does not provide for the maintenance of canal blocking and revegetation.

2.5 OVERVIEW OF THE EX-ANTE ECONOMIC ANALYSIS

The ex-ante CBAs for the BGPP, Rimba Corridor, and PSDABM grants assessed the feasibility of these grants from the perspective of the Indonesian economy. Three categories of benefits were included in the models:

1. Increased incremental income from existing farm activities (all three models) and new wet-tolerant forest commodities (only in BGPP and Rimba Corridor);
2. Cost-savings through a new technology (only in the BGPP); and
3. Fire risk reductions (only in the BGPP and Rimba Corridor models).

While all three grants had stated objectives of reducing GHG emissions, this benefit was not explicitly modelled in ex-ante CBAs. All three analyses adopted similar approaches to estimating benefits in the ex-ante CBAs; these are summarized below.

In the case of **BGPP[8],** the following benefits and costs were modeled:

- Benefit: Increased revenue from existing farm activities due to best management practices promoted by the grant (rubber, palm oil)
- Benefit: Increased revenue from new wet-tolerant forest commodities as part of the peatland revegetation planting (jelutong)
- Benefit: Cost-savings from biogas digesters as a result of not needing to collect firewood
- Benefit: Reduction in the risk of fire once the peatland is rewetted
- Costs: Investment cost, MCA-I overhead

The **Rimba Corridor[9]** case is similar to the BGPP grant, with the exception that it did not have a biogas component:

- Benefit: Increased revenue from existing farm activities due to best management practices promoted by the grant (rubber, coffee, cacao)
- Benefit: Increased revenue from new wet-tolerant forest commodities as part of the peatland revegetation planting (jelutong)
- Benefit: Reduction in the risk of fire once the peatland is rewetted
- Costs: Investment cost, MCA-I overhead

[8] The ex-ante CBA spreadsheet includes multiple worksheets; this section refers to the spreadsheet entitled "ERR_PG-P-03 EUROCONSULT MOTT MACDONALD B.V_6.5.17" and uses the worksheet: "Econ Analysis (OH Cost 20%)" as the latest version of the ex-ante model.

[9] There were multiple Excel models for this model; the document entitled "ERR_PG-P-09 WWF INDONESIA-7.31.17" and using Tab: "EconAnalysis (OH Cost 20%)" is referenced.

The **PSDABM**[10] grant was the most limited model and only included the benefits from improved rice production. It did not include the benefits from fire risk reduction nor any benefits from the revegetation (jelutong). The only cash flows modeled include:

- Benefit: Increased revenue from existing farm activities due to best management practices promoted by the grant (rice)
- Costs: Investment cost, MCA-I overhead

The critical assumptions behind the analytical approach of the ex-ante CBAs were as follows:

- Changes in crop yields resulting from the grants will be sustained over the analysis time frame;
- There are no monitoring or maintenance costs for the canal blocks;
- The land remains rewetted following the canal blocks and revegetation activities; and
- Communities will be the beneficiaries of revegetation activities.

The ex-ante analyses of the peatland grants uses the same time horizon, 22 years: two years of investment and 20 years of operation.

A summary of the investment criteria results estimated by the ex-ante CBAs is included in Table 3. This includes the Economic Rate of Return (ERR) and the Economic Net Present Value (ENPV). Two different results are presented for the evaluation-based CBA, the differences are based on whether GHG emissions were included as a benefit —one scenario does not include the value of GHG of the social cost of carbon of reduced GHG emissions (w/o SCC) and another scenario includes reductions to GHG emissions valued at the country social cost of carbon (CSCC).

Table 3. Investment Criteria Results (Ex-Ante and Evaluation-Based CBAs)

Grant	Ex-Ante CBA ERR (%) ENPV ($)	Evaluation-based CBA ERR (%) ENPV ($)	
		W/O SCC	CSCC
BGPP	23.83% $18.29 million	8.63% -$1.09 million	12.76% $2.33 million
Rimba Corridor	20.74% $12.44 million	1.51% -$3.95 million	7.26% -$1.34 million
PSDABM	19.96% $0.81 million	24.20% $2.09 million	27.25% $2.40 million

2.6 PROGRAM PARTICIPANTS

A cornerstone for investment under MCC-funded compacts is the use of public-private partnerships to support activity implementation. International organizations, national institutions, national associations and platforms, government counterparts, civil society, and local NGOs

[10] There were multiple tabs; the document titled "#09_ERR_Yayasan Mitra Aksi" and using Tab: "Sustainable Agriculture" as the latest version of the ex-ante model is referenced.

worked with grant beneficiaries in the GP Project. Table 4 lists the entities involved in supporting the GP peatland grant activities implemented by EMM, WWF Indonesia, and Mitra Aksi.

Table 4. Project Stakeholders

Level	Stakeholder
International	• Wetlands International
National	• National Peatlands Restoration Agency (BRG) • Ministry of Environment and Forestry (MoEF) • National Development Planning Agency (BAPPENAS) • Ministry of Home Affairs (MoHA) • Ministry of Public Works and Housing (PUPR) • Ministry of Agriculture • Geospatial-Mapping Agency (BIG)
Province	• Provincial Development Planning Agency (BAPPEDA) • Regional/Provincial Governments Organisasi Pemerintah Daerah (OPD) • Provincial Forest Departments • Coordinating Centre for Forestry in Sumatra • Sumatra Eco-Regional Centre • Berbak National Park • Program NEWTREES • TRGs
District	• Local government and technical organizations
Local/Community	• Village governments • Villagers around Tahura and Londerang (men and women, considered separately in view of gendered needs and benefits)

2.7 GEOGRAPHIC COVERAGE

The GPF identified and financed activities in 14 provinces in the RE and NRM sectors. The critical regions identified for sustainable peatland management by MCA-I were Kalimantan and Sumatra for LiDAR-based elevation and peat thickness mapping and Sumatra for on-the-ground management activities. In Sumatra, the Province of Jambi was a key priority region and the main focus for the implementation for the on-the-ground interventions for sustainable peatland management. It was recognized by the GoI and has an internationally significant peatland landscape, which is one of Southeast Asia's largest remaining peatland areas. It is notable due to impacts from degradation that have resulted in intense flooding and fire risk in the region

Under Window 1, both EMM and WWF Indonesia conducted activities in Muaro Jambi and Tanjung Jabung Timur in Jambi Province. EMM operated in the buffer-zone of the Berbak National Park, in the Tahura Orang Kayo Hitam, and WWF Indonesia in the Londerang Peat Swamp Forest protected area. The sole completed Window 2 grantee, Mitra Aksi, was the smallest of the portfolio grants. Mitra Aksi worked in the Tanjung Jabung Timur, Muaro Jambi, and Kerinci[11] districts, overlapping in some areas with WWF Indonesia and EMM, in addition to providing consortium support to EMM through "socialization of the canal blocking and

[11] Activities in Kerenci district were not evaluated as they were not directly associated with peatland rehabilitation.

revegetation works” (EMM, 2018) and working with WWF Indonesia in the construction of block dams.

3. EVALUATION METHODOLOGY AND DESIGN

3.1 EVALUATION TYPE

This report documents an *ex post* performance evaluation of the peatland grant activities within the GPF. A mixed-methods approach to determine implementation efficacy through quantitative and qualitative data collection and analysis was used. This evaluation examined the relevant peatland activities implemented by the two completed grants under Window 1, and the one completed grant under Window 2. The primary purpose of the PE was to identify results (outputs and outcomes) and assess grant implementation as of the end of the compact (June 2018) and prospects for future sustainability. This will enable MCC and the GoI to capture lessons learned and inform future work. In addition, the PE was paired with an evaluation-based CBA to update the ex-ante CBA following the compact. Building a CBA off of the evaluation data can verify and update the assumptions behind earlier CBA models, leading to more accurate assessments of ERR) and enabling learning about common mistakes or systematic biases in ex-ante CBAs.

3.2 COUNTRY-SPECIFIC AND INTERNATIONAL POLICY RELEVANCE OF THIS EVALUATION

Successful peatland rehabilitation in Indonesia is as much dependent on meaningful land use policy and governance reform, as it is on the technical effectiveness of specific restoration methods. In this vein, the evaluation can serve three primary purposes:

1. Inform the design of future MCC/MCA peatland activities;
2. Test the efficacy of the project logic; and
3. Provide lessons learned to the GoI and other stakeholders for improved sustainable peatland management.

As the grant facility model is currently being used by MCC and there is interest in the expansion of grant facilities, an improved understanding of the lessons from the results of, and processes entailed, for these grants may inform MCC as to the replicability of this model in other MCC compacts.

Similarly, the result should provide additional information for other stakeholders, including the GoI, to consider when implementing future peatland restoration and rehabilitation activities. The results of this evaluation may also help with considerations of measurable benefits of peatland rewetting or restoration, as discussed in Section 6 below.

3.3 EVALUATION QUESTIONS

The evaluation questions focus on common issues faced across all grants in the peatland grants, as well as on comparing outcomes between the activities conducted under the respective grants (Table 5). The evaluation questions on effectiveness and sustainability (Questions 3 and 4 in Table 5) also informed the CBA.

Table 5: Evaluation Questions

Evaluation Question	Areas of Inquiry
1. Relevance / Design of Grants [Implementation Fidelity]	a) Were the activities in the peatland portfolio designed to achieve the GP objectives?
2. Grant Implementation [Lessons Learned]	a) What were the processes and lessons learned from GP's efforts to improve long-term management of peatland? Specific areas to include are: ○ Canal blocking and rewetting, including community engagement in canal blocking construction, legal and policy obstacles and steps to overcome obstacles, construction methods and techniques, construction restoration, and long-term maintenance of structures; ○ Building capacity in central, provincial, and district government entities, to sustainably manage peatland, including training of personnel, TA, and creation of training material. ○ Mapping in and around peatland. b) What administrative or legal actions or documents were required to properly execute the various peatland activities? c) What were the major challenges of canal blocking along legal, permitting, and technical dimensions? d) What capacities for peatland protection were built, and how were they disaggregated by gender? e) Did the grant implementers have the skills necessary to achieve intended results?
3. Effectiveness / Impact	a) How do targeted communities perceive the canal blocking process and its utility? This relates to time, finance, and convenience. b) Did the implementers effectively teach communities how to properly build dams to block canals (WWF)? c) In the case of canal blocking with heavy equipment, what are the advantages, disadvantages and perception of communities? d) Were there any unforeseen, outcomes of canal blocking? e) Were land and water management improved through the development of zonal plans and mapping? If so, how? f) What impact, if any, has there been on re-vegetation in the targeted areas? g) Have targeted communities' economic activities changed as a result of the peatland activities, particularly the alternative livelihoods activities? If so, how? h) Is there evidence of an effect on the incidence and/or severity of peatland fires? i) What is the ex-post ERR for the portfolio?

4. Sustainability	a) What mechanisms/activities have been put in place to ensure sustainability of the blocked canals? b) What was the long-term outcome of the dams built – that is, over the period of the evaluation, how many of the dams built were still functioning, and is there evidence of more hectares rewetted? c) What was the long-term outcome of the replanting of wet-tolerant species – that is, over the period of the evaluation, how many of the replanted hectares are still supporting at least 60% of the trees originally planted? d) Was BRG able to adopt and utilize the analytical tools, including the mapping and the detailed engineering designs (DEDs) and other donor proposals provided to them? What is the likelihood of BRG's continued use of these tools? What was the impact of training?

3.4 METHODOLOGY

3.4.1 OVERVIEW OF METHODOLOGY

Evidence to support evaluation conclusions was obtained through a mixed-methods approach relying primarily on qualitative data, derived from an in-depth desk-based review of key GP Project monitoring and government documentation (secondary data), as well as a stakeholder analysis and mapping, a series of key informant interviews (KIIs), facilitated focus group discussions (FGDs), and via direct observation of the evaluators (primary data) with project stakeholders.

All interviews strove for gender inclusion, and FGDs were gender-segregated. Primary data findings were triangulated against secondary qualitative and quantitative data. Data from KIIs and FGDs were coded for analysis.

Quantitative data was collected through the review of documentation (e.g., ex-ante CBA, M&E, spatial data) in addition to the results of structured questions through the use of questionnaires. Quantitative data was also obtained through geospatial analysis.

The evaluation followed a three-phased approach to data collection, analysis, and reporting of findings using quantitative data, such as project outputs and remote sensing data, and qualitative data from KIIs and FGDs.

Phase 1 – Scoping and Data Collection. To inform the evaluation design the evaluation team met with MCA-I staff, government counterparts, and local stakeholders from July 9-21, 2018. This initial consultation was a scoping trip designed to provide the team with an understanding of what information was available and what would need to be collected to support the evaluation. The location of files and access to information was explored and collected via MCA-I and BRG. This initial data collection continued upon the team's return to the U.S. as data were reviewed and gaps were assessed. MCC facilitated the collection of key documents where possible, if they were not recovered either through MCA-I directly or through the procurement management information system (PMIS).[12] In this phase, the evaluation team spent considerable effort mining data for critical project details, such as the precise location of canal barriers, with limited success.

[12] Procurement Management Information System developed under the Procurement Modernization Activity for the Compact.

Phase 2 – Fieldwork and Data Collection. The Evaluation Team returned to Indonesia in April 2019 to continue the collection of vital documentation, conduct KIIs, and to facilitate FGDs and site visits. Phase 2 focused on meetings with targeted stakeholders, such as former MCA-I staff, national, provincial, regional GoI stakeholders, local counterparts and grantees, and beneficiaries of the activities.

Phase 3 – Analysis and Report Writing. After completing the research and conducting consultations, the evaluation team provided analysis and recommendations for the production of this report.

Data collection was hindered by the timing of the evaluation during the rainy season, which limited access to large areas of the grant implementation sites, and by the limited amount of quantitative available due to the short period between the commencement of implementation and evaluation.

3.4.2 THE EX-ANTE CBA ANALYSIS AND DEVIATIONS IN METHODOLOGY FOR THE EVALUATION-BASED CBA

The ex-ante CBAs for BGPP, Rimba Corridor, and PSDABM grants assessed the feasibility of these grants from the perspective of the Indonesian economy. Three categories of benefits were included in the models:

1. Increased incremental income/revenue from existing farm activities (all three models) and new wet-tolerant forest commodities (only in BGPP and Rimba Corridor);
2. Cost-savings through a new technology (only in the BGPP); and
3. Fire risk reductions (only in the BGPP and Rimba Corridor models).

While all three grants had stated objectives of reducing GHG emissions, this benefit was not explicitly modelled in ex-ante CBAs. All three analyses adopted similar approaches to estimating benefits in the ex-ante CBAs; these are summarized below.

In the case of **BGPP**[13] grant, the following benefits and costs were modeled:

- Benefit: Increased revenue from existing farm activities due to best management practices promoted by the grant (rubber, palm oil).
- Benefit: Increased revenue from new wet-tolerant forest commodities as part of the peatland revegetation planting (jelutong).
- Benefit: Cost-savings from biogas digesters as a result of not needing to collect firewood
- Benefit: Reduction in the risk of fire and associated costs once the peatland is rewetted.
- Costs: Investment cost, MCA-I overhead.

The case of **Rimba Corridor** [14] grant looks similar to the BGPP grant:

- Benefit: Increased revenue from existing farm activities due to best management practices promoted by the grant (rubber, coffee, cacao).

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[13] The ex-ante CBA spreadsheet includes multiple worksheets, we are referring to the spreadsheet titled "ERR_PG-P-03 EUROCONSULT MOTT MACDONALD B.V_6.5.17" and using the worksheet: "EconAnalysis (OH Cost 20%)" as the latest version of the ex-ante model.

[14] The ex-ante CBA spreadsheet includes multiple worksheet; we referenced the spreadsheet titled "ERR_PG-P-09 WWF INDONESIA-7.31.17" and using worksheet: "EconAnalysis (OH Cost 20%)".

- Benefit: Increased revenue from new wet-tolerant forest commodities as part of the peatland revegetation planting (jelutong).
- Benefit: Reduction in the risk of fire and associated costs once the peatland is rewetted.
- Costs: Investment cost, MCA-I overhead.

The **PSDABM**[15] grant was the most limited model and only included the benefits from improved rice production. It did not include the benefits from fire risk reduction nor any benefits from the revegetation (jelutong). The only cash flows modeled include:

- Benefit: Increased revenue from existing farm activities due to best management practices promoted by the grant (rice).
- Costs: Investment cost, MCA-I overhead.

The critical assumptions behind the analytical approach of the ex-ante CBAs are as follows:

- Changes in crop yields resulting from the grants will be sustained over the analysis time frame.
- There are no monitoring, maintenance, or replacement costs for the canal blocks.
- The land remains rewetted following the canal blocks and revegetation activities.
- Communities will be the beneficiaries of revegetation activities.

The ex-ante analyses of peatland grants use the same time horizon, 22 years: two years of investment and 20 years of operation.

The evaluation-based CBAs following the compact differed from the ex-ante CBAs in a number of ways (which are discussed in depth in Annex I), including:

- Methodological changes that were applied to all three models; and
- Model-specific changes due to changes during implementation or adjustments to parameter values with the benefit of hindsight in the evaluation-based CBAs.

Methodological changes were made to all three evaluation-based CBAs including:

- **New Benefit—the residual value of jelutong trees**: The ex-ante CBAs do not include a residual value of the jelutong trees, although they are expected to be productive for 20 years beyond the time horizon for the analysis.[16] The evaluation-based CBAs have included this benefit in the final year of the analysis to account for the future benefits of the jelutong trees. It was estimated that jelutong trees can produce latex until they are at least 40 years old (i.e., 20 years of residual value following the end of the 20-year period of analysis in the evaluation-based CBA).
- **Methodology adjustment—reduction in fire risk:** The PSDABM ex-ante CBA did not include cost savings from reduced fire risk, which is included in the evaluation-based model. The ex-ante CBAs for BGPP and Rimba Corridor included the benefits of reduction in fire risk. However, the CBA team believes the ex-ante models significantly overvalued this benefit, and they have proposed an alternative methodology (as detailed in Annex I). There were a number of issues, but the overestimation in the ex-ante CBAs primarily

[15] There were multiple tabs, we are referring to the document titled "#09_ERR_Yayasan Mitra Aksi" and using Tab: "Sustainable Agriculture" as the latest version of the ex-ante model.

[16] Jelutong trees can be productive for up to 40 years. See Munden Project (2014).

stems from using the cost of the 2015 Jambi fires as an estimate of the average annual cost of fire. The 2015 Jambi fires were a particularly rare and devastating event that is not expected to occur on an annual basis. The evaluation-based CBAs downwardly adjusted the cost savings attributable to the grant to less than 1 percent of the ex-ante value. To do so, the team relied on a National Renewable Energy Laboratory (NREL)[17] study that scaled peat fires in Indonesia in 1997 and 1998 through three steps: (1) estimating the probabilities associated with different size fires for all of Indonesia, (2) estimating a mean annual fire cost in Indonesia by benchmarking the 1997-98 fires to the assumption that this fire occurs once in 100 years, (3) scaling those mean annual damages to the area of Berbak National Park, and (4) estimating the value of a 20 percent reduced fire risk in that region as a result of the GP project (there is no justification given for this 20 percent value). These values were further reduced for the Rimba Corridor and PSDABM project, to prevent double counting (discussed in more depth in the response to question EQ 3G: What is the evaluation-based ERR for the portfolio?). *This is a significant change and is the primary driver of the difference between the economic rates of return (ERRs) reported by ex-ante and evaluation-based CBAs for the BGPP and Rimba Corridor models.*

- **New Benefit—reduced GHG emissions:** GHG emissions reductions were a primary objective for the peatland grants. This benefit was not included in the ex-ante analysis, because the social cost of carbon has conventionally been estimated from a global perspective making it difficult for it to enter CBA models from a single country's perspective (in line with MCC's requirements for economic analysis). New research has resulted in models that can generate the social cost of carbon from a single country's perspective. These studies move beyond weighing the cost by population or area of the country and estimate the actual impacts of climate change on the economic well-being of the country based on a wide range of socioeconomic, industrial, and geospatial parameters. A recent study allows for the estimate of the social cost of carbon for Indonesia, which has been used to estimate the country-level social value of the GPF's reduced carbon footprint, as well as a global-level value. All these results are in the investment criteria results in Table 9 below. It should be noted that there is a lot of uncertainty in this variable, and it is quite sensitive to variation in the Rimba Corridor CBA.
- **New Cost—maintenance and replacement for canal block dams:** The ex-ante models did not include maintenance and replacement costs for the canal blocks, which are a necessary expense for maintaining these investments and particularly essential for the wooden box dams used in the Rimba Corridor and PSDABM grants. Replacement, maintenance, and monitoring costs are incorporated into each model although, at the time of evaluation, there was no plan or funding for their maintenance. The results of this are that ERRs are not sensitive to the inclusion of maintenance costs. Because of the risk that maintenance might not actually be performed in the future (discussed above in the sustainability findings of the report), the CBA included a "no-maintenance" scenario analysis.
- **Methodology adjustment—integrated approach to CBA:** Lastly, the evaluation team used the integrated approach to CBA for evaluation-based analysis, reporting the net impact on each beneficiary and stakeholder along with the ERR and the ENPV. Mathematically, this does not affect the calculation of the overall ERR, but it does allow for MCC to assess the financial viability, or the capability for these beneficiary smallholder

[17] J. Macknick, M. Elchinger, B. Stoltenberg, G. Hill, J. Katz, and J. Barnett. (2014) Berbak Landscape Integrated Management Project. National Renewable Energy Laboratory (NREL).

producers to finance and profit from the MCC interventions. Similarly, the financial obligations or incentives for other stakeholders to participate in maintaining the activities from rewetting peatland is vitally important for ensuring the sustainability of this intervention.

In addition, the evaluation revealed some significant changes during implementation that required new assumptions, or the removal or addition of benefit streams found in the ex-ante CBAs. The key model-specific changes include:

BGPP

- **Income from revegetation:** In the ex-ante model, it was assumed that nearby communities benefit from harvesting the nontimber forest products in the Tahura revegetated area. However, this revegetation is on protected land, and no benefit-sharing agreements have yet been put in place; in practice it is unclear whether and how the communities will benefit from the jelutong. As a result, this benefit was removed from this model.
- **Palm oil certification:** It was assumed that following International Sustainability and Carbon Certification (ISCC) palm oil training, the palm smallholders would receive a certification price premium. However, at the time of evaluation, no premium had been yet attained. KIIs revealed that given the short implementation window, too few farmers were trained to reach a critical mass for certified crude palm oil shipments. It was also revealed that another donor will continue providing training to farmers, however, it is unclear when a critical mass will be achieved. Initially, a modelling approach was considered where a portion of the forecasted premium would be attributed to the BGPP grant. However, data limitations around when and what portion of the premium will be available to farmers rendered this approach indefensible, and so this training for certification was treated as a stranded asset.
- **Biodigesters**: The ex-ante CBAs included cost-savings through the introduction of biodigesters. The original plan was that palm mills would provide a village with Palm oil mill effluent (POME) to feed the biodigesters, and thereby reduce their need to collect wood for cooking activities. However, upon learning about the opportunities for biogas, palm mills retained the POME for their own use, rather than supplying the villages. The villages then switched to using manure. Unfortunately, little is known about the implication on household cost-savings (for fuel) and time-savings (for wood collection) by switching to manure, making estimating this benefit tenuous. For this reason, and the deviation in implementation, this benefit was removed. However, a scenario with this benefit is reported below as a robustness check.

RIMBA CORRIDOR

- **Cacao farmers:** These were not included in the intervention and, therefore, not included in the evaluation-based CBA.
- **Palm oil and coffee producers:** WWF Indonesia worked with existing producers, rather than new producers as modeled in the ex-ante CBA. As a result, the incremental gains in the ex-ante analysis are quite significant when farmers move from day laborers to plantation owners in the ex-ante analysis; specifically, the ex-ante analysis assumed incremental incomes would increase by 60 percent for coffee and 427 percent for palm oil. Focus group discussions and KIIs suggest incremental incomes increased by only about 20-30 percent.

- **Rubber producers:** These producers were assumed to be worse off in the first five years after the training in the ex-ante analysis, when in fact rubber producers began to see benefits immediately; this assumption was remodeled in the evaluation-based CBA. In addition, the ex-ante analysis assumes that incremental yield increases by 380 percent (yields increase from 1 tonne per hectare in the counterfactual to 4.8 tonnes per hectare in the "with project" scenario); this was considered in expert interviews to be quite high and was adjusted downward to 20 percent, which was believed by stakeholders to be much more realistic (see parameter values, Table 26 in the Annex).

PSDABM

- **Horticulture:** Only rice interventions were modeled in the PSDABM ex-ante models. However, this grant worked significantly with horticulture farmers as well, the benefits of which were modeled in the evaluation-based CBA.
- **Rice Miscalculation:** The ex-ante analysis mistakenly calculated there would be 1,000 rice farmers in the counterfactual and 737 rice farmers in the "with project" scenario, thereby underestimating the benefit of this intervention. The evaluation-based CBA corrected for this mistake.

Many other changes have the benefit of hindsight and parameter values were simply updated to take into account actual figures, rather than projections at the time the ex-ante analyses were designed. Annex 1 provides tables summarizing the changes in parameter values for each model and the reasons for any deviations.

Finally, it is important to note that neither the ex-ante model nor the evaluation-based CBA include the benefits from reduced flooding attributable to the GPF, which the evaluation team believes is a benefit to this grant. Insufficient data prevented the CBA analysts from including this benefit in the evaluation-based CBA. This omitted benefit likely undervalues the overall economic viability of the evaluation-based CBAs if maintenance on the canal blocks are maintained.

The results for the evaluation-based CBA are discussed in Section 5.

3.4.3 IMPLEMENTATION FIDELITY ASSESSMENT

Integra has determined that the most appropriate definition of implementation fidelity for this evaluation is as the National Institutes of Health put forward in its implementation in community-based interventions.

> **"Implementation fidelity** is the degree to which an intervention is delivered as intended and is critical to [the] successful translation of evidence-based interventions into practice" (Breitenstein et al. 2010).

Integra assessed implementation fidelity by assessing how changes to the original design of the GPF and peatland grants have impacted the grant process. The starting point was a review of compact and GPF documents to see what, if any, changes have taken place since inception. The team endeavored to understand the reasons why changes occurred and the impact of each change. Finally, key informants were asked to discuss changes made during their grant process, including how changes may have impacted their success, and what measures they took to mitigate risk.

3.5 QUANTITATIVE APPROACH

Quantitative data were obtained through a desk review of GPF documents, literature review of policies, regulations, procedures, best practices, and other donor-funded projects, in addition to KIIs with grantees and beneficiary communities.

3.5.1 DESK REVIEW

Quantitative data were collected through the tabulation of information from GPF documents, such as feasibility studies, spatial data, monitoring and evaluation plans, ex-ante CBA data, as well as cost and budgetary data that were used for financial analysis. Monitoring data were used as available to identify key results and achievements under the peatland grant, as well as any areas where the grant activities failed to achieve targets. To assess sustainability the team reviewed cost-related data for support from the GoI where available.

SPATIAL DATA COLLECTION

As part of the desk-based research, geospatial data were used to address specific components of the peatland evaluation questions. Data collected by MCC and GP Project grantees were also utilized, and readily accessible open data sources to support findings and/or address gaps in information.

The initial remote sensing methodology was to use a Landsat satellite vegetative measure known as Enhanced Vegetative Index (EVI), which is advantageous over other satellite measures due to its ability to correct for background noise, atmospheric noise, and saturation. However, a thorough exploration of the EVI data catalog revealed that imagery for the implementation area during the wet season (when photosynthesis is at its highest) was extremely cloudy and an alternative method was required. Due to this constraint and to address the evaluation questions related to rewetting and revegetation, an alternative remote sensing method had to be found. The first method was the use of ground-penetrating radar. The satellite was the European Space Agency's Sentinel 1 SAR instrument. Due to moisture and temperature levels, seasonality plays a factor in radar imagery. For this reason, the 2018 early-spring, spring, and summer satellite imagery were combined and used to derive a composite. In most cases, it was possible to distinguish peat forest, peat swamp, and plantations. The radar imagery was also useful in determining degraded areas from revegetating areas, e.g., the Tahura versus the EMM reference site.

A second alternative was the use of Landsat atmospherically corrected data to model surface water. During 2018, there were no instances of multi-seasonal surface water, which was to be expected. For the long term, the data record from 1984 to the study year was useful in revealing issues of subsidence.

Finally, reference points were taken for each of the intervention areas and for sample sites in the vicinity. As an alternative to EVI, the entire Landsat 8 time series was used to derive a normalized difference vegetation index (NDVI) record. This record quantifies vegetation by measuring the difference between near-infrared (which vegetation strongly reflects) and red light (which vegetation absorbs). The NDVI time series contained several hundred data points for each reference site. However, cloud cover was still an issue, and therefore a harmonic model was used to plot estimated NDVI. Results indicated trends in revegetation, growth, and resiliency. The findings and graphs are in Section 6.2.

3.6 QUALITATIVE APPROACH

Integra collected qualitative data through document and literature reviews, 37 key informant interviews, eight focus group discussions, and ten site visits. Communities could not be selected for site visits in advance because of inadequate data from MCA-I.

Where data were lacking, inconsistent, or unavailable, the evaluation team triangulated through the use of KIIs to address these gaps. This included beneficiary data and information related to a

number of canals actually constructed and functioning as designed, hectares rewetted, and revegetation and seedling uptake.

3.7 STUDY SAMPLE

The peatland portfolio contained sub-projects in three completed grants. The evaluation team interviewed key informants with direct responsibility for implementation for all three grants, as well as some of their relevant implementing partners and several communities that benefitted from the grants. The team also interviewed the relevant government agencies at the national and provincial levels. Table 6 provides a snapshot of interviews and site visits conducted by type of respondent interviewed.

For the fieldwork portion of the evaluation (i.e., KIIs, FGDs, and site visits), the evaluation team worked in consultation with MCC and considered stakeholder recommendations to determine a purposeful sampling of beneficiary communities and representative site locations for direct observation (e.g., canal blocks, revegetation/reforestation, and livelihood activities. Criteria for sampling consideration included:

- Number of grantees represented in that location;
- Canal blocking activities undertaken; and
- Logistical considerations (wet vs. dry season accessibility and visual functionality of construction features, e.g., canal blocks).

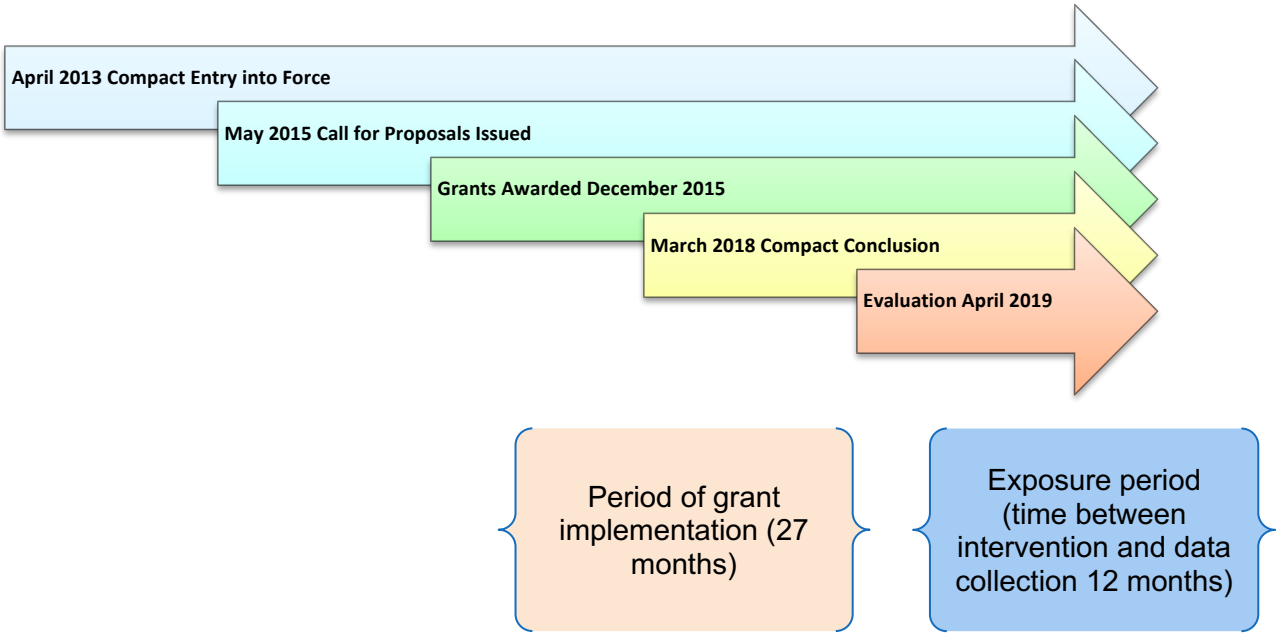
Table 6: Summary of Qualitative Data Collection Respondents

Respondent Type	KIIs[18]	FGDs	Site Visits
Beneficiary Communities		8	8
Village Leaders	5		
Grantee (and their relevant vendors/implementing partners)	4		
GoI (national, provincial, and local)	18		
External Stakeholders	5		2
MCA-I	1		
MCC	4		
Total	37	8	10

[18] Supplemental meetings with KIIs are not counted separately. In some cases, there were as many as three follow up meetings

3.8 TIMEFRAME

Figure 2. Timeframe of GP Peatland Implementation



Evaluation timeline

The evaluation team collected data through literature and data reviews prior to fieldwork, followed by two trips. The first trip was in July 2018 while MCA-I staff were still at MCA-I and available. This was critical because there was no certainty that these key people would be available in the future. It also allowed the team to collect data from the PMIS.

The second trip took place between mid-April and mid-May 2019 and involved 10 site visits over a two-week period, as well as two weeks in Jakarta to meet with grantees and government officials.

The team was able to collect data on a rolling basis by taking advantage of national staff, with each data collection round serving to fill in gaps from the previous round. Table 7 below summarizes the data collection rounds.

Table 7: Data Collection Rounds

Timing	Location	Purpose
July 2018	Jakarta, Washington, D.C.	KIIs and data collection before MCA-I closed. Limited KIIs with other stakeholders
August 2018 - March 2019	Washington DC.	Literature Review
April-May 2019	Indonesia, various locations	KIIs with MCA-I staff, grantees, GoI, local governments, and other stakeholders; site visits and FGDs.
May 2019	Washington, D.C.	Follow up to KIIs for clarification, additional literature review

3.9 LIMITATIONS

The evaluation encountered several challenges and limitations to the data collection.

- **MCA-I and Project Closure.** MCA-I closed in July 2018 and all GP peatland grant activities were closed out as of March 2018. This complicated information gathering with respect to the availability of former project staff for requests from the evaluation team, and with regard to access to documentation from the project management information system. For example, the evaluation team was unable in some cases to determine precise project locations in advance of arrival in Indonesia, and they were dependent upon grantees for information on locations and names of beneficiaries. In addition, the information and documentation needed to support the evaluation were incomplete or missing. The National Development Planning Agency (BAPPENAS) now has proprietorship over all MCA-I data but cannot understand the system. Integra compensated as much possible through the use of open data sources, KIIs, FGDs, and through consultations with other stakeholders.
- **Limitations in Access.** Due to the high water in the peatland areas in the rainy season, the evaluation team was not able to undertake a representative sampling of dams built to validate reporting by the grantee or to make projections for sustainability and future impacts. The LiDAR data collected for the BRG was not useful to the evaluation because there was no time series for comparison.
- **Missing Documentation and Contradicting Information.** In addition to some information being unavailable during the planning phase (such as canal inventory and location data) dating and verification (provenance) issues were rampant. Several files transferred to the evaluation team were either not labeled or were labeled inappropriately, creating challenges as to the date, version, or acceptance of changes. Not all processes or comments from MCA-I or grantees were properly recorded—some critical decisions were only logged in the "action logs" of the PMIS system and could either not be found or were no longer available. For the evaluation, this created a knowledge gap in the team's ability to understand when a change was requested, or approved, and, why. The record of instructions from MCA-I to grantees is incomplete.
- In addition, data across and within reports on deliverables is inconsistent. For example, several grant deliverables record a different "number of canals blocked" or "hectares rewetted" within the same report. When compared to other documents from MCA-I or external consultants the numbers again are not consistent. The evaluation team was able to resolve most inconsistencies but could not corroborate all information given in interviews.
- **Impact and Sustainability.** As the grants themselves were implemented only in the last 18 months of the compact, it was not possible for the team to evaluate the long-term outcomes of their activities. The projections provided in this evaluation report were based on available data—for example, by examining recent updates in legacy, higher level remote sensing data catalogs (e.g., long-term deforestation trends) to offset the temporal challenges mentioned.
- **Cost-Benefit Analysis.** Not all participants associated with each intervention under each grantee could be visited (e.g., WWF had coffee, palm, rubber, and fruit tree farmers as well as villagers trained in non-timber forest products, such as fish salting, canal construction, and maintenance and fire prevention, among other interventions). However, triangulating data from the grantee-level interviews as well as other external sources

should be sufficient for modeling the impact of all key interventions in each grantee CBA model. Sources for all data parameters are highlighted in the CBA models.

As an additional challenge to the CBA, all grantees have continued to work with many of the MCA-I villages using different sources of funding. Isolating the impact of the MCA-I project from these other external interventions proved to be a challenge both in discussing behavior change with villages (who are sometimes not aware of who the donor is) as well as delimiting where the compact's impact ended, and the other donor's impact begins. For example, following the ISCC trainings for palm smallholders under the BGPP grant, additional funds were provided by L'Oréal to continue training. This is important because despite some cooperatives receiving the ISCC certification, the volume of production by those trained under the BGPP grant was too low for one certified palm oil shipment by the certified mill. Meeting the sufficient volumes for certified crude palm oil (CPO) shipment, therefore, is a product of both MCA-I and L'Oréal funds.

Finally, evidence from the evaluation only provides quantitative and qualitative data from the beginning of the grant implementation until the date of the analysis. The CBA, however, analyzes a period of 20 years. As with all CBA projections, creating reasonable and conservative estimates using data over a short period of time (just a few years of implementation in this case) is a challenge—especially as there are considerable uncertainties about the future maintenance of the GPF investments (this issue is discussed in the next section). To manage these uncertainties, the CBA team examined increasingly conservative estimates for the future (under the scenario that maintenance is not performed).

4. LITERATURE REVIEW OF THE EVIDENCE

4.1 EXISTING LITERATURE

The underlying logic for the rehabilitation and long-term management of peatland hinges on its perceived economic value. Indonesia has an estimated 20 million ha of tropical peatland and between June and October 2015 almost 875,000 ha burned as a result of the 2015 fires. The World Bank estimates that the fires and haze produced cost Indonesia at least IDR 221T (~USD $16.1B), which was 1.9 percent of its 2015 GDP (World Bank Group, 2016). As a result, a number of initiatives have been devised to address deforestation and degradation resulting from logging, drainage, fires, and land use conversion across the country. The techniques and approaches being used for rehabilitation to date have generated some key lessons learned that are relevant to the grants being evaluated under MCA-I's peatland portfolio.

4.1.1 SUMMARY OF EXISTING EVIDENCE

Rehabilitation barriers involve a range of biophysical, hydrological, ecological, socioeconomic, and policy barriers, which are compounded by a changing climate. Existing research examines these constraints to effective tropical peatland rehabilitation, informing current practice and approaches toward rewetting, revegetation, and sustainable management of peatland landscapes.

4.1.2 REHABILITATION BARRIERS

DIRECT

- **Biophysical:** Changes in peat physical properties and peatland micro-topography as the result of removal of vegetation and the construction of artificial drainage canals may constrain successful regeneration of peat forests. Altered physical properties of peat can be due to changes in micro-climate conditions, hydrological fluctuations, oxidation, and recurrent fires leading to peat subsiding, reduction of peat "hammock-hollow" topography, and increased flooding (Graham, Giesen, and Page, 2017).
- **Hydrological:** Recurring fires—wild or triggered through clearing—and disruptions to the hydrological balance of the peatland landscape as a result of drainage are also barriers to peat forest regeneration and revegetation. A lowered water table impacts water availability and quality, and drainage increases flooding and drought risks.
- **Ecological:** Protection of remnant natural peat forests is necessary for restoration. However, the impacts from fire and hydrological fluctuations and destabilization of peatland have permitted the invasion of dense ferns and shrub species. These water-loving plants increase competition for indigenous plant species and are prone to fire during drought, hampering natural regeneration of degraded peat areas.

INDIRECT

- **Socioeconomic:** Poverty and lack of alternative livelihood options are the main barriers for rehabilitation in communities living on, or adjacent to, peatland and which rely on peat swamp areas. Communities illegally plant on peatland, including burning peat forests for cultivation purposes, and use canals to transport pulp, ash, and other products to markets.

- **Policy:** There is still uncertainty surrounding regulatory and policy measures governing peatland use in Indonesia, and there is a lack of consistency among ministries and institutions that govern peatland. For example:
    - The protection of peatland is based upon peat depth. The *Ministry of Agriculture (MoA) Regulation 14/2009* allows oil palm cultivation on deep peat "if the peatland is outside conservation areas or has been allocated for cultivation under the planning régime". This contravenes the Central Government policy for the moratorium on natural forests and conversion to cultivation (previously noted *Presidential Decree 10/2011).*
    - There is no uniform water table minimum threshold. MoA's *Regulation 14/2009* and the GoI *Regulation 71/2014* stipulate different levels: MoA at 60-80cm and the GoI at 40cm.

4.1.3 REHABILITATION EFFORTS

Peatland management should follow a landscape-based approach that considers all of the barriers noted above. Rehabilitation efforts to date have focused on the techniques described in the following with rewetting and revegetation identified as critical activities.

- **Rewetting / Hydrological Rehabilitation –** The technique currently being used in Indonesia for rewetting is the use of canal or ditch blocking. Canal blocking requires the placement of dams (i.e., wooden, compact peat, concrete) or water weirs in targeted sections of artificial and drained canals to reverse surface water outflow and raise surface and groundwater-levels along the canal course (Ritema et al., 2014). While hydrology must be restored, rewetting is not enough on its own to restore degraded peat areas because as peat compacts (oxygenation or combustion) it loses its ability to reabsorb carbon effectively.
- **Community Engagement –** Given the complexities of social and economic interactions in the peatland, sustainable canal blocking also depends upon free, prior, and informed consent among key stakeholders to mobilize and engage communities in the sustainable management of peatland.
- **Enrichment Planting and Landscape Level Management –** (or revegetation). Regeneration of vegetation and forests through seedling production, transportation, and promotion of dispersal. Landscape-level efforts also included fire management initiatives that mix incentives and criminalization for enforcement and training provided to fire brigades, alongside risk-based EWSs and innovations for water table monitoring.
- **Alternative Livelihood Options –** A lesser explored and seemingly less thoughtfully applied rehabilitation effort has been on the identification and sustainability of livelihood options as alternatives to cultivation, peat ash, and logging. Although alternative products are being explored (such as faster growing *gelam* and *jelutong*, which thrive in a peat swamp environment, biomass for aviation fuel, freshwater fish for areas that cannot be restored, and even honey) these have not been promoted effectively or been a focus to date.
- **Institutional Strengthening and Capacity Building** – A far more recent effort comes with the establishment of the BRG in 2016, which has been tasked with the restoration of critical peat across the country. New initiatives have now emerged for improving peatland mapping, disturbance level identification, and ecosystem carbon stocks assessments. However, knowledge of the GHG footprint of existing drained lands is based on sporadic data, while knowledge on the GHG footprint of restored lands remains elusive.

4.1.4 GREENHOUSE GAS EMISSIONS

To address the shortcomings in understanding the GHG footprint of GP activities, MCA-I contracted with ICF International to evaluate the potential of the 65 grants that comprise the GP Project for GHG reduction.[19] ICF collected data on agriculture, forestry, peatland rehabilitation, and renewable energy practices that impact GHG emissions from the GP grantee, and it developed methodologies to estimate the potential for GHG reduction.

ICF's finding was that the majority of emission reductions are due to reforestation and agroforestry and peatland wetting. The total potential emission reductions across the 65 grants are 1 million tonnes CO_2e per year. These potential emission reductions could contribute to Indonesia's goal to reduce GHG emissions as defined by Indonesia's Nationally Determined Contribution. Estimates for the amount of reduced GHG emissions attributable to each grant is included in the evaluation-based CBA figures.

ICF and MCA shared these methodologies with the Ministry of Environment and Forestry and the Peatlands Restoration Agency to promote consistency in estimating GHG emissions.

4.1.5 DONOR INITIATIVES

Tropical peatland rehabilitation in Indonesia is very much in its infancy, with the earliest initiatives starting in the early 2000s. One of the first bodies to focus on rewetting through the use of canal blocks was the Climate Change Forests and Peatlands in Indonesia (CCFPI) comprised of three conservation organizations: Wetlands International (Indonesia Programme), Wildlife Habitat Canada, and the Global Environment Centre (Malaysia). These dams were constructed from 2003-2007 in Central Kalimantan and South Sumatra, and following this "successful" experience, additional dams were constructed in 2005 under the EU-funded project Restoration of Tropical Peatland for Sustainable Use of Renewable Natural Resources, from 2005-2009 under the Dutch Ministry of Foreign Affairs funded NGO-partnership[20] Central Kalimantan Peatland Project (CKPP), in 2009 by Greenpeace's Defender Climate Camp, and in 2010 under Orangutan Tropical Peatland Project. More recent initiatives include those by CIFOR and under the USAID-funded LESTARI project.

As part of a landscape-based approach to peatland rehabilitation, efforts to revegetate bare peatland have been implemented concurrently with rewetting activities in Central Kalimantan. Pilot and trial activities for enrichment planting include seedling nurseries and transplanting. Fire management initiatives have been instituted, alongside EWSs. Less work has been done to date regarding alternative livelihood options and less so on institutional, regulatory, and policy reform. There has not been any significant coordination effort across donor initiatives as a result of these smaller initiatives.

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[19] See ICF, 2018. Greenhouse Gas Emission Reductions for MCA-Indonesia Green Prosperity Project. Final Summary Report prepared for MCA-Indonesia, contract number: GP-B-046.

[20] Members of the partnership included Wetlands International (Indonesia) CARE Indonesia, WWF Indonesia, Borneo Orangutan Survival Foundation (BOSF), University of Palangka Raya (UNPAR)

4.2 GAPS IN LITERATURE

As previously mentioned (see Section 4.1), peatland management in Indonesia is still in its infancy. While the barriers to restoration are readily identifiable, there is little coherent or rigorous reflection on the effectiveness and sustainability of interventions.

In addition, a comprehensive economic valuation encompassing the public benefits of peatland ecosystems and how these compare with the costs of rehabilitation has been lacking to date. This means that policymakers have thus far had very little guidance with respect to the economic efficiency of investments in rehabilitation of this climate-critical ecosystem on its own or compared to competitive government spending for climate change mitigation and adaptation related to land use or in other sectors. Although 11 years have passed since the Stern Review (2007), there is still no comprehensive economic analysis of this climate-critical ecosystem available to help guide decisions (Dohong, Aziz, and, Dargusch, 2018). In addition, the lack of an economic rationale for rehabilitation hampers the potential for developing market-based financing mechanisms, such as payments for ecosystem services that could potentially complement publicly financed peatland rehabilitation aimed at climate change mitigation (Glenk and Martin-Ortega, 2018). As yet no peatland landscape in Indonesia has developed a balanced economic growth model that includes effective management of the combined hazards of peat subsidence, floods, and fires.

4.3 SPATIAL DATA

Because of the scale of peatlands in Indonesia, much of the science and technology associated with measurement of peatland rehabilitation must rely upon remote sensing and GIS. There are many benefits to the use of remote sensing and GIS, including the capacity for the synoptic landscape to global measurement of biophysical variables, the ability to quantify trends at long-term observational scales, and the ability to model trends into the future. However, many gaps remain in the available science and toolsets:

- **Issues associated with resolution.** Until recently, the majority of spatial data was available either at landscape scale (estimate 30m) or the 1km+ scale. Using data at higher resolution often incurs high acquisition costs and can increase the complexity of analysis and modeling.
- **Acquisition period.** Temporal issues associated with the available data reflect some of the cost and computational constraints discussed above (e.g., LiDAR at a monthly scale would be prohibitively expensive).
- **Algorithm sensitivity.** Peatland is innately one of the more difficult ecosystems to depict with remote sensing. This is partially due to the complexity of peatland, but it is also due to the need for accurate field training data for algorithms (e.g., data points for dams, water depth/flow).

5. EVALUATION QUESTION FINDINGS

This section presents the detailed findings for each evaluation question, a higher-level summary and concludes with policy implications.

EQ 1: RELEVANCE / DESIGN OF GRANTS [IMPLEMENTATION FIDELITY]

EQ 1A: WERE THE ACTIVITIES IN THE PEATLAND PORTFOLIO DESIGNED TO ACHIEVE THE GP OBJECTIVES?

The GP objectives were to increase productivity, reduce reliance on fossil fuels, and reduce land-based GHG emissions by expanding renewable energy, improving land use practices, and better management of natural resources.

All of the activities in the peatland grants portfolio were designed to achieve the GP objectives. All interventions were based on solid logic and most were rooted in evidence. (The exception is the revegetation activities, which were weakly supported by economics or ecological science).

The GP Program, as expressed in the compact, was designed to encompass the full period of the compact and would have had to begin implementation soon after entry into force to realistically achieve the objectives. Although the compact entered into force in April 2013, the call for proposals did not go out for more than two years, on May 19, 2015. Grants were not awarded until December 2015, leaving 27 months for implementation. This delay imposed significant challenges for implementation fidelity. Further barriers to implementation followed when MCA-I did not issue prompt releases on compliance deliverables. The problem was compounded by conflicting rulings by government authorities concerning permitting.

The PLUP Activity was intended to be used to inform the design of peatland management grant proposals. PLUP implementation was also delayed by MCA-I. As a result, the PLUP Activity deliverables had to be delinked from the grants. It is not possible to determine what effect this had on the design, especially of sustainable livelihoods and land use components. The longer implementation time would have also allowed PLUP and GK to inform and guide the grants. Under these circumstances, achieving implementation fidelity was not a given, and any shortcomings identified in this report need to be understood in the context of the management MCA-I. It is a tribute to the grant recipients that they were able to accomplish as much as they did in this context.

EQ 2: GRANT IMPLEMENTATION [LESSONS LEARNED]

EQ 2A: WHAT WERE THE PROCESSES AND LESSONS LEARNED FROM GP'S EFFORTS TO IMPROVE LONG-TERM MANAGEMENT OF PEATLAND?

Three processes are in play; canal blocking and rewetting, capacity building to manage peatland, and mapping in and around peatland.

A. CANAL BLOCKING AND REWETTING, INCLUDING COMMUNITY ENGAGEMENT IN CONSTRUCTION, LEGAL AND POLICY OBSTACLES AND STEPS TO OVERCOME OBSTACLES, CONSTRUCTION METHODS AND TECHNIQUES, CONSTRUCTION REHABILITATION, AND LONG-TERM MAINTENANCE OF STRUCTURES.

Sites were selected to support the protection of two important peatland forest assets, the Hutan Undung Gambut Londerang, or Londerang Peat Swamp Forest protected area and the Tahura.

Canal blocking strategies varied between the grants, depending upon the context. Table 8 on the following page describes the strategies in common usage. In the Rimba Corridor grant led by WWF, grantees worked in the perimeter of the Londerang Peat-Swamp Forest protected area, in permit areas[21] and community lands. Here, community and concession on reclaimed peatland militated in favor of partial rewetting using box dams with spillways. This allows water to reach a specific height before it drains over the dam. This design does not bring the water table to the top of the peat but raises it to no less than 40cm below the level of the peat, consistent with government requirements for rewetting. This allows the top level of the peat to remain dry enough to permit palm plantations,[22] while allowing deeper levels of peat to become saturated.[23]

In the case of the Berbak GP Partnership led by EMM, the rewetting took place in the severely degraded Tahura Orang Kayo Hitam protected buffer of the Berbak National Park. As conservation land, this area was not legally available for logging, plantations, or farming. The objective of rewetting was to protect Berbak National Park and to restore peat-swamp forests in the Tahura. Here, the strategy favored complete rewetting, and the grant employed a compacted peat dam design without spillways to completely halt the flow of water in the canals.

Inspection by the evaluation team of both types of blocked canals, in comparison with untreated areas, and review of remote sensing data indicated that rewetting is occurring in both cases.

It is not possible to determine based on available evidence that one design is superior. Each design is well suited to its context. Each design has durability issues.

In the case of box dams with spillways, construction involves the use of wood and of geomembranes to retain sand. Wood deteriorates rapidly and should be replaced on average annually, depending upon the type of wood used. Geomembranes also degrade; consequently, each dam constructed must be rebuilt every 5 to 10 years in perpetuity. Community members were trained and employed for construction in the case of both Mitra Aksi PSDABM and WWF Rimba Corridor grants, so the capacity is in place. The major challenge, discussed below under sustainability, is the labor and material requirements for such work are high; the participating communities indicated that this was unaffordable. The CBA does model the assumption that the investments are not maintained as part of an alternative scenario analysis (discussed below).

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[21] Permit Areas are lands open for concession for resource extraction and other commercial uses, such as plantations

[22] Sustainable oil palm production guidance precludes the production of oil palm on peat; however, the established plantations, including community owned assets, are essential for local livelihoods, and their protection is therefore critical to community support for rewetting.

[23] In Jambi, peat can be as much as 15 m in depth.

Stages in Peatland Rewetting

1. Mapping peat
    - To determine the location of degraded peat
    - To determine the type of degraded peat—different types require different restoration strategies
    - To determine hydrological condition
    - To determine appropriate monitoring for peatland restoration
2. Determine the type of restoration, implementation plan, and timeframe for restoration
    - The type of restoration that is in accordance with peatland and community conditions
    - The wetting cycle
    - Replanting (revegetation)
    - The time of implementation and which interests are involved
3. Rewetting the peat
    - The proper target for wetting peatland is to increase the humidity of the peat (especially in the dry season) so that it is not easily oxidized and / or burned.
    - Water management can be done through canal blocking, canal backfilling, boreholes, and / or water retention to store water in rivers or canals
4. Revegetation
    - When it is rewetted, peatland can be revegetated
    - Native plants for peatland ecosystems are jelutong, ramin, gaharu, and meranti
    - Some peat-friendly plants and have economic value for local communities, including plants such as coffee, pineapple, and coconut.
5. Empowering the economy of the local community (revitalization)
    - When the local community does not have alternative livelihoods, they will use an easy way to drain peatland and plant plants that are rich in economic value, but not friendly with peatland.
    - Practitioners must work with residents to find ways to improve living standards through economic activities appropriate to rewetted peatland, such as planting sago, rubber, coffee, and coconut, or promoting fisheries

Table 8: Comparison of Canal Blocking Options[24]

Characteristics and suitability	Concrete structure	Wooden box dam	Manually built peat dam	Mechanically built peat dam	Palisade block	(Partial) infilling of canal
Characteristics:						
- Strength	++	+	– –	+	+/–	+/–
- Durability	++	–	+/–	+	+/–	+/–
- Risk of leakage through dam	++	+	– –	+	–	–
- Community participation in construction	–	++	++	–	++	+
- Cost	– –	–	+	+	++	–
Suitability:						
- Small canals (<2 m wide)	–	+	+	–	+	++
- Large canals, small drainage basin	+	++	–	++	+	+/–
- Large canals, large drainage basin	++	+	– –	++	–	– –

In the case of permanent closures using mechanically compacted peat dams, the grantee claims that there is no need for on-going maintenance. BRG and technical experts in NGOs question this, citing the risk of high water levels overtopping and eroding the compacted peat. Assuming that the dams survive, EMM estimates that the process of gradual infilling of the canals between the dams by natural process will take approximately 30 years. Once accomplished, the peatland will be restored absent further human activity. Impact on the peatland from the use of heavy equipment could not be detected due to high water levels. Experts at BRG and NGOs consulted confirmed that though not evident, impacts from compaction in track ruts may result in additional, counterproductive water flow. For these reasons, ongoing monitoring not provided for in the activity design will be necessary and some mitigation could be required.

In terms of community engagement and buy-in, participating communities were uniformly supportive of the effort, reflecting substantial effort in socialization. In the case of the Rimba Corridor grant of WWF for example, 2 out of 10 targeted communities opted out of participation. Buy-in reflects the extent to which grantees accommodated community requirements, e.g., for access to waterways for transportation, for access to peatland for economic activity, technical assistance and training improved livelihoods.

EQ 2B: CONCLUSIONS BASED ON REMOTE SENSING AND GIS

Use of remote sensing and GIS analysis in the evaluation allowed the team to draw several significant conclusions for each reference site (see red points in Figure 6 of Annex IV):

Remote sensing helped understand how different components of the landscape functioned. Berbak NP represented the most normal ecosystem function for 2014 to present, demonstrating cyclic seasonal growth and resiliency. Radar measurements confirmed that soil moisture levels were highest in these areas of healthy peat forest (see Figures 6, 7, 8 and 9).

[24] From Technical Guideline Number 4 - Guideline for Canal Blocking Design in the Ex-Mega Rice Project Area in Central Kalimantan. ++ very favorable – very unfavorable, +/- uncertain

One of the disadvantages of remote sensing is that any image acquisition can be subject to cloud cover, smoke, and other environmental factors. To get around this, Figure 8 provides a reference composite image of the entire Landsat 8 time series for 2014 to the present. Here, in general, red indicates dryness and blue indicates moisture. These data were used to generate a Landsat NDVI time series for each of the reference sites. Low-quality or cloudy data were omitted and gaps in time series were filled using a harmonic model.

The Rimba Corridor treatment area does not indicate significant surface water indicative of complete rewetting. However, the radar imagery did detect some multi-seasonal 2018 surface water, possibly attributable to rainy season rewetting. This area shows an increased NDVI response but also greater seasonal variability, in the form of more pronounced periods of vegetative response. The 2014-2018 trend in the intervention area is indicative of increased vegetative activity. However, in comparison to the control, Berbak NP, the higher peaks and valleys indicate a greater seasonal response. Based on in situ observations, rewetting activity may be responsible for this positive trend (Figures 6-7, 10).

The most interesting findings were the significant dynamics in and around the BGPP canal blockages in the Tahura (Figure 11). This treatment area indicates multiseasonal surface water indicative of rewetting, in contrast to adjacent areas (e.g., the oil palm plantation represented in Figure 12). This area shows increased photosynthetic response between 2014 and the present, based upon NDVI analysis, which differed substantially from sites outside of the BGPP to the north and south, and which saw either a decline in NDVI or pronounced seasonal response, based upon statistical analysis of data drawn from in and around the grant implementation sites between 2014 and the present. The area to the north of the EMM canal blocking saw an upswing in NDVI activity, indicating multiyear growth or regrowth that is possibly linked to agriculture.

The PSDABM area (Figure 9) had a much smaller rewetting footprint and showed less change than the areas of the other grant recipients.

B. BUILDING CAPACITY IN CENTRAL, PROVINCIAL, AND DISTRICT GOVERNMENT ENTITIES, TO SUSTAINABLY MANAGE PEATLAND, INCLUDING TRAINING OF PERSONNEL, TECHNICAL ASSISTANCE, AND CREATION OF TRAINING MATERIAL.

The evaluation team could find only limited recognition of direct capacity augmentation in the central government, specifically the BRG. Senior staff interviewed in Jakarta were unaware of any training that had taken place, nor of training materials provided. However, there was considerable difficulty in gaining access to BRG senior staff, which may account for the lack of acknowledgement of contributions especially from BGPP, despite direct questions posed.

Neverthelesss, the Peatland portfolio was praised by BRG for the provision of dam construction design work and important proofs of concept for use elsewhere.

At the provincial level technical assistance and training (including the provision of training material) were provided by both EMM and WWF.

C. MAPPING IN AND AROUND PEATLAND

Common to all grants in the peatland portfolio is the need for hydrological mapping to determine the head pressure in the canal for effective placement of canal blockages. All the grants in the portfolio designed the placement of barriers according to good engineering practice.

In addition, training was given in participatory mapping techniques and technical assistance provided for communities to demarcate boundaries and plan land use in the Rimba Corridor and PSDABM grants.

EQ 2C: WHAT ADMINISTRATIVE OR LEGAL ACTIONS OR DOCUMENTS WERE REQUIRED TO PROPERLY EXECUTE THE VARIOUS PEATLAND ACTIVITIES?

An environmental management permit *(Surat Pernyataan Pengelolaan Lingkungan (SPPL*)) from the Regional Environment Agency (BLHD) was required for canal blocking, as well as approval of plans by the provincial offices of the *Dinas Kehutanan* (Forestry Service) and Ministry of Environment.

EQ 2D: WHAT WERE THE MAJOR CHALLENGES OF CANAL BLOCKING ALONG LEGAL, PERMITTING, AND TECHNICAL DIMENSIONS?

Regional government cooperation with the GP Fund activities was strong. However, substantial delays were experienced in permitting due in part to poor coordination and understanding of requirements on the part of provincial agencies. For example, it took WWF nearly seven months to clear all hurdles of the Environment Agency and the Investment Agency due in part to risk aversion on the part of key officials and in part on the interpretation of legal requirements. EMM reported that permitting issues, on top of contractual issues, left it only four months for implementation.

Poor coordination between national and regional agencies was a significant issue. National agencies imposed requirements including unfunded mandates on provincial agencies. In the case of approval of the management plan for the Tahura, the Ministry of Environment and Forests at the national level stipulated requirements for public consultations, including in Jakarta, which the province is unwilling to finance, creating an impasse that remained unresolved at the time of the evaluation mission.

The BRG has a problematic relationship with the land management agencies at the provincial level because they perceive potential "mission-creep" and that BRG is pushing beyond its original mandate of coordination and technical support to become a project implementer.

An additional major obstacle reported was in working with MCA-I. All grantees reported substantial technical challenges in the use of the PMIS, constantly changing procurement and reporting requirements, delays, and lost documentation.

> **"It took (MCA-I) a year to get the … environmental and social management system approved. This effectively gave us a 3-month implementation window.… Honestly, I had the impression that MCA was trying to delay us.…This was not an easy project."**
>
> **- GPF Grantee**

EQ 2E: WHAT CAPACITIES FOR PEATLAND PROTECTION WERE BUILT, AND HOW WERE THEY DISAGGREGATED BY GENDER?

Capacity development for peatland protection in the GP peatland portfolio took three main forms:

1. Canal barrier construction – in the PSDABM and Rimba Corridor grants, cadres were trained in the construction of canal dams. These were exclusively male. Specific numbers are not available, but construction crews are typically 8-10 people.
2. Fire management – all grants claimed to provide fire management training, but specific and disaggregated numbers are unknown.
3. Alternative livelihoods – in the Rimba Corridor, WWF trained 1,269 men and 629 women in improved agricultural practices including rubber, coffee, and horticulture; in PBMASP, Mitra Aksi trained 717 male and 539 female farmers in rice production and horticulture. EMM documented training of 6,619 smallholder oil palm farmers for increased productivity and sustainable production practices. Best management practice training in rubber production was provided to 423 smallholder farmers in the communities adjacent to the Tahura intervention area. Farmer cooperatives covering 2,055 members received training in internal control systems and sustainable intensification for certification.

Both the PSADABM and the Rimba Corridor grants concentrated efforts on harvesting and post-harvest practices. More than 70% of FGDs and KIIs conducted in/with farming communities reported a resulting increase in yields. Farmers supported by the BGPP reported improvement in harvests of palm fruit and rubber. Farmers and grantees both attribute improvements in yields to better use of fertilizer and improved harvesting techniques.

Both WWF and Mitra Aksi promoted local production of organic fertilizers; WWF demonstrated adoption in their final report. In Mitra Aksi's PSDABM intervention area, one master farmer reported that organic fertilizers required too much time and labor, suggesting that adoption is probably not universal. No indication was provided by Mitra Aksi about adoption levels. As a result, the CBA used the number of farmers that Mitra Aksi reported had "learned" these skills, which could be an overestimation if adoption rates were low. Mitra Aksi's approach is noteworthy as offering a holistic approach to low emissions agriculture and improved post-harvest management and marketing, based on several decades of experience in promoting sustainable agricultural development. EMM moved households to biogas digesters that used manure instead of burning wood, which is an innovative approach, but it is too early to tell if the innovation can be sustained.

EQ 2F: DID THE GRANT IMPLEMENTERS HAVE THE SKILLS NECESSARY TO ACHIEVE INTENDED RESULTS?

The skills required to achieve the intended results included:

- Technical knowledge of peatland ecology, hydrology, and restoration;
- Skill in working at landscape levels across multiple agencies and a diverse cast of stakeholders, to build consensus on the development pathway;
- Skills in community development, including the identification of strategies for achieving sustainable livelihoods;
- The ability to consult with communities and win their consent drawing on principles of free prior and informed consent;
- Skill in the management of complex projects; and
- Skill in building capacity at all levels.

Based on available evidence, each of the grantees broadly demonstrated the skills necessary to implement their grants. One exception is in revegetation, where the design did not appear to adequately address either economic or ecological realities.

> **"(Mitra Aksi performance) … was good – they have green knowledge. They know what they are doing and how to transfer the knowledge…"**
>
> - **Focus group in PSDABM**

Given the limitations of this PE in terms of time and resources, it is not possible to directly measure these skills; instead, the evaluation team reviewed any indicators of weakness in implementation and looked for attribution to capacity. The KIIs and FGDs confirmed that the interventions by the grantees were ultimately well received and provided knowledge that was relevant and useful.

The major weakness identified in this evaluation, the lack of provisions for the sustainability of the canal rewetting process, is a systemic problem for MCA-I, the grants, and the governments.

The other weaknesses or shortcomings described in this report were, for the most part, identified and adjustments were made.

The issues of poor government coordination and poor MCA-I management systems severely challenged the skills of the implementers and were often beyond the manageable interests of the grantees. That they were able to successfully overcome these challenges is a strong indication of the skills of the implementers.

Challenges cited include:

- Delays in operationalizing the MCA-I for reasons that go beyond the scope of this evaluation;
- Delays in acknowledging compliance with contractual condition (in the case of EMM, a six-week delay after submission of the Environmental and Social Management System, before the contractual conditions precedent were lifted);
- Complex formats for budgeting and approval process; and.
- Poor document tracking and retention.

EQ 3. HOW SUCCESSFUL WAS GRANT IMPLEMENTATION?

EQ 3A: HOW DO TARGETED COMMUNITIES PERCEIVE THE CANAL BLOCKING PROCESS AND ITS UTILITY? THIS RELATES TO TIME, FINANCE, AND CONVENIENCE.

Communities in Jambi Province were traumatized by the fires of 2015, which imposed severe hardships both in terms of health and the economy. The fires of 2015 represented a turning point in attitudes towards peat rewetting and canal blocking. All of the communities that opted into the canal blocking supported it, primarily as a fire prevention strategy. However, each of the grant recipients had to adapt their canal blocking approach to community needs, as discussed above. Accommodations and compromises produced designs that satisfied community needs, and in the case of the Rimba Corridor and PSDABM grants, community members were employed in the construction of the canal barriers.

> **"We really like how WWF consulted with us, and that there will be no more forest fires after rewetting"**
>
> **- Community leader, Rimba Corridor Grant**

There is a concern, however, on the part of communities, especially in the Rimba Corridor grant, that the responsibility for maintenance in the absence of grant funds will fall to them. Government officials interviewed confirmed that in the absence of maintenance plans they would rely upon the communities to voluntarily maintain the barriers.

Costs varied widely between grants. A 7m wide canal cost Mitra Aksi 26 million IDR ($1,860 USD) and WWF 80 million IDR ($5,500 USD). The difference is that WWF used external experts for initial construction and training).

Each dam must be monitored monthly to mitigate any major damages if there are any leaks, weathered wood, or cracks. Annual maintenance and monitoring are estimated to cost roughly $200 per canal block (for a 3 m dam) to include monthly monitoring and light repairs to the wood and other damages. It is estimated that the dam would need replacing every 5-10 years, costing about $940 (2016 values) for tools, materials, and labor.[25] This is a substantial drain on human resources for a small community.

Community members are monitoring dams in the PSDABM and Rimba Corridor grant sites. However, they lack the resources for maintenance, and, without a plan to support maintenance, it is reasonable to question an erosion of the commitment of communities over time. Due to the heterogeneity of communities and the variable number of canals under their control, it is impossible to predict the extent to which they will invest in even a single maintenance cycle. To the extent that the grantees have commitments to the communities at these sites extending beyond the timeframe of the project, there can be a reasonable expectation that maintenance will continue – this is the case in the Rimba Corridor and PSDABM grant sites. However, commitment to maintenance cannot be counted upon should the grantees depart. This should be an important lesson for future programs.

The evaluation-based CBA models do estimate that the government will pay the Rimba Corridor communities for their canal blocks, based on statements made in the field that funding might be forthcoming. However, there was no evidence that this will actually come to pass. There is also no expectation that the government will pay for the PSDABM communities for canal block maintenance, although the communities did express their willingness to perform low-level maintenance on their own. The CBA also includes a no-maintenance scenario to examine the economic viability of these grants if the communities do not maintain these investments.

EQ 3B: DID THE IMPLEMENTERS EFFECTIVELY TEACH COMMUNITIES HOW TO PROPERLY BUILD DAMS TO BLOCK CANALS (WWF)?

Community members in the Rimba Corridor were employed and instructed in dam construction and have the capacity to independently construct and maintain dams. This has been demonstrated through the use of grant-trained community teams to construct barriers under the supervision of an engineering contractor. Communities in the WWF administered Rimba Corridor grant do have the capability to properly build and maintain dams, provided they have the necessary resources.

[25] Estimates from the evaluation team's Hydrological Engineer.

EQ 3C: IN THE CASE OF CANAL BLOCKING WITH HEAVY EQUIPMENT, WHAT ARE THE ADVANTAGES, DISADVANTAGES, AND PERCEPTION OF COMMUNITIES?

The advantage of using heavy equipment are threefold. The canals could be constructed much more rapidly than they could by hand, allowing the Berbak GP partnership to construct over 100 dams in three months, despite the excessive delays. A much greater degree of compaction was achieved than would have been possible using manual techniques, making the dams much more durable. Over time, the use of heavy equipment is cost-effective to the extent that the dams are expected to remain functional until the canals infill. This can be contrasted to the box dams with spillways, which require perpetual maintenance, the conditions for which are very difficult to envision.

The disadvantages are the high upfront cost of the construction due to the equipment expense and the greater degree of engineering acumen that is required to construct such a dam.

The community perception was positive. All of the canal construction and use was by and for illegal timber extraction by people who came outside the communities adjacent to the Tahura, and they saw insignificant benefit from the existence of the canals. The loss of access due to canal blockages therefore has a negligible impact on them.

On the other hand, they were severely impacted by the fire crisis of 2015 and were willing to support any measures that helped to mitigate that risk.

The risk of dam destruction due to renewed efforts to log illegally is real but limited by several factors. The first is that the remaining forest, which is adjacent to Berbak National Park, is remote, and the costs of extraction will be high, compared with other forest areas. The Tahura is for practical purposes logged out (see photo at EQ3F, below. The second is that protection of Berbak is a government priority, so the likelihood of lax enforcement in the Tahura is lower now than it was in the past. And the third is that attitudes have significantly changed as a result of the fire emergency, and the rewetting is widely embraced as a positive development.

"The project outcome is good due to the blocked canals, as they can rewet the land… in 2015 there was a catastrophic fire (here)"

- **Village Secretary, Berbak GP Partnership.**

EQ 3D: WERE THERE ANY UNFORESEEN OUTCOMES OF CANAL BLOCKING?

The GP Project focused on GHG emissions and did not take into account another benefit of peatland rewetting: the prevention of subsidence (which results in land inundation and total loss of land). This occurs when peat is exposed to air, and anaerobic processes are replaced with aerobic ones, and soil microbes begin to oxidize the peat, breaking down its structure. This process can result in up to 4cm of subsidence annually, or a meter every 25 years, enough to drop the land below the water table, resulting in flooding. Evidence of land subsidence is widespread in the implementation area, as illustrated in Figures 3 below.

Figure 3. Subsidence in Londerang – Note Fire Damage

EQ 3E: WERE LAND AND WATER MANAGEMENT IMPROVED THROUGH THE DEVELOPMENT OF ZONAL PLANS AND MAPPING? IF SO, HOW?

Extensive landscape planning work was undertaken in the Peatland portfolio. No evidence is available to link zoning and mapping to impacts on land and water management, primarily because insufficient time has elapsed to determine what the project impacts have been on land and water management. However, with the conclusion of the project, there is uncertainty about the continued use of these inputs. This is attributable to the attenuated project period of implementation, which has resulted in limited opportunities to use these tools.

It should be noted that all grantees made strong use of the Landscape/Lifescape Analysis methodology in planning livelihood approaches. WWF indicates that it will continue to use this methodology, through its long-term commitment to the Rimba Corridor activity (with other sources of financial support), and thus has more opportunity to mainstream the use of the landscape planning tools and maps developed.

WWF and EMM made extensive use of GIS to plot burned areas, intervention sites, and waterways. No sharing of GIS data, the establishment of a repository, or the use of agreed standards and protocols to promote interoperability was observed. However, printed maps were shared with government counterparts.

WWF developed a spatial planning information system integrated with social networking to enable communication between stakeholders at a landscape scale and trained 30 representatives of stakeholder institutions in its use (8 women, 22 men). This innovation has the potential to scale and promote cross-sectoral collaboration, but it is too early to tell if this is happening.

EQ 3F: WHAT IMPACT, IF ANY, HAS THERE BEEN ON RE-VEGETATION IN THE TARGETED AREAS?

Revegetation is concentrated in two sites. Insufficient time has passed to determine what the impact will be. Given the high costs of planting and maintaining plantations, and the imperative to rewet more peatland to prevent catastrophic fire and land subsidence, revegetation through natural succession may be sufficient in the near term.

It is clear that a natural process of succession is occurring (Figure 4). Such regrowth, especially grasses and forbs, is vulnerable to fires. As long as the peat is moist, the catastrophic peat fires cannot occur, but continuous fire can convert the land to fire-adapted species and prevent succession to peat-swamp forest. Exclusion of fire is essential to successful revegetation, either assisted or natural.

All of the revegetation areas are at risk of being burned, especially in the Rimba Corridor grant, where this is at present a lack of financial resources to hire a crew to brush and weed the plantations (Figure 5).

Figure 4. Natural Regeneration in the Tahura

Figure 5. Overgrown Jelutong Plantation, Rimba Corridor Grant

EQ 3G: HAVE TARGETED COMMUNITIES' ECONOMIC ACTIVITIES CHANGED AS A RESULT OF THE PEATLAND ACTIVITIES, PARTICULARLY THE ALTERNATIVE LIVELIHOODS ACTIVITIES? IF SO, HOW?

In the Rimba Corridor grant both success and failure were observed in alternative livelihood development. However, in Londerang village, livelihood efforts were somewhat desultory. A small number of women were trained in the production of fish-crackers and salted fish. They were not trained in marketing their product. Moreover, the subcontractor providing the livelihood training took the processing equipment and provided it to another village, leaving them without the ability to continue. These women reported no change in their livelihood after the machine was removed.

In Mitra Aksi's PSDABM grant, communities demonstrated a diversification of crops and greater productivity through inputs including improved seed varieties, organic fertilizers, irrigation, and mechanical clearance of land using walk-behind tractors. Grant reporting indicates a 79 percent increase in income from rice crops as a result of grant interventions and a 60 percent increase in horticulture incomes; FGDs and KIIs reported increased income as a result of grant interventions.

In addition, all three communities provided training and technical assistance for communities to map and demarcate boundaries for land use planning.

The BGPP promoted paludiculture, or wetland agriculture, on the rewetted land of the Tahura to adjacent communities. This is potentially problematic because the Tahura classification prohibits extractive forest use. Raising community expectations of rights of access could potentially place the communities and the management authority in conflict.

These actual benefits, as well as those of the rubber and palm oil producers and anticipated future benefits from the jelutong plantations, are included in the evaluation-based CBAs.

EQ 3G: IS THERE EVIDENCE OF AN EFFECT ON THE INCIDENCE AND/OR SEVERITY OF PEATLAND FIRES?

> **"Before the project, the forest fires were huge – after there are only a few fires, but not around here"**
>
> **- Community member in FGD, Rimba Corridor.**

It is premature to attempt to answer this question. The catastrophic fire season of 2015 occurred during an *El Niño* year, and 2019 is also an *El Niño* year. If 2019 is a drought year, a comparison of the degree to which the water table drops in treatment and nontreatment areas may determine the *relative* effectiveness of rewetting and provide a test of how robust rewetting is at preventing peat fires. However, results will not be dispositive without repeated observations. Because of seasonal variability and interannual and decadal climate cycles (including the *El Niño-Southern Oscillation)*, the weather in a given year may bring greater or lesser fire risk. The true effect of rewetting in the incidence or severity of fire cannot be determined until several of the three-to-seven-year cycles have passed. For this reason, a long-term ecological research activity would be an appropriate complement to a rewetting strategy. However, there is a perception among communities that there is a causal link between the rewetting done in 2017 and the low fire incidence in 2018. This perception will be tested over time.

EQ 3G: WHAT IS THE EVALUATION-BASED ERR FOR THE PORTFOLIO?

The deviations and updates to the evaluation-based CBA (described above in Section 3.4.2), result in the ERRs and ENPVs as presented in Table 9 on the following page (along with the ex-ante CBA results), under two scenarios. The criteria reported are ERR and the ENPV for:

- ERR and ENPV *without* the social cost of carbon (SCC)
- ERR and ENPV *with* the country social cost of carbon (CSCC)

Table 9: Investment Criteria Results (Ex-Ante and Evaluation Based CBAs)[26]

Grant	Ex-Ante CBA ERR (%) ENPV ($)	Evaluation-based CBA ERR (%) ENPV ($)	
		W/O SCC	CSCC
BGPP	23.83% $18.29 million	8.63% -$1.09 million	12.76% $2.33 million
Rimba Corridor	20.74% $12.44 million	1.51% -$3.95 million	7.26% -$1.34 million
PSDABM	19.96% $0.81 million	24.20% $2.09 million	27.25% $2.40 million

[26] ENPV discounted at 10% rate.

The BGPP grant is economically viable when GHG emissions are valued at the country level. While the BGPP grant originally underestimated the total benefit for smallholder farmers that would be trained under the grant. However, the economic return to this grant has decreased significantly as a result of the ex-ante CBA's overestimated benefits associated with the fire risk reductions.

The Rimba Corridor is no longer an economically viable grant and likely never was, considering the overestimation built into the ex-ante estimates for the fire risk reduction and the lack of costs for the maintenance of canal blocks and revegetation. In addition, the ex-ante analysis included unrealistic assumptions about the benefits to the smallholder producers (with revenues increasing by as much as 427 percent per year).

The PSDABM is economically viable under both scenarios, and the ERR is higher than the ex-ante analysis. This improvement is largely attributable to the inclusion of revegetation benefits, which were omitted from the ex-ante CBA.

The additional benefit of averted GHG emissions valued at the country cost of carbon is a significant economic value in all models and one of the largest benefit streams in value (see Table 10).

Table 10: Present Value of Reduced GHG Emissions (2016 USD)

Grant	Present value of CSCC
BGPP	$3,418,617
Rimba Corridor	$2,610,506
PSDABM	$317,093

Using the country cost of carbon (CSCC) above in the models captures an important benefit of the peatland portfolio and is closer towards valuing MCC's of mitigating climate change objectives.[27] The ERR that includes the reduced GHG emissions valued with CSCC is likely the measure that most closely captures the net benefits to the peatland grants at the country level. In measuring this value, the CBA team used conservative estimates (see discussion in Annex I).

The grantees, communities, GoI, MCC, and the public were included in the stakeholder analysis. Findings include:

- Both EMM (BGPP) and WWF (Rimba Corridor) contributed significantly to the total grant investments; this comprised nontrivial proportions of the total investments.
- The communities benefit the most from all the grants. They are financially viable, which is an indication that they are financially resourced to maintain the investments that benefit them. Additionally, community interviews confirmed that individuals have been trained in maintenance and are motivated to maintain the canal blocks. However, the communities also expressed that they are either not responsible for canal maintenance (i.e., Rimba

[27] The inclusion of this benefit was discussed in the Evaluation Design Report and has been argued by others, see: Wolosin, Michael (2014). Measuring Green Prosperity in Indonesia: Technical and Policy Considerations for Including Avoided Climate Impacts in the Millennium Challenge Corporation's Cost-Benefit Analyses. Climate Advisors.

Corridor) or that it is too expensive (PSDABM), as discussed in more depth below. Additionally, certain limitations during implementation inhibit the communities' abilities to reap the full benefits of the grants (for example, through revegetation activities on permit land in the BGPP grant, which does not allow for community harvesting). Finally, during discussions with the communities, it became clear that there is no mechanism for the financial transfer of the incremental income within the community to the maintenance of the investments or from government entities for the grants where they may be responsible for maintenance.

- Costs to the GoI with respect to monitoring and maintenance of canal blocks and revegetated areas are not insignificant. The estimated costs for maintaining all investments under each grant over the 20-year period of analysis are as follows:
    - PSDABM – nearly $35,000;
    - Rimba Corridor – more than $360,000; and
    - BGPP – more than $171,000.[28]
    - The long-term feasibility of this funding is unclear.
- The public stood to benefit through the reduced risk of fire and reduced GHG emissions under all three grants.

Threats to the effectiveness of this activity should be considered; specifically, the question remains as to who will maintain the key investments of the GPF to ensure the long-term sustainability of these benefits. However, threats to the sustainability of these benefits (as well as those of the broader public) primarily relate to the question of maintenance and the long-term sustainability of these investments, especially the canal blocks, which represent a financial loss. If the canal blocks or the trees in the revegetated areas are not properly maintained, future benefits from the reduced fire risk, averted GHG emissions, and alternative livelihoods from wet-tolerant plant species will be jeopardized and the economic viability for each grant will decrease.

The CBA performed a scenario analysis to test the economic viability of all peatland grants under a realistic scenario that maintenance will not be performed on the revegetation and the canal blocks after the initial years. The associated assumptions in all CBAs are that costs are reduced to zero for canal block and revegetation maintenance and replacement. Similarly, benefits then reduce for jelutong revenue, and cost savings from averted GHG emissions and reduced fires (more details are given in the Sensitivity and Scenario Analyses section below). These reductions in benefits were modeled as a linear percentage reduction, given the lack of literature with more precise estimates on how all these benefits would be impacted by the degradation of key investment assets. Unsurprisingly, ERRs in all models decrease in the no-maintenance scenario, with the following results in each grant (see Table 11).

[28] In present value terms, discounted at 10 percent over the 20-year period of analysis.

Table 11: Results of the "No Maintenance" Scenario, Evaluation-Based CBAs

Grant	Baseline Model ERR (%) ENVP ($)	Sensitivity Analysis ERR (%) ENVP ($) (assumptions of % linear reductions in benefits from the baseline model)			
	CSCC	25%	50%	75%	100%
BGPP	12.76% $2.33 million	12.36% $1.94 million	11.82% $1.46 million	11.25% $0.98 million	10.65% $0.50 million
Rimba Corridor	7.67% -$1.14 million	6.17% -$1.75 million	4.49% -$2.29 million	2.33% -$2.83 million	0.85% -$3.37 million
PSDABM	27.7% $2.45 million	26.17% $1.95 million	24.63% $1.47 million	22.63 % $990,115	19.67% $510,665

- The BGPP grant remains viable even under the worst assumptions (100 percent reduction in all benefits after the initial years) in a no-maintenance scenario, suggesting the findings are robust. This is in part given that majority of the benefits, apart from the GHG emissions, are due to increased revenue through sustainable farming practices.
- The Rimba Corridor, while not economically viable in the baseline model using the country social cost of carbon to value GHG emission reductions, has worse ERRs under the no-maintenance scenario. Under the worst assumptions for the consequences of no-maintenance (100 percent reduction in all benefits after the initial years), the ERR is just 0.85%. It is worthwhile to point out that the trees in the Rimba Corridor are already showing signs of stunting because the fields have not been weeded, which already suggests that the baseline model and the assumptions around the future gains from jelutong production and averted GHG emissions might be optimistic.
- The PSDABM grant remains viable even under the worst assumptions (100 percent reduction in all benefits after the initial years) in a no-maintenance scenario. This is likely because the grant focused more heavily on agroforestry and improved farm management practices, and expensive assets are relatively few in this grant. This limits the grant's overall vulnerability to a no-maintenance scenario.

EQ 4: HOW SUSTAINABLE WAS THE PROJECT?

EQ 4A: WHAT MECHANISMS/ACTIVITIES HAVE BEEN PUT IN PLACE TO ENSURE SUSTAINABILITY OF THE BLOCKED CANALS?

At a minimum, sustainability would normally require maintenance and financing. However, the evaluation team did not find any evidence that sustainability had been addressed. BRG is nominally responsible for maintaining the dams, once built, but BRG's future is uncertain, and specific resources to support the maintenance of the GPF peatland portfolio were not identified to the evaluation team. Nor was the evaluation team able to identify any specific mechanisms put

in place for canal barrier maintenance in any of the three grants. This is a major risk to sustainability of the GPF investment.

It is of particular concern that all government land management agencies interviewed considered communities the default option for canal maintenance. Given the maintenance requirements, this poses a heavy financial burden to communities, as discussed previously. Consequently, this is a risk that community support could turn against rewetting, especially as the fire disaster of 2015 recedes from their collective memories if there is no support to communities for maintenance.

In the instance of EMM, the case was made that the compacted peat dams are permanent and maintenance free. As previously noted, outside experts expressed skepticism, noting the potential for overtopping during heavy rains, which could result in erosion leading to failure. At a minimum, a monitoring and a rapid response system is required to ensure that any damage to a peat barrier, for any reason, is promptly repaired.

The Berbak GP partnership led by EMM produced a significant report on issues and options for finance of peatland rehabilitation or restoration through carbon credits,[29] but the grant ended before this could be disseminated. *Had the GP run without delays, it is possible that the means of replication of these proofs of concept in peatland restoration would have been in play. This would have had the possibility of transforming the peatland environment in Sumatra and beyond through leveraging private and public finance. Unfortunately, it was a missed opportunity.*

EQ 4B: WHAT WAS THE LONG-TERM OUTCOME OF THE DAMS BUILT – THAT IS, OVER THE PERIOD OF THE EVALUATION, HOW MANY OF THE DAMS BUILT WERE STILL FUNCTIONING, AND IS THERE EVIDENCE OF MORE HECTARES "REWETTED"?

It is not possible to determine long-term outcomes, given the short time span and limited data on dam performance. However, we can infer that the dams have been built as proposed and are functional.

It was not possible to physically inspect every dam constructed. All the dams that the evaluation team inspected were in working order, and the communities and grantees indicated that the dams were performing according to design and will continue to function as long as periodic maintenance is conducted. For the dams constructed by Mitra Aksi and WWF, routine maintenance is required on a two-year cycle. This involves the replacement of deteriorating wood (Figure 6) and the repair of any damaged geomembranes. Remote sensing confirms that there is increased photosynthetic activity in the rewetted areas, an indicator of increased wetness (See Annex III).

[29] Climate Financing Options for the Taman Hutan Raya (Tahura) Orang Kayo Hitam, Jambi, 12/1/2017, produced by Forest Carbon, a subcontractor to EMM.

Figure 6. WWF Dam and Deteriorating Wood

EQ 3C: WHAT WAS THE LONG-TERM OUTCOME OF THE REPLANTING OF WET-TOLERANT SPECIES – THAT IS, OVER THE PERIOD OF THE EVALUATION, HOW MANY OF THE REPLANTED HECTARES ARE STILL SUPPORTING AT LEAST 60 PERCENT OF THE TREES ORIGINALLY PLANTED?

As with the previous question, it is not possible to determine long-term outcomes. We can infer outcomes, based upon work to date.

WWF reports a minimum of 70 percent survival rate of planted trees. In addition, dead or dying saplings have been replaced. WWF geotagged a random sample of 10 percent of their saplings for monitoring purposes. Due to the presence of high grass and water, the evaluation team could not reach far into the 200-ha revegetation plot. We did consistently identify planted *jelutong, gelam*, bamboo, and *pulai* in a random walk at the periphery (Figure 16).

The revegetation plot in the *Tahura* was better maintained. EMM reports a 90 percent survival as of March 2018, which corresponds with visual inspection. It is unclear why EMM selected economically valuable species for reseeding in an area that is to be restored to natural peat forest, rather than select a more biodiverse assortment of species for revegetation. It is also unclear why they did not revegetate the compacted peat barriers, as root structure would further strengthen the compacted peat.

As discussed in Question 3 above, natural regeneration is robust, outpacing the saplings planted. The labor intensity and concomitant high costs of replanting and weeding the revegetation plots, and the scale of the challenge, call into question revegetation as a first investment priority in the face of the urgent need to rewet more peatland.

"If the seedlings die, they should be replaced, but otherwise it is not sustainable"

– FGD in Tahura vicinity.

Overall, the revegetation that was in the portfolio did not appear to be well planned for the following reasons:

1. Relative costs and benefits of revegetation are questionable. A substantial amount of labor is required to plant maintain a plantation until seedlings have grown large enough to compete with natural regeneration. In terms of priority actions, the return on investment from labor for further dam construction will outweigh the returns for paludiculture.
2. The risk of loss of investment in revegetation is high. Without longer term support for maintenance of revegetation plots, they are highly susceptible to ground fire (e.g., for land clearing). Addressing this, in turn, requires stepped up enforcement, as well as support for mechanical means of land clearing. While one grant (PSDABM) did introduce mechanical land clearing, the machines (walk-behind tractors) were rented and financial support for rentals terminated with the grant.
3. The revegetation strategies lacked coherence. The evaluators understand that the strategy for revegetation arises at least in part in the interests of developing sustainable livelihoods for wetland communities. Yet, there is no evidence of revegetation without grant support, and no compelling constraint to revegetation is in evidence. If there are no constraints, and viable livelihoods are possible, it is reasonable to expect that some innovation in paludiculture would have already taken place. Further, the environmental arguments for revegetation are incoherent. Seed disbursal is cited as a strategy, but the concentration of seedlings in a single cluster (as is the case in both the BCPP and Rimba Corridor grants) is not optimal for disbursal and recolonization by tree species. And, as discussed above, the selection of only economically valuable species for ecological restoration in a place zoned as a protected area is further evidence of incoherence. In the Tahura, adjacent communities definitely refer to the revegetation plots as “crops.”

When revegetation is undertaken for the restoration of natural forest, it should augment natural regeneration where possible, using established best practices of restoration ecology. When revegetation is undertaken for economic uses the costs of planting and maintenance need to be factored into a study of the feasibility of sustained economic use.

EQ 4D: WAS BRG ABLE TO ADOPT AND UTILIZE THE ANALYTICAL TOOLS, INCLUDING THE MAPPING AND THE DETAILED ENGINEERING DESIGNS (DEDS) AND OTHER DONOR PROPOSALS PROVIDED TO THEM? WHAT IS THE LIKELIHOOD OF BRG'S CONTINUED USE OF THESE TOOLS? WHAT WAS THE IMPACT OF TRAINING?

During the grant design process, MCA-I encouraged WWF and EMM to cooperate with BRG, but BRG was in its infancy and unready to engage, so there was a misalignment. Consequently, WWF engaged with two *Kesatuan Pengelolaan Hutan* (Forest Management Units, or KPH) in the intervention area. The two KPH have become major stakeholders.

BRG had considerable difficulty in getting custody of the LiDAR maps paid for by MCA-I from the national company that did LiDAR mapping, PT ASE. BRG claimed that no training was provided. The support from the Norwegian government to BRG includes technical assistance that should be able to be applied to build BRG capacity to use this data. BRG is likely to use the DEDs and other donor proposals provided to them, on the evidence of attestation by BGG personnel. BRG senior staff did not acknowledge any training from MCA-I.

6. CONCLUSIONS AND POLICY IMPLICATIONS

Conclusions are presented along the four thematic areas of the evaluation questions: 1) Relevance/Design of Grants, 2) Grant Implementation, 3) Effectiveness/Results and 4) Sustainability. In addition, a final section of policy implications is included.

6.1 RELEVANCE/DESIGN OF GRANTS

Grant-funded interventions were rooted in evidence and in support of the objectives, with the exception of the revegetation activities, which were weakly supported by economics or ecology.

Regarding implementation fidelity, most compacts last for five years and begin implementation shortly after entering into force, allowing for almost five years of activity. The peatlands portfolio was provided slightly more than two years of operating time. Due to an over two-year delay in releasing the call for proposals, grantees were provided a significantly shorter implementation timeframe, compounded by additional delays and conflicting rulings concerning permitting by government authorities.

Lastly, the PLUP activity intended to inform the design of the peatland management grant proposals was delayed, and thus unable to support the implementation of the peatland portfolio.

6.2 GRANT IMPLEMENTATION

The categories below identify lessons learned from the implementation of grants under the Peatland portfolio.

IMPROVING LONG-TERM MANAGEMENT

There were three categories of efforts made to improve the long-term management of Peatland under GP: canal blocking and rewetting, capacity building and mapping.

Canal blocking and rewetting took place in two important peatland forest assets: the perimeter of the Londerang Peat-swamp Forest protected area and the Tahura. Each site used a different approach, and the evaluation team determined that the respective strategies used for each area were suitable for the context. However, site visits to both revealed durability issues that will result in an increased need for labor, materials (wood) and monitoring.

Separately, remote sensing and GIS data helped to draw the following conclusions:

- Berbak National Park (as a control site) demonstrates expected cyclic seasonal growth and resilience and established that the highest soil moisture levels correlated with areas of healthy peat forest.
- The Rimba Corridor treatment area does not indicate complete rewetting, although radar imagery did detect some multi-seasonal 2018 surface water. The 2014-2018 trend indicates an increase in vegetative activity consistent with expected results of rewetting.
- The trend in BGPP area 2014-2018 indicates the gradual increase in vegetative activity expected of rewetting.
- The PDABM area had a much smaller rewetting footprint and showed less change than the rewetting sites administered by the other grant recipients.

To summarize, the time frame is too short to draw definitive conclusions about long-term management outcomes, but there is evidence that management strategies are paying off, particularly concerning canal blocking and rewetting. We could, however, draw no correlations between mapping and long-term management, and we identified significant concerns about capacity and provisions for the management of canal blockages.

ADMINISTRATIVE, LEGAL AND TECHNICAL ISSUES

While regional government cooperation with GP was strong, significant delays in the permitting process resulted in shortened timelines for implementation. Poor coordination between national and regional agencies also made meeting requirements difficult, particular those requiring financing. Lastly, all grantees reported challenges in working with MCA-I and using the PMIS including frequent changes in requirements and loss of documentation.

CAPACITY BUILDING EFFORTS

Capacity efforts took place in the areas of canal barrier construction, fire management, and alternative livelihoods. Particularly in the area of agriculture, farmers reported improved yields as a result of using better fertilizer and harvesting techniques. The adoption of organic fertilizers was inconsistent across WWF and Mitra Aksi's intervention areas.

GRANTEE SKILL REQUIREMENTS

This evaluation determined that each of the grantees demonstrated the skills required to successfully complete their respective grants. Responses from the KIIs and FGDs confirmed that grant implementation was well received.

6.3 EFFECTIVENESS / RESULTS

The evaluation finds that the peatland rewetting process indicates a strong probability of effectiveness. There is insufficient evidence to support the effectiveness of revegetation, either from a biological or an economic perspective.

The effectiveness of livelihood strategies is mixed and heavily context dependent. Important lessons can be drawn from the oil palm production that was studied from the perspective of cost/benefit analysis but not part of the evaluation proper (being undertaken away from the peatland areas). The holistic systems approach employed by the Mitra Aksi Foundation in the BGPP area showed the strongest indications of uptake of those areas evaluated, but the short timeframe does not permit conclusions.

6.4 SUSTAINABILITY

Sustainability is a major concern in this evaluation; none of the grant recipients put in place measures for long-term management of the blocked canal areas. Given the maintenance requirements for box dams in particular, it is impossible to know the extent to which the peatland rewetting activities are ultimately successful; without maintenance, the eventual failure is virtually guaranteed. In the case of the compressed peat canal barriers, the evaluation, while agreeing that the compressed peat dams should require significantly less maintenance than do the box dams, does not accept EMM's argument that these structures are maintenance free. We have no basis for assigning the probability of failure, as there is insufficient data, but the risks are non-trivial and stem from overtopping with concomitant erosion, or from deliberate human damage.

Threats to the effectiveness of this activity should be considered; specifically, the question remains as to who will maintain the key investments of the GFP to ensure the long-term sustainability of the benefits discussed throughout this report and monetized in the CBA.

Specifically, this relates to the question of maintenance and the long-term sustainability of the investments in the canal blocks and the revegetation, representing a financial loss to the government in the stakeholder analysis of the CBA. If the canal blocks or the trees in the revegetated areas are not properly maintained, future benefits from the reduced fire risk, averted GHG emissions, and alternative livelihoods from wet-tolerant plant species will be jeopardized and the economic viability for each grant will decrease. We observed that the trees in the Rimba Corridor are already showing signs of stunting because the fields have not been cleared of fast-growing weeds that compete with the trees for resources.

Alternative livelihood options, including alternatives to cultivation and logging, were not exhaustively explored. Well scoped and implemented alternative livelihoods, in such areas as biomass for aviation fuel, freshwater fish for areas that cannot be restored, would have had the potential to bolster the sustainability of peatland rewetting efforts.

There are no known financial or other community mechanisms in place for the communities to self-organize to maintain these investments to capture possible future financial gains. Significantly, the Berbak GP partnership did produce a report on issues and options for finance of peatland rehabilitation or restoration through carbon credits. As a result of delays in implementation documented above, this product was not disseminated or otherwise acted upon. Had this been implemented through a pilot project, it could have had the possibility of transforming the peatland environment in Sumatra and beyond by leveraging both private and public finance.

Communities were trained in maintenance and are monitoring dams, but none of the grants produced a plan to designate roles and responsibilities to individuals or groups to conduct the maintenance, with the default being to leave the responsibility with elected community leader. In the Rimba Corridor and the PSDAMB, communities are passively awaiting funds in order to pay for labor and material for maintenance. BRG officials interviewed insist that funds will be made available, but no one was able to supply specific details on amounts or timetables. It is widely assumed that the BRG mandate will be extended, but this is not guaranteed. If the mandate is allowed to expire it is unclear how peatland restoration will be managed.

Women in the communities visited were highly incentivized to prevent fires, as a result of their role as caregivers and their experiences of harm from the 2015 peat fire emergency. Women's efforts to maintain the canal blocking infrastructure can be expected to be a driving force in the continued success of rewetting efforts. This is an important lesson for replication.

6.5 POLICY IMPLICATIONS

The Peatland portfolio grants have demonstrated how context-specific technical solutions, attention to sustainable livelihoods, and coordination of stakeholders, including government, at the landscape level, can converge to address NRM problems once thought impossible to resolve.

Some key implications emerge for policy:

- Peatland management and rehabilitation involves multiple agencies with different, and sometimes competing mandates. Government coordination is a key ingredient in success.
- Rehabilitation is not equivalent to restoration, which is the return of ecological functions not contemplated in the GP Project. It is important to maintain the distinction between rewetting peatland to prevent fire and to return peatland to ecological functionality. For example, the failure to address this distinction resulted in confusion in the BGPP grant, where a former peat swamp forest on protected lands was to be restored for conservation purposes, but where the selection of plants for revegetation was based on economic considerations.

- Peatland restoration is a multidecadal process. Canal barriers must be monitored and maintained, and fire controlled. For this reason, emphasis should be given to long-term financing solutions. Long-term financing is an important component of a restoration strategy. This can be achieved through private sector investment opportunities identified, but not used, in this project.

6.6. NEXT STEPS AND/OR FUTURE ANALYSIS

Integra plans to disseminate the final results through presentations at MCC headquarters in Washington, D.C., and in Jakarta to BRG, Bappenas, and other GoI stakeholders in December 2019.

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ANNEX II: COST-BENEFIT ANALYSIS

INTRODUCTION AND OVERVIEW

This Annex outlines in detail the approach and findings of an evaluation-based CBA of the Green Prosperity Facility's (GPF) peatland portfolio. The financing facility was a component of the GP Project implemented by the Millennium Challenge Account- Indonesia (MCA-I) in Indonesia. The team conducted the evaluation-based CBA on three grants of this financing facility discussed throughout this report.

The three grants evaluated include the BGPP, Rimba Corridor, and PSDABM grants. All three grants engaged in canal blocking (using different technologies) to rewet degraded peatland, promoted revegetation on degraded peatland, and promoted livelihood strategies for the surrounding communities. These interventions are discussed in depth in the main body of the report and examined as part of the evaluation-based CBAs. The evaluation did not evaluate the benefits to palm oil producers, but this benefit is calculated using secondary information and included in ex-post CBA.

In addition to describing the approach and results of the evaluation-based CBA, this annex provides a detailed description of the differences between the evaluation-based CBA and ex-ante CBAs. The main body of the annex is organized as follows:

- Comparing the ex-ante CBAs with evaluation-based CBAs (specifically, adjustments due to changes in the grant design, methodology, and parameter values); and
- Evaluation-based CBA approach and results (including costs and benefits, results, methodology, and commentary on extensions, such as broadening the scope of CBA).

COMPARING EX-ANTE CBAS WITH THE EVALUATION-BASED CBAS

COSTS & BENEFITS IN EX-ANTE CBAS

The ex-ante CBAs for BGPP, Rimba Corridor, and PSDABM grants assessed the feasibility of these grants from the perspective of the Indonesian economy. Three categories of benefits were included in the models:

1. Increased incremental income/revenue from existing farm activities (all three models) and new wet-tolerant forest commodities (only in BGPP and Rimba Corridor).
2. Cost-savings through a new technology (only in the BGPP).
3. Fire risk reductions (only in the BGPP and Rimba Corridor models).

While all three grants had stated objectives of reducing GHG emissions, this benefit was not explicitly modelled in ex-ante CBAs. All three analyses adopted similar approaches to estimating benefits in the ex-ante CBAs; these are summarized below.

In the case of **BGPP** [30], the following benefits and costs were modeled:

- Benefit: Increased revenue from existing farm activities due to best management practices promoted by the grant (rubber, palm oil)
- Benefit: Increased revenue from new wet-tolerant forest commodities as part of the peatland revegetation planting (jelutong)
- Benefit: Cost-savings from biogas digesters as a result of not needing to collect firewood
- Benefit: Reduction in the risk of fire and associated costs once the peatland is rewetted
- Costs: Investment cost, MCA-I overhead

The case of **Rimba Corridor** grant[31] looks similar to the BGPP grant, with the exception that it did not have a biogas component:

- Benefit: Increased revenue from existing farm activities due to best management practices promoted by the grant (rubber, coffee, cacao)
- Benefit: Increased revenue from new wet-tolerant forest commodities as part of the peatland revegetation planting (jelutong)
- Benefit: Reduction in the risk of fire and associated costs once the peatland is rewetted
- Costs: Investment cost, MCA-I overhead

The **PSDABM** [32] grant was the most limited model and only included the benefits from improved rice production. It did not include the benefits from fire risk reduction nor any benefits from the revegetation (jelutong). The only cash flows modeled include:

- Benefit: Increased revenue from existing farm activities due to best management practices promoted by the grant (rice)
- Costs: Investment cost, MCA-I overhead

The critical assumptions behind the analytical approach of the ex-ante CBAs are as follows:

- Changes in crop yields resulting from the grants will be sustained over the analysis time frame.
- There are no monitoring, maintenance, or replacement costs for the canal blocks.
- The land remains rewetted following the canal blocks and revegetation activities.
- Communities will be the beneficiaries of revegetation activities.

The ex-ante analyses of peatland grants use the same time horizon, 22 years: two years of investment and 20 years of operation.

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[30] The ex-ante CBA spreadsheet includes multiple worksheets, we are referring to the spreadsheet titled "ERR_PG-P-03 EUROCONSULT MOTT MACDONALD B.V_6.5.17" and using the worksheet: "EconAnalysis (OH Cost 20%)" as the latest version of the ex-ante model.

[31] The ex-ante CBA spreadsheet includes multiple worksheet; we referenced the spreadsheet titled "ERR_PG-P-09 WWF INDONESIA-7.31.17" and using worksheet: "EconAnalysis (OH Cost 20%)".

[32] There were multiple tabs, we are referring to the document titled "#09_ERR_Yayasan Mitra Aksi" and using Tab: "Sustainable Agriculture" as the latest version of the ex-ante model.

EX-ANTE METHODOLOGY & SPECIFICATIONS

The tables below illustrate the approach to each calculation in the ex-ante CBAs of the grants that have both peatland and non-peatland components. Where there are similarities between all three models for each benefit or cost stream, they are represented in the same table. Differences are highlighted in the narrative section and in the calculations.

It is important to note that the ex-ante CBAs were not accompanied by any narratives, which presented two issues: (1) in some cases, the analysts had to infer the underlying model assumptions based on the calculations, and (2) in other cases, the analysts had to infer what the calculations were trying to estimate due to inconsistencies in the way parameter values were defined, entered in the model, and used in the calculation of costs and benefits. The team's understanding of the ex-ante model specifications is described below, and include:

- Table 12 through 16: Increased revenue: rubber; palm oil, coffee, cacao; rice; jelutong
- Table 17 through 18: Cost-savings from biodigesters and avoidance cost of fire
- Table 19 through 20: Estimation of investment and MCA-I overhead cost

INCREASED REVENUE SPECIFICATIONS

Table 12: Estimate of Increased Revenue (Ex-Ante CBAs): Rubber

Relevant Grants		
Rimba Corridor; BGPP		
Narrative		
Counterfactual: Quantities, prices, and hectares (and therefore incomes) are fixed over a 20-year time period for both grantees. **With Project:** The ex-ante CBAs estimated the expected incremental incomes attributable to the rubber interventions due to increased yields. The price and number of hectares cultivated do not vary over time or in either the "with project" or counterfactual scenario. Only the quantity produced on average will increase because of the grant and remains fixed after a one-time increase. For *BGPP*, yields increase in Year 1 of the operational period. For *Rimba Corridor*, yields increase in Year 5 of the operational period. In years 1-4, it is assumed that there is no production at all in the "with project" scenario *(Note: this was likely a mistake and was adjusted in the evaluation-based CBA)*		
Timeframe		
Operation after investment period, 20-year time frame		
Inputs	*Definition*	*Units*
HA^{rubber}	Total rubber cultivation area	ha
$Q^{rubber,w}$	Yield for rubber with the project per hectare	tonnes/ha
$Q^{rubber,w/o}$	Yield for rubber without the project per hectare	tonnes/ha
P^{rubber}	Price of rubber per tonne	IDR/tonne
Calculation		
Benefit (BGPP)	All Years: $(Q^{rubber,w} - Q^{rubber,w/o}) \times HA^{rubber} \times P^{rubber}$	
Benefit (Rimba Corridor)	Years 1-4: $(0 - Q^{rubber,w/o}) \times HA^{rubber} \times P^{rubber}$ Years 5-20: $(Q^{rubber,w} - Q^{rubber,w/o}) \times HA^{rubber} \times P^{rubber}$	

Table 13: Estimation of Increased Revenue (Ex-Ante CBAs): Palm Oil, Coffee, and Cacao

Relevant Grants		
Rimba Corridor		
Narrative		
Counterfactual: In the authors' understanding of the ex-ante model, the counterfactual is estimated based on the income that employees receive for working on the farm and captures the opportunity cost of time for employees of these plantations. The amount is fixed over a 20-year time period. (*Note: The assumptions behind these calculations are quite vague, but it seems there is a significant mathematical error in this estimation.)* **With Project:** The expected incremental benefit is due to increased gross incomes that begin in Year 5 and remain constant thereafter. In years 1-4, it is assumed that there is no production at all in the "with project" scenario. *(Note: this was likely a mistake and was adjusted in the evaluation-based CBA)* The number of hectares does not vary over time or in either the "with project" or counterfactual scenario.		
Timeframe		
Operation after investment period, 20-year time frame		
Inputs	Definition	Units
HA^{palm}	Total palm cultivation area	ha
D^{palm}	Person days working on a palm farm per hectare	days/ha
S^{palm}	Salary earned from working on a palm farm per month	IDR/month
I^{palm}	Income per hectare per month	IDR/month
Calculation		
Benefit	Years 1-4: $-D^{palm} \times HA^{palm} \times S^{palm} \times 12$ Years 5-20: $(I^{palm} \times 12) - (D^{palm} \times HA^{palm} \times S^{palm} \times 12)$ This benefit denotes "palm" but is specified the same for the coffee and cacao plantations.	

Table 14: Estimate of Increased Revenue (Ex-Ante CBAs): Palm Oil

Relevant Grants		
BGPP		
Narrative		
Counterfactual: In the authors' understanding of the ex-ante model, the counterfactual is estimated based on the income that employees receive for working on the farm. The amount is fixed during the operational period (years 4-20). Note the income is scaled by 0.7; this value is not explained. In years 1-3, it is assumed that there is no production at all in the counterfactual scenario. *(Note: this was likely a mistake and was adjusted in the evaluation-based CBA).* **With Project:** The expected incremental benefit is due to increased gross incomes, International Sustainability & Carbon Certification (ISSC) premium, and improved oil extraction rate. These incremental benefits begin in Year 4 and remain constant thereafter. The certification premium benefit is scaled by 0.7 in the "with project" and 0.8 in the counterfactual (even though there is no certification in this scenario); these values are not explained. In years 1-3, it is assumed that there is no production at all in the "with project" scenario. *(Note: this was likely a mistake and was adjusted in the evaluation-based CBA)* The number of hectares remains constant in the "with project" and counterfactual scenario.		
Timeframe		
Operation after investment period, 20-year time frame		
Inputs	Definition	Units
HA^{palm}	Total palm cultivation area	ha
HA^{cert}	ISCC certified palm cultivation area	ha
$Q^{palm,w}$	Annual yield for palm with the project per hectare	tonnes/ha
$Q^{palm,w/o}$	Annual yield for palm without the project per hectare	tonnes/ha
P^{palm}	Price per tonne	IDR/tonne
P^{ISCC}	ISCC certification premium per tonne	IDR/tonne
$Q^{CPO,w}$	Annual incremental increase in crude palm oil (CPO) output	tonnes
$Q^{extract,w}$	Annual incremental increase in CPO extraction	%
P^{CPO}	Price of CPO per tonne	IDR/tonne
Calculation		
Benefit	Years 1-3: 0 Years 4-20: $[(HA^{palm} \times Q^{palm,w} \times P^{palm} \times 0.7) - (HA^{palm} \times Q^{palm,w/o} \times P^{palm} \times 0.7)] + [(HA^{cert} \times Q^{palm,w} \times P^{ISCC} \times 0.7) - (HA^{cert} \times Q^{palm,w/o} \times 0.8)] + (HA^{palm} \times Q^{CPO,w} \times Q^{extract,w} \times P^{CPO})$	

Table 15: Estimate of Increased Revenue (Ex-Ante CBAs): Rice

Relevant Grants		
PSDABM		
Narrative		
Counterfactual: Quantities, prices, and farmers (and therefore incomes) are fixed over a 20-year time period. It seems the assumption was each farmer was responsible for one hectare. **With Project:** The ex-ante CBAs estimated the expected increased revenues attributable to the rice interventions are due to increased yields "with project" starting in Year 1 of the operational phase. The model calculates the "with project" revenue scenarios for three different regions in Jambi, where the prices differ slightly. Additionally, the total "with project" hectares are fewer compared to the counterfactual hectares. *(Note - this was a mistake because there are more farmers in the counterfactual than there are in the "with project" scenario - discussed below).*		
Timeframe		
Operation after investment period, 20-year time frame		
Inputs	Definition	Units
$HA^{rice,w}$	Total number of rice farmers (assumption: farmers manage 1 hectare each) with project	#
$HA^{rice,w/o}$	Total number of rice farmers (assumption: farmers manage 1 hectare each) without project	#
$Q^{rice,w}$	Yield for rice with project per hectare	kg/ha
$Q^{rice,w/o}$	Yield for rice without project per hectare	kg/ha
P^{price}	Price of rice per kilogram	IDR/kg
Calculation		
Benefit	$(Q^{rice,w} \times HA^{rice,w} - Q^{rice,w/o} \times HA^{rice,w/o}) \times P^{price}$	

Table 16: Estimation of Increased Revenue from Peatland Revegetation Planting (Ex-Ante CBAs): Jelutong

Relevant Grants		
BGPP; Rimba Corridor		
Narrative		
Counterfactual: The counterfactual assumed zero revenue. **With Project:** The expected incremental incomes attributable to the jelutong plantations are due to productive harvests once the trees mature. For *BGPP*, this occurs in Year 10. Year 10 trees have about half the productive yield of a mature tree and Years 11 onward assume a constant yield for a mature tree. For *Rimba Corridor* this occurs in Year 11. Year 11 trees have about half the productive yield of a mature tree and years 12 onward assume a constant yield for a mature tree. The price and number of hectares do not vary over time.		
Timeframe		
Years after which jelutong trees are expected to yield		
Inputs	Definition	Units
$HA^{jelutong}$	Total cultivation area for jelutong	ha
${Q_t}^{jelutong}$	Yield of jelutong per hectare in period t	tonnes/ha
$P^{jelutong}$	Price of jelutong per tonne	IDR/tonne
Calculation		
Benefit	${Q_t}^{jelutong} \times HA^{jelutong} \times P^{jelutong}$	

COST-SAVINGS SPECIFICATIONS

Table 17: Estimation of Cost-savings (Ex-Ante CBA): Biodigesters

Relevant Grants		
BGPP		
Narrative		
Counterfactual: The counterfactual assumes a fixed cost per household for cooking fuel expenses. **With Project:** Biodigesters would result in cost-savings for households as of Year 1 when local mills provide palm oil mill effluent (POME) as cooking fuel to households; the assumption built into the model is that this thereby reduces household expenditures on cooking fuel to zero. Cost-savings and number of households do not vary over time.		
Timeframe(s)		
Operation after investment period, 20-year time frame		
Inputs		
HH	Number of households receiving POME as cooking fuel	#
$C^{cooking}$	Monthly cost of cooking fuel per household	IDR/HH
Calculation		
Benefit	$C^{cooking} \times HH \times 12$	

Table 18: Estimation of the Avoidance Cost of Fire (Ex-Ante CBA)

Relevant Grants		
BGPP; Rimba Corridor		
Narrative		
Counterfactual: An expected annual cost of fire (per hectare) was estimated using fire damages in the Jambi region in 2015. This per hectare cost was multiplied by the total number of hectares that would be rewetted in the grants to derive an annual cost of fire in each grant's intervention areas. It was assumed this fire cost would occur every year for the 20-year operational period. **With Project:** It was assumed that fire risk would decrease by 60% on hectares that are rewetted because of the grant. This 60% fire reduction was applied to the expected average annual cost of damage used in the counterfactual beginning in Year 1 of the operational phase. The remaining annual cost was assumed to be the same over the 20-year period. This benefit is then a cost savings, due to the averted cost of fire.		
Timeframe		
Operation after investment period, 20-year time frame		
Inputs	Definition	Units
$FC^{2015\ fire}$	Total economic cost due to forest fire in Jambi in 2015	IRD
$HA^{2015\ fire}$	Total forest area burnt in Jambi in 2015	ha
$HA^{rewetted}$	Rewetted area due to the canal blocks	ha
r	Contribution of canal blocking to fire prevention (as a percentage of how much fire risk has reduced)	%
Calculation		
Benefit	$\frac{FC^{2015\ fire}}{HA^{2015\ fire}} \times HA^{rewetted} \times r$	

ESTIMATION OF INVESTMENT AND OVERHEAD COST IN EX-ANTE CBA

Table 19: Estimation of Investment Costs (Ex-Ante CBAs)

Relevant Grants		
All: BGPP; Rimba Corridor; PSDABM		
Narrative		
The investment cost is an exogenous parameter in the ex-ante CBA, which is equally distributed over two years for all models.		
Timeframe		
Investment period, 2-year period		
Inputs		
I	The total investment cost	IRD
L^{inv}	Length of investment	Years
Calculation		
Cost	$\frac{I}{L^{inv}}$	

Table 20: Estimation of MCA-I Overhead Costs (Ex-Ante CBAs)

Relevant Grants		
All: BGPP; Rimba Corridor; PSDABM		
Narrative		
The MCA-I overhead cost is estimated as a fixed percentage of the total investment cost in each year.		
Timeframe		
Investment period, 2-year period		
Inputs		
I	The total investment cost	IRD
L^{inv}	Length of investment	Years
O	Overhead cost as a percentage of investment cost	%
Calculation		
Cost	$O \times \frac{I}{L^{inv}}$	

CHANGES TO THE EX-ANTE CBAS IN THE EVALUATION-BASED CBAS

This section presents deviations in the evaluation-based CBAs from the ex-ante CBAs. It is structured as follows:

- Methodological changes that were applied to all three models;
- Model-specific changes due to changes during implementation or adjustments to parameter values with the benefit of hindsight in the evaluation-based CBAs.

METHODOLOGICAL CHANGES TO ALL MODELS

The methodological adjustments are introduced by the team to address issues with the ex-ante CBA, to reflect on new information obtained by the team through evaluation, or to expand the range of costs and benefits. The evaluation led to the following changes to the ex-ante methodology in the evaluation-based CBAs for all three models:

New Benefit - residual value of jelutong trees: The ex-ante analysis does not include a residual value of the jelutong trees, although the life of these investments exceeds the time horizon for the analysis. The evaluation-based models have included this benefit in the final year of the analysis (Year 20) to account for benefits in the future to these jelutong trees. It was estimated that jelutong trees can produce latex until they are at least 40 years old (i.e., 20 years of residual value following the end of the 20-year period of analysis in the evaluation-based CBA). The ERR is not sensitive to assumptions in this parameter.

Methodology adjustment - reduction in fire risk: The PSDABM ex-ante model did not include a cost savings from reduced fire risk, which was included in the evaluation-based model. The BGPP and Rimba Corridor models did have cost savings from reduced fire; however, the evaluation-based CBAs have adjusted the methodology that was used in the ex-ante CBAs. The ex-ante models used the cost of fire damage from a World Bank economic analysis of the 2015 Jambi fires[33] to estimate an average annual cost of fire in the intervention area. The World Bank valuation of the 2015 fire damages comprised costs to agriculture, biodiversity loss, carbon emissions, forestry, manufacturing and mining, trade, transportation, tourism, health, education, and firefighting. The ex-ante models calculated the value of this cost on a per hectare basis and scaled this 2015 fire cost, annually, to the intervention area in the BGPP and Rimba Corridor models. Then, it was assumed that through rewetting via the canal blocks, there will be a 60 percent annual risk reduction of fire damage (valued using the 2015 Jambi fire) and associated cost savings. There are several issues with this approach resulting in a significant overestimation of the fire risk reduction benefit.

- First, the total Jambi 2015 fire damages were scaled proportionately to the rewetted areas under the GP grants to estimate 'Current Economic Cost due to Forest Fire per Ha (IRD).' It is unlikely that costs scale proportionally, particularly when it comes to effects on health or transport. Similarly, the costs of the Jambi fire were averaged across regions, but factors unique to particular regions would imply that some areas may experience lower average costs of fire as a whole. For example, the population density of areas covered under BGPP and Rimba Corridor are lower than Muaro Jambi as a whole, suggesting the average costs of fire will be lower in these areas relative to the regional average.
- Second, the 2015 Jambi fires were a particularly rare and devastating event that are unlikely to occur on an annual basis as modeled in the ex-ante CBAs. This again resulted in a significant overestimation of the annual cost of fire each year (and the associated cost savings in the “with project” scenario).
- Finally, there was no reference regarding the 60 percent risk reduction making it difficult for the evaluation-based CBA to validate methods used.

[33] World Bank Group (2016), The Cost of Fire: An Economic Analysis of Indonesia’s 2015 Fire Crisis, Indonesia Sustainable Landscapes Knowledge Note: 1.

Given these limitations, the team adjusted the methodology used to estimate this benefit by relying on a report by the National Renewable Energy Laboratory (NREL)[34] that estimated the peatland fire risk reductions for Berbak National Park. This study scaled peat fires in Indonesia in 1997 and 1998 through three steps: (1) estimating the probabilities associated with different size fires for all of Indonesia, (2) estimating a mean annual fire cost in Indonesia by benchmarking the 1997-98 fires to the assumption that this fire occurs once in 100 years, (3) scaling those mean annual damages to the area of Berbak National Park, and (4) estimating the value of a 20 percent reduced fire risk in that region as a result of the GP project (there is no justification given for this 20 percent value).

The CBA team made additional adjustments to the NREL paper. The NREL paper scaled the mean annual fire damage costs to the area of the Berbak National Park; however, the CBA team determined that assuming the 6,000 rewetted hectares in the BGPP grant will protect 160,000 hectares in the Berbak National Park from fire risk was unlikely. Therefore, the team additionally scaled the mean annual costs of Indonesian fires in the NREL paper to *only* the hectares rewetted by the GP project. The values for reduced fire damages associated with each grant are listed below, which are far below the ex-ante estimations. Finally, for the Rimba Corridor and the PSDABM grants, the NREL figures were further reduced to prevent the risk of double counting. Because the NREL estimates the value of fires to include timber loss, agriculture, fire-fighting costs, and reduced tourism, there is double-counting of the value of agriculture and timber from the reforestation efforts (which represent 92 percent of the total fire loss value in the NREL paper). Counting the jelutong revenue benefits to the community and the averted loss benefits in the Rimba Corridor and PSDABM grants would be double counting, so the fire benefits for those two grants were further reduced by 92 percent of the total NREL estimates limiting the value of fire averted to only averted firefighting costs and marginal impacts on tourism. The BGPP grant does not value the timber or the agriculture from the jelutong trees so there is no risk of double counting.

While the value of fire reduction may lead to underestimation, it assuages the concern regarding incorrect scaling of other costs such as loss of biodiversity, health impacts, and transportation problems.

Table 21: Summary of Fire Risk Reduction Cost Savings

Grant	# of hectares rewetted	Ex-Ante Fire Damage Savings (Annual USD)	Evaluation-Based Fire Damage Savings (Annual USD)
BGPP	6,000	3.8 million	24,000
Rimba Corridor	7,280	3.0 million	2,328
PSDABM	1,620	n/a	518

It should be emphasized that there are a lot of uncertainties with the values used to reach these figures, as acknowledged by the authors of this report. However, the team has erred on the side of being conservative in these figures.

New Benefit - Reduced GHG Emissions: Both peatland rewetting and the planting of trees in all three peatland grants has a large impact on GHG emission reductions. To quantify the amount of GHG emissions each of the peatland grants is responsible for, the team relied on a report

[34] J. Macknick, M. Elchinger, B. Stoltenberg, G. Hill, J. Katz, and J. Barnett. (2014) Berbak Landscape Integrated Management Project. National Renewable Energy Laboratory (NREL).

prepared by the ICF in 2018 on the GHG emissions averted through the GP portfolio.[35] GHG are converted to carbon dioxide equivalent (CO_2e) units using global warming potentials from the IPCC's Fourth Assessment Report (AR4) for carbon dioxide, nitrous oxide, and methane.

The ICF report appendices provide extensive details about these grant-specific tonnes of reduced GHG emissions calculations. This included estimates for the carbon content of specific revegetated trees (adjusted for the maximum tonnes of carbon capture possible in a hectare), an emissions factor for drained peatland and low emission agricultural practices promoted by the grants. The estimates are based on Verified Carbon Standard and Clean Development Mechanism methodologies.

The only adjustment made to the ICF report was a downward adjustment in the carbon sequestration associated with the Rimba Corridor and BGPP grants: the ICF report estimated a higher number of mature trees than the evaluation team believes will reach maturity in the revegetated areas (the evaluation team believes roughly half of the ICF trees will reach maturity, based on data collected in the evaluation on survival rate). The final number of annual GHG emissions is derived from the following estimates of GHG emission reductions attributed to each component of each peatland grant can be seen in the table below.

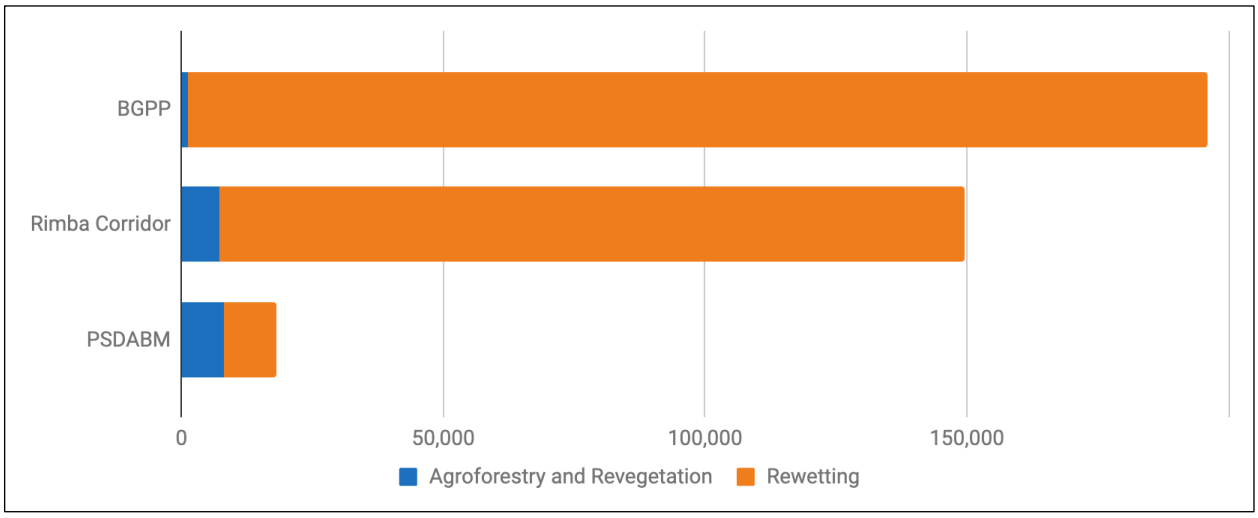
Table 22: Summary of Potential Annual GHG Emission Reductions (tonnes CO^2e per year)

Grant	Agroforestry & Revegetation	Rewetting	Total
BGPP	1,275	194,799	195,947
Rimba Corridor	7,262	142,366	149,628
PSDABM	8,091	10,084	18,175

Any adjustments made to agroforestry assumptions and biogas have a limited impact on the overall estimate of GHG reductions attributable to each grant. As can be seen in the next graph, the majority of the averted GHG emissions are due to assumptions around the number of hectares that are rewetted:

[35] ICF (2018). Greenhouse gas emission reductions for MCA-Indonesia Green Prosperity Project.

Figure 7: Summary of Potential Annual GHG Emission Reductions (tonnes CO2e per year)



Next, to put a dollar value on the GHG emissions, the team used a web-based tool[36] based from a recent study[37] for the estimation of the country social cost of carbon (CSCC). Under the recommended assumptions of the study, the CSCC in Indonesia is estimated at $10.935 USD (2018) per tCO_2, which is about 2.6 percent of the global social cost of carbon (GSCC) reported by the same study ($417 USD (2018) per tCO_2). This value is more than four times $80 to $100 USD (2016) - the average expert opinions for the value of SCC reported in a recent study.[38] The CSCC study, however, highlights the disproportionate allocation of the social cost of carbon and shows that Indonesia bears 2.6 percent of the global social cost of carbon. To accommodate the large discrepancy between these studies, we used a conservative value of $2.34 USD (2016) per tCO_2. This value is calculated by taking 2.6 percent of $90 (the average of $80 to $100). Total annual savings attributable to each grant within Indonesia are presented in the table below.

Table 23: Annual Country Value of Reduced GHG Emission Reductions (2016 USD)

Grant	Annual CSCC Savings
BGPP	$458,516
Rimba Corridor	$350,130
PSDABM	$42,530

New Cost - Maintenance and Replacement for Canal Block Dams: The ex-ante models did not include maintenance and replacement costs for the canal blocks, which are a necessary expense for maintaining these investments. This is especially the case for the wooden box dams built in the Rimba Corridor and PSDABM grants, which need to be replaced on average five years

[36] Ricke, Katharine, et al. Supplemental Information - Interactive Figures: Country-level social cost of carbon. Nature Climate Change 8.10 (2018): 895. Accessed through: http://country-level-scc.github.io/cscc-web-2018/

[37] Ricke, Katharine, et al. "Country-level social cost of carbon." Nature Climate Change 8.10 (2018): 895.

[38] Pindyck, Robert S. "The social cost of carbon revisited." Journal of Environmental Economics and Management 94 (2019): 140-160.

and regularly monitored and maintained on a monthly basis. A replacement cost was modeled in the evaluation-based CBA every five years, and an estimated annual cost was modelled in the years when the canal is not replaced. This includes costs for community labor given that both these grants trained the communities to construct and maintain the canals, and appropriate tools and materials based on estimates provided by the Evaluation Hydrological Engineer.

There were mixed opinions about the necessity to replace or maintain the compacted peat dams under the BGPP grant. Although the compacted peat dams were not expected to require any maintenance (hence no maintenance costs were modelled in the ex-ante analysis), consultations with key informants highlighted that these dams should nevertheless be monitored monthly for soil subsidence, dam leakages, and potential vandalism. Therefore, a monthly monitoring and minimal maintenance cost was added to the model.

The Evaluation Hydrological Engineer and CBA analysts derived the following figures for the maintenance and replacement of the canal blocks, with the following assumptions:

Table 24: Estimated Costs of Canal Block Replacement and Maintenance in Evaluation-Based Model

Feature	Compacted Peat Dam	Wooden Box Dam (Rimba Corridor and PSDABM)
Replacement Cost	$0	$942
Frequency	Never	Every 5 years
Maintenance Cost	$135	$240
Frequency	Every year	Every year, excluding canal block replacement years
Assumptions	Replacement costs are not expected. Maintenance costs primarily reflect monthly monitoring and minor maintenance activities. One day per month of labor per dam at a daily wage of 150,000 IDR (wage based on insights from key informants) was assumed.	These expenses are estimated for a 3m wide canal. Replacement costs include materials and labor. Maintenance costs assume monthly monitoring, light materials (wood) once a year, and four times per year some additional labor for small fixes and leaks.

In all grants, stakeholders were not able to definitively say who was responsible for maintaining these canal blocks. Rimba Corridor and BGPP had contracts in place to conduct initial maintenance but those have since expired and as of April 2019; there were no clear plans in place to conduct this maintenance. These costs have been modeled into the CBA as if they are being maintained, but this could be a fairly optimistic outlook. This has been explored in more depth in the sensitivity analysis.

Methodology adjustment - Integrated Approach to CBA: Lastly, the evaluation team used the integrated approach to CBA for the evaluation-based CBA, reporting the net impact on each beneficiary and stakeholder along with the economic rate of return (ERR) and the economic net present value (ENPV). Mathematically this does not affect the calculation of the overall ERR, but it does allow for MCC to assess the financial viability, or the capability for these beneficiary smallholder producers to finance and profit from the MCC interventions. Similarly, the financial

obligations or incentives for other stakeholders to participate in maintaining the activities from rewetting peatland is vitally important for ensuring the sustainability of this intervention.

Additional grant-specific changes to the ex-ante CBAs are presented below.

BGPP: CHANGES DURING IMPLEMENTATION

A number of changes occurred during implementation that resulted in discrepancies between the ex-ante and evaluation-based CBAs. These are addressed in different ways, as described below:

- **Palm Oil Certification:** It was assumed that following the International Sustainability and Carbon Certification (ISCC) training, palm smallholders would receive a certification price premium. However, upon speaking to the certified cooperatives and the certified mill, it was revealed that too few farmers were trained under the MCA-I grant to supply enough palm fruit for a certified CPO shipment. Therefore, at the time of evaluation, no premium had been yet attained. Currently, further trainings are being conducted under L'Oréal funding. Therefore, once enough farmers are trained, it is possible that this premium will be passed down to the farmers. However, it is unclear (1) when this will occur, and (2) what proportion of the premium they will receive. In the evaluation-based CBA, therefore, this was treated as a stranded asset and excluded from the benefits stream. While in theory, projections could be made regarding when a critical mass will be attained and attribute the appropriate proportion of the premium to just those farmers trained under the MCA-I grant, data limitations make this prediction tenuous.
- **Extraction Rates:** Related to this, the ex-ante CBA assumed that palm oil extraction rates would increase due to higher quality palm fruits as a result of training. The owner of the certified palm mill, however, did not report improvements in oil extraction and so this is excluded from the evaluation-based CBA. This does not necessarily reflect a limitation in implementation but deviation between theory about the effect of best management practices and what is realized.
- **Revegetation Benefits on Protected Land:** In the ex-ante model, it was assumed that the local communities would benefit from the jelutong revegetation through increased incomes. However, given that the planning was on protected land, and no-benefit sharing agreement is currently in place, it is illegal for communities to harvest these crops. Therefore, in the evaluation-based CBA, the revenue from jelutong is omitted (but explored in a sensitivity analysis).
- **Cost-Savings from Biodigester**: In the ex-ante model, the biodigester was expected to reduce cooking fuel costs to zero by enabling households to substitute fuel sources from wood to POME (combined with some cattle manure). The POME was to be provided by the palm mills to the communities. However, once the mills were educated on the value of POME for bio-energy, they elected to retain the POME for the mill's use. As a result, the communities had to switch to using cattle manure exclusively. While the manure was available in communities, labor is nevertheless required to transport it to the biodigester, therefore not entirely offsetting the cost of wood. Unfortunately, little is known about the implication on household cost-savings (for fuel) and time-savings (for wood collection), making estimating this benefit tenuous. For this reason, and the deviation in implementation, this benefit was removed. However, a scenario with this benefit is reported below as a robustness check.

BGPP: JUSTIFICATION FOR CHANGES TO PARAMETER VALUES

Summary of adjusted parameters used in ex-ante CBA and evaluation-based CBA are presented in Table 25. This does not include parameters that were discussed above as part of the changes to methodology.

Table 25. Summary of Adjusted Parameters Used in Ex-Ante CBA (BGPP)

Inputs		Ex-ante Value	Ex-post Value	Source of Verification for deviation	Explanation for Deviation
HA^{rubber}	Total rubber cultivation area (ha)	114	423	EMM Final Report: Berbak Prosperity Partnership (2018)	Grant achieved more than expected
Q^{rubber}	Incremental yield - rubber (%)	20%	20%		Rubber experts with SNV did not have any data yet on these increases but 20% was believed to be realistic so there is no change
P^{rubber}	Price of rubber per kilogram (IDR/kg)	6,000	5,000	Cluster II LLA Report. January 2017	Used farmgate price quoted directly by the grant studies
HA^{palm}	Total palm cultivation area (ha)	10,400	13,238	EMM Final Report: Berbak Prosperity Partnership (2018)	Grant achieved more than originally projected
$\Delta Q_t^{palm,cert}$	Change in output for ISCC certified farmers (palm) (%)	12.5%	20.0%	KIIs with Kud Makarti (May 2, 2019)	The cooperative reported higher yields. Given the cooperatives oversight and organization this increase seemed credible
C^{rubber}	Incremental costs for farm maintenance per hectare (rubber) (USD/ha)	0	58	KII with Ilahang (Rubber Expert), SNV	It is unclear why maintenance costs were excluded from the ex-ante model. Ilahang, a rubber expert with SNV developed materials on best management practices (BMP) in rubber and reported that BMP requires additional/more expensive inputs
$C^{palm,cert}$	Annual incremental costs for farm maintenance of certified farms per hectare (palm) (USD/ha)	0	-$58.00	KIIs with Kud Makarti (May 2, 2019)	The certified cooperative noted that the efficiency introduced by better fertilizer use reduced the amount of fertilizer farmers were using annually by 50%. It was expected by some that the farmers may substitute more expensive inputs (such as organic fertilizer), but the

Inputs		Ex-ante Value	Ex-post Value	Source of Verification for deviation	Explanation for Deviation
					cooperative said this did not occur uniformly, instead, the trainings resulted in more efficient fertilizer use
$C^{jelutong}$	Jelutong maintenance costs per hectare (USD/ha)	143	143	Could not verify independently so relied on ex-ante value	Assumed this figure would be less than revegetation areas that will be harvested due to lower production costs
O	Overhead cost as a percentage of investment cost (%)	20%	28%	Social Impact. Evaluation Report: Green Prosperity Grant Facility. 2018[39]	Ex-ante value was an estimate, value has been updated with actual figures for the GP grant funds, based on an average across the portfolio
I	Total investment cost (USD)	13.5 mil[40]	11.4 mil	EMM Final Report: Berbak Prosperity Partnership (2018)	Ex-ante value was an estimate, value has been updated with actual figures
L^{inv}	Length of investment (Years)	2	3	EMM Quarterly Financial reports	Ex-ante value was an estimate, value has been updated with actual implementation timelines
L^{op}	Length of operation (Years)	20	17		20-year time period of analysis, assumes that benefits begin accruing in the same year as the last year of investment

RIMBA CORRIDOR: CHANGES DURING IMPLEMENTATION

Several changes relevant to the CBA occurred between when the ex-ante CBA analyses were crafted, and the evaluation (detailed below):

- **Cacao:** No cacao farmers were trained and therefore, this benefit was removed from the evaluation-based CBA.
- **Palm Oil and Coffee Producers:** The ex-ante models seem to suggest that palm oil and coffee producers targeted by the intervention would be new farmers. As highlighted above, the ex-ante models include a counterfactual estimation that looks like it is the opportunity cost of laborers on the farm, and the "with project" scenario includes a full farm budget with trees that mature five years after planting. However, WWF worked only with farmers

[39] Social Impact (2018). "Evaluation Report: For Evaluation Services in Support of the Indonesia Green Prosperity Grant Facility."

[40] Total cost was reported in IDR. Total cost in USD was calculated based on the exchange rate EMM used in their model (13,368 IRD = 1 USD).

who were already palm and coffee producers. In the evaluation-based CBA, the incremental revenues and incremental costs are calculated for palm and coffee farmers who have increased their yields as a result of the MCA-I program. These benefits begin right after training is complete, in Year 3. *Note: This adjustment also corrects for a number of miscalculations in the ex-ante analysis such as the assumption that farmers are worse off for the first 5 years after the grant (without any income compared to the counterfactual) as well as what appears to be a fairly sizeable over-calculation of the incremental revenue earned "with project": Specifically, the ex-ante analysis assumed incremental incomes would increase by 60 percent for coffee, and 427 percent for palm oil. FGDs and KIIs suggest incremental incomes increased by only about 20-30 percent.*

- **Rubber Producers:** The ex-ante analysis modeled the "with project" benefits starting in Year 5 after the investment, and assumed that farmers were worse off for those first 5 years with zero income, compared to the counterfactual farmers who had a consistent income over this period. The evaluation-based CBA included no increase or decreased income during the investment period for rubber farmers, and an incremental yield improvement starting right after training, in Year 3. *Note: Additionally, the ex-ante analysis assumes that incremental revenues increase by 380 percent; this was considered to be quite high and was downward adjusted to 20 percent (see parameter values table below).*

RIMBA CORRIDOR: JUSTIFICATION FOR CHANGES TO PARAMETER VALUES

A summary of adjusted parameters used in ex-ante CBA and evaluation-based CBA is presented in Table 26, with an explanation for any deviations.

Table 26: Summary of Adjusted Parameters Used in Ex-Ante CBA (Rimba Corridor)

Inputs (Unit)		Ex-Ante Value	Ex-Post Value	Source of Verification for deviation	Explanation for Deviation
HA^{rubber}	Total rubber cultivation area (ha)	280	380	WWF Indonesia (2018), Final Report, less the number of farmers reportedly not adopting best practices	Grant achieved more than originally projected.
Q^{rubber}	Incremental yield - rubber (%)	380%	20%	Ex-ante assumptions from BGPP	Rubber experts with SNV and WWF did not have any data yet on these increases. Borrowed the ex-ante estimate from the BGPP model, as it is much more realistic than the ex-ante WWF estimate (confirmed with SNV).
P^{rubber}	Price of rubber per kg (IRD/kg)	6,500	5,000	Cluster II LLA Report, January 2017	Used farmgate price quoted directly by the grant studies.
HA^{coffee}	Total coffee cultivation area (ha)	50	191	WWF Indonesia (2018), Final Report	Grant achieved more than originally projected.

Inputs (Unit)		Ex-Ante Value	Ex-Post Value	Source of Verification for deviation	Explanation for Deviation
Q^{coffee}	Incremental yield - coffee (%)	n/a	30%	KIIs	See reasons above for why ex-ante coffee values were calculated differently. Although the calculations are different - effectively the incremental income difference for coffee was 60% greater "with project" in the ex-ante analysis, and the evaluation-based CBA estimates incremental incomes increase by 30% (due to the same increase in yields).
P^{coffee}	Price per kg - coffee (no premium) (IDR/kg)	2,000	2,000	Could not verify independently so relied on ex-ante value	
$P^{coffee\ premium}$	Price per kg premium - coffee (IDR/kg)	n/a	200	WWF Indonesia (2018), Final Report	See reasons above for why ex-ante coffee values were calculated differently.
HA^{palm}	Total palm cultivation area (ha)	420	429.9	Final report figures, and scaled to account only for the number of farmers who demonstrated improved practices	Grant achieved more than originally projected.
Q^{palm}	Incremental yield - palm (%)	n/a	22%		See reasons above for why ex-ante palm values were calculated differently. Although the calculations are different - effectively the incremental income difference for palm was 427% greater "with project" in the ex-ante analysis, and the evaluation-based CBA estimates incremental incomes increase by 22% (due to the same increase in yields).
P^{palm}	Price of palm per kg (IRD/kg)	n/a	1,000	Cluster II LLA Report, January 2017.	See reasons above for why ex-ante palm values were calculated differently.
$HA^{jelutong}$	Total jelutong	200	212	WWF Indonesia (2018), Final Report	WWF additionally supported 12 extra hectares on community lands.

Inputs (Unit)		Ex-Ante Value	Ex-Post Value	Source of Verification for deviation	Explanation for Deviation
	cultivation area (ha)				
$Q^{jelutong}$	Yield per hectare-mature trees (starting at tree age 10) (kg/ha)	2.8	1.4	World Agroforestry estimates[41]	There was a wide variety of estimated yields for jelutong. CBA team took a more conservative assumption given the fact that these trees are not being well maintained and unlikely to be highly productive.
$P^{jelutong}$	Price of jelutong per kg (IDR/kg)	3,000	12,004	Munden Project (2014)	Prices for latex varied significantly in the literature and were always much higher than the ex-ante value, which could not be verified anywhere in the literature. This value comes from a 2008 estimate (adjusted to 2016 dollars) for water-containing condensed latex, which was the most common commodity sold by jelutong farmers in this study. This figure was lower than estimates in the Macknick et al. (2014) paper.
C^{rubber}	Rubber maintenance cost - incremental per hectare (IRD/ha)	0	770,034	KII with Ilahang (Rubber Expert), SNV.	SNV estimated that incremental costs are associated with increased fertilizer, figure represents incremental fertilizer costs.
C^{palm}	Palm oil maintenance cost - incremental per hectare (IRD/ha)	0	0	KII with SNV	KII suggested palm oil increased yields had to do with better harvest techniques, which required no extra costs or labor.
C^{coffee}	Coffee maintenance costs - incremental	0	0	KII with WWF	KII suggested coffee increased yields had to do with better harvest

[41] World Agroforestry Center. "Understanding jelutong (Dyera polyphylla) value chains for the promotion in peatland restoration and sustainable peatland management in Indonesia." Brief No. 72. Site: https://www.worldagroforestry.org/region/sea/publications/download?dl=/PB00133-16.pdf&pubID=3853&li=6736

Inputs (Unit)		Ex-Ante Value	Ex-Post Value	Source of Verification for deviation	Explanation for Deviation
	per hectare (IRD/ha)				techniques, which required no extra costs or labor.
$C^{jelutong}$	Jelutong maintenance costs (after trees mature) per hectare (USD/ha)	181	181	Could not verify independently so relied on ex-ante value	
I_t^{total}	The total investment cost (USD)	10 mil	5.9 mil	WWF Indonesia (2018), Final Report	Shorter grant timeframe impacted the amount of activities (and costs) that were anticipated.
I_t^{MCA}	Total MCA-I investment cost (USD)	n/a	4.3 mil	WWF Indonesia (2018), Final Report	
$I_t^{grantee}$	Total grantee investment cost (USD)	n/a	1.6 mil	WWF Indonesia (2018), Final Report	
O	Overhead cost as a percentage of investment cost (%)	20%	28%	Social Impact. Evaluation Report: GP Grant Facility. 2018.	Ex-ante value was an estimate, value has been updated with actual figures based on an average across the portfolio.
L^{inv}	Length of investment (years)	2	3	Rimba Corridor Quarterly Financial Reports	Ex-ante value was an estimate, value has been updated with actual figures.
L^{op}	Length of operation (years)	20	18		20-year time period of analysis, assumes that benefits begin accruing in the same year as the last year of investment.

PSDABM: CHANGES DURING IMPLEMENTATION

In addition to the methodological changes incorporated in the evaluation-based PSDABM model (including the avoidance cost of reduced fire risk, canal maintenance and replacement costs, and the averted GHG emissions), the following changes were made to the ex-ante PSDABM model:

- **Horticulture:** Only rice interventions were modeled in the PSDABM ex-ante models. However, this grant worked significantly with horticulture farmers as well, the benefits of which are now modeled in the evaluation-based CBA.

- **Rice:** The ex-ante analysis mistakenly assumed there would be 1,000 rice farmers in the counterfactual and 737 rice farmers in the "with project" scenario, thereby underestimating the benefit of this intervention. In the evaluation-based CBA, this is corrected for.

PSDABM: JUSTIFICATION FOR CHANGES TO PARAMETER VALUES

A summary of adjusted parameters used in ex-ante CBA and evaluation-based CBA is presented in Table 27, with an explanation for any deviations.

Table 27: Summary of Adjusted Parameters Used in Ex-Ante CBA (PSDABM)

Inputs (Unit)		Ex-Ante Value	Ex-Post Value	Source of Verification for deviation	Explanation for Deviation
HH^{rice}	Total number of rice farmers (#)	737	536	Mitra Aksi (2017), Final Report	The total number of farmers trained were 536 in improved rice techniques. This was downwardly adjusted to assume 75% of farmers will adopt (same downward adjustment as in ex-ante analysis)
i^{rice}	Incremental income per year for rice farmers (USD/farmer)	254	226	Mitra Aksi (2017), Final Report, Incremental values could not be independently verified but KIIs did suggest significant increases	Presumably, ex-ante value was an estimate, and ex-post value has been updated with actual figures
$HH^{horticulture}$	Total number of horticulture farmers (#)	n/a	629	Mitra Aksi (2017), Final Report	The total number of farmers trained was 838 in improved horticulture techniques. This was downwardly adjusted to assume 75% of farmers will adopt (same downward adjustment as in ex-ante rice analysis)
$i^{horticulture}$	Incremental income for horticulture farmers per year (USD/farmer)	n/a	119	Mitra Aksi (2017), Final Report, Incremental values could not be independently verified but KIIs did suggest increases	
$HA^{jelutong}$	Total jelutong cultivation area (ha)	n/a	440	Mitra Aksi (2017), Final Report	
$Q^{jelutong}$	Yield per hectare - mature	n/a	1.4	First year of productive jelutong yields,	There was a wide variety of estimated yields for jelutong (ranging from 1 tonne per

Inputs (Unit)		Ex-Ante Value	Ex-Post Value	Source of Verification for deviation	Explanation for Deviation
	jelutong trees (starting at tree age 10) (kg/ha)			figure brought from the Rimba Corridor	ha to over 4 tonnes per ha). CBA team took a more conservative assumption given the fact that these trees are not being well maintained and unlikely to be highly productive
$P^{jelutong}$	Price of jelutong per kg (IDR/kg)	n/a	12,004	Munden Project (2014)	Prices for latex varied significantly in the literature and were always much higher than the ex-ante value, which could not be verified anywhere in the literature. This value comes from a 2008 estimate (adjusted to 2016 dollars) for water-containing condensed latex, which was the most common commodity sold by jelutong farmers in this study. This figure was lower than estimates in the Macknick et al (2014) paper.
$C^{jelutong}$	Jelutong maintenance costs per hectare (IRD/ha)	n/a	240,441	Relied on ex-ante value from the BGPP and Rimba Corridor models	Jelutong was not included in ex-ante analysis
I_t^{total}	The total investment cost (USD)	874,281	538,132	Mitra Aksi (2017), Final Report	Shorter grant timeframe impacted the amount of activities (and costs) that were anticipated
I_t^{MCA}	Total MCA-I investment cost (USD)	874,281	538,132	Mitra Aksi (2017), Final Report	Shorter grant timeframe impacted the amount of activities (and costs) that were anticipated
$I_t^{grantee}$	Total grantee investment cost (USD)	0	0	Mitra Aksi (2017), Final Report and Quarterly Reports	
O	Overhead cost as a percentage of investment cost (%)	10%	28%	Social Impact. Evaluation Report: GP Grant Facility. 2018.	Ex-ante value was an estimate, value has been updated with actual figures based on an average across the portfolio
L^{inv}	Length of investment (years)	1	2	Mitra Aksi Quarterly Reports	Ex-ante value was an estimate, value has been updated with actual figures

Inputs (Unit)		Ex-Ante Value	Ex-Post Value	Source of Verification for deviation	Explanation for Deviation
L^{op}	Length of operation (years)	19	18		20-year time period of analysis, assumes that benefits begin accruing in the same year as the last year of investment

COMPARING THE LOGIC OF CBAS

Tables 28 through 30 compare the costs and benefits included in ex-ante CBA and evaluation-based CBA for the three peatland grants. In the notation used for evaluation-based CBA: "B," "C," and "T" are used to identify benefits, costs, and transfers, respectively. In integrated CBA, "transfer" refers to an exchange of funds between two stakeholders within the economy, where the exchange does not directly reflect the use of a resource or the value of a benefit. These notations and numbering, such as B1 and C3, are later used in the methodology section to identify each cost, benefit, or transfer.

Table 28: Comparison of Benefits and Costs between Ex-Ante and Evaluation-Based CBA (BGPP)

Impacts	Ex-ante CBA	Evaluation-based CBA
Benefits	• Increased revenue from existing farm activities due to best management practices promoted by the grant • Increased revenue from new wet-tolerant forest commodities as part of the peatland revegetation planting • Reduction in the risk of fire once the peatland is rewetted • Cost-savings through biogas digesters	• B1 Increased revenue (BMP) • B2 Reduction in fire risk • B3 Reduction in emissions of GHG
Costs	• Investment cost • MCA-I Overhead	• C1 Incremental costs for farm maintenance • C2 Costs for Canal Block Maintenance and Replacement • C3 Investment cost • C4 MCA-I overhead
Transfers		• T1 Grant (MCA → Grantee)

Table 29: Comparison of Benefits and Costs between Ex-Ante and Evaluation-Based CBA (Rimba Corridor)

Impacts	Ex-ante CBA	Evaluation-based CBA
Benefits	• Increased revenue from existing farm activities due to best management practices promoted by the grant (estimates from "with project" and counterfactual scenarios) • Increased revenue from new jelutong trees (estimates from "with project" and counterfactual scenarios) • Reduction in the risk of fire once the peatland is rewetted	• B1 Incremental revenue (for new and existing farm activities) • B2 Reduction in fire risk • B3 Reduction in emissions of GHG
Costs	• Costs for farm maintenance (with project and counterfactual) • Investment cost • MCA-I Overhead	• C1 Incremental costs for farm maintenance • C2 Costs for Canal Block Maintenance and Replacement • C3 Investment cost • C4 MCA-I overhead
Transfers		• T1 Grant (MCA → Grantee) • T2 Government maintenance of revegetation and canal block (GoI → Community)

Note on T2: As mentioned throughout the evaluation, it was very unclear who will pay for the maintenance of the 200 ha of revegetation on protected land as well as the 80 canals built under the Rimba Corridor activity.[42] The KIIs and FGDs in these communities made it clear that they expect the government to allocate a budget for this, at which point they would be willing and technically capable to do the work based on the training provided by WWF Indonesia. Although this arrangement has not yet happened in this way, we have treated maintenance of the revegetation and canal blocks as a transfer from the government to the communities.

[42] WWF Indonesia supported the revegetation of 212 hectare; 12 of those hectares were on community land and would not be maintained by the government.

Table 30: Comparison of Benefits and Costs between Ex-Ante and Evaluation-Based CBA (PSDBAM)

Impacts	Ex-ante CBA	Evaluation-based CBA
Benefits	• Increased revenue from existing farm activities due to best management practices promoted by the grant	• B1 Increased revenue (for new and existing farm activities) • B2 Reduction in fire risk • B3 Reduction in emissions of GHG
Costs	• Incremental costs for farm maintenance • Investment cost • MCA-I Overhead	• C1 Incremental costs for farm maintenance • C2 Costs for Canal Block Maintenance and Replacement • C3 Investment cost • C4 MCA-I overhead
Transfers		• T1 Grant (MCA → Grantee) • T2 Government maintenance canal block (GoI → Community)

Note on T2: The revegetated land was all built on community soil, so there is no expectation that the government would maintain this. In fact, Mitra Aksi's intervention was to train farmers to engage in intercropping in order to help make this investment viable. However, FGDs did make it clear that they have been trained in the maintenance and construction of the canal blocks, and are waiting for government support in order to perform this function. Although this arrangement has not yet happened in this way, maintenance of the canal blocks is treated as a transfer from the government to the communities (but not revegetation).

EVALUATION-BASED CBA APPROACH & RESULTS

BENEFITS AND COSTS

The integrated approach to cost-benefit analysis is used for the evaluation-based CBA. Tables 31 through 33 summarize the benefits, costs, and transfers by stakeholders for each grant. The addition of "transfers" enables the team to report the net impact of the grant by stakeholders.

Table 31: Costs, Benefits and Transfers in Evaluation-based CBA (BGPP)

Impacts	Grantee	Communities	GoI	MCC	Public
B1 Increased revenue		✓			
B2 Reduction in fire risk					✓
B3 Reduction in emissions of GHG (at the country and global levels)					✓
C1 Incremental costs for farm maintenance		✓	✓*		
C2 Costs for canal block maintenance and replacement			✓		
C3 Investment cost	✓				
C4 MCA-I overhead				✓	
T1 Grant (MCA → Grantee)	✓+			✓-	

*The government is responsible for maintaining the revegetated plantations (jelutong) in the protected area. All other farm maintenance costs are the responsibility of the communities.

Table 32: Costs, Benefits and Transfers in Evaluation-based CBA (Rimba Corridor)

Impacts	Grantee	Communities	GoI	MCC	Public
B1 Increased revenue		✓			
B2 Reduction in fire risk					✓
B3 Reduction in emissions of GHG (at the country and global levels)					✓
C1 Incremental costs for farm maintenance		✓			
C2 Costs for canal block maintenance and replacement		✓			
C3 Investment cost	✓				
C4 MCA-I overhead				✓	
T1 Grant (MCA → Grantee)	✓+			✓-	
T2 Government maintenance of revegetation and canal block (GoI → Community)		✓+	✓-		

Table 33: Costs, Benefits and Transfers in Evaluation-based CBA (PSDABM)

Impacts	Grantee	Communities	GoI	MCC	Public
B1 Increased revenue		✓			
B2 Reduction in fire risk					✓
B3 Reduction in emissions of GHG (at the country and global levels)					✓
C1 Incremental costs for farm maintenance		✓			
C2 Costs for canal block maintenance and replacement		✓			
C3 Investment cost	✓				
C4 MCA-I overhead				✓	
T1 Grant (MCA → Grantee)	✓+			✓-	
T2 Government maintenance of canal block (GoI → Community)		✓+	✓-		

EXCLUDED BENEFIT STREAMS

A number of important benefit streams were not included in the evaluation-based CBAs but are undoubtedly benefits attributable to the grants in the peatland portfolio, as follows:

Averted Flooding Damage: One of the devastating effects of peatland drainage is the oxidation of peat resulting in land subsidence and subsequent flooding as land is no longer drainable. When this occurs, land will be too flooded for any subsequent economic use. Due to vast rainfall and low value of some crops, pumping will not likely be an economically feasible option[43] if this occurs.

At this time, the impact of flooding has not been reflected in the evaluation-based CBA. First, we received mixed opinions from key informants and focus group participants regarding the grant's impact on flooding. Second, given the multitude of activities occurring in the intervention areas, attributing averted flooding to just the MCA-I grants is challenging, especially given the uncertainties regarding future maintenance of activities. This said, it should be acknowledged averted flooding (i.e., land loss) is likely a benefit stream of this grant, but the level of attribution is unclear.

Revegetated Plants: A variety of economically valuable crops were planted in all grants as part of the revegetation efforts, not only jelutong trees (including gelam, bamboo, pulai, etc.). These were not reflected in the ex-ante CBA and due to the absence of data will not be reflected in the evaluation-based CBA. All plants are treated as if they are jelutong trees in the evaluation-based CBA as well.

[43] Euroconsult Mott MacDonald (2018). Tropical Peatland Restoration Report: the Indonesian Case. Retrieved from: https://luk.staff.ugm.ac.id/rawa/GiesenNirmala2018TropicalPeatlandRestorationReportIndonesiaForBRG.pdf

A NOTE ON DOUBLE COUNTING

We have been careful to avoid double counting in these evaluation-based CBAs, especially looking at the benefits of revegetation, fire risk reduction, and GHG emissions reduction which all originate with the land that has been rewetted and revegetated. Revegetation benefits directly lead to financial gains to communities from harvesting the forest products once they begin to harvest. Fire risk reduction benefits did not include averted GHG emissions and only included the value of averted losses to timber, tourism, agriculture, and fire-fighting costs. The averted fire benefits were reduced for the Rimba Corridor and the PSDABM grants to prevent double counting the benefits from timber and agriculture, which are directly accounted for as benefits from the jelutong production. However, because the BGPP grant does not include the benefits from the jelutong production to the community, the value of the averted fire risk is much higher to incorporate the averted loss of timber and agriculture, so there is no risk of double counting. The GHG emissions estimates exclude emissions from wildfires and value directly the carbon stock in the trees and peat, as well as the carbon captured from the air as a result of the trees.[44] Therefore, there is no double counting of the GHG emissions with the reforestation benefits streams nor the averted fire risk benefit stream.

INVESTMENT CRITERIA (ERR AND ENPV)

Table 34 summarizes the investment criteria for the three grants studied in this evaluation-based CBA. The table shows the ex-ante CBA criteria, along with evaluation-based criteria under two scenarios: (1) without the SCC, and (2) with the CSCC. The criteria reported are ERR and ENPV.

Table 34: Summary of ERRs and ENVPs for All Grants

Grant	Ex-ante CBA ERR (ENPV in USD @ 10%)[45]	Evaluation-based CBA ERR (ENPV in 2016 USD @ 10% discount rate)	
		Without SCC	With CSCC (Country)
BGPP	23.83% $18.29 million	8.63% -$1.09 million	12.76% $2.33 million
Rimba Corridor	20.74% $12.44 million	1.51% -$3.95 million	7.26% -$1.34 million
PSDABM	19.96% $0.81 million	24.20% $2.09 million	27.25% $2.40 million

The BGPP grant was found only economically viable if reductions in GHG emissions valued at the CSCC are included in the benefit streams. Although there were a number of deviations from the ex-ante model, this can largely be explained by the main source of benefit (ignoring SCC) remaining relatively similar: increased incomes of rubber and palm oil producers through adoption of best management practices, and the underlying assumptions that (1) such practices will be sustained over time and (2) crops will maintain an increased yield. The CBA is sensitive to deviations from these assumptions.

[44] Howard, Peter. (2014). Flammable Planet: Wildfires and the Social Cost of Carbon. Retrieved from: https://costofcarbon.org/files/Flammable_Planet__Wildfires_and_Social_Cost_of_Carbon.pdf

[45] Year of analysis is unclear.

Rimba Corridor is no longer a viable grant, and likely never was considering the miscalculation of the fire risk reduction in the ex-ante analysis. Even after including the GHG emission reductions as the primary objective of this grant, it is still not viable using conservative estimates of the country cost of carbon.

The PSDABM is viable under both scenarios. The improvements in feasibility are largely attributable to the inclusion of fire risk reduction and revegetation benefits, omitted from the ex-ante CBA.

The results above should be treated as an upper bound for the results, given the significant uncertainties in the future about the sustainability of these investments. Specifically, in the interviews with government stakeholders and local communities, it was unclear who is responsible for maintaining the canal blocks (which is particularly relevant for the box dams built under the Rimba Corridor and PSDABM grants) and who will be maintaining the re-vegetated areas (see discussion in the main evaluation report under the heading 6.4 Sustainability). The results above represent the strong assumption that the canal blocks will be replaced at regular intervals and regularly maintained and the new seedlings in the peat areas will mature on schedule, partially due to regular weeding and maintenance of the revegetated areas. The sensitivity analysis below examines the impact on the investment criteria results presented in this section, when these assumptions are relaxed.

GLOBAL COST OF CARBON EMISSIONS

A third scenario was examined for the ERR results: valuing the GHG emission reductions at the global value for the social cost of carbon. Estimating a social cost of carbon at a global scale captures the global nature of impacts from GHG emissions, which are not limited to the Indonesian borders. Therefore, the global social cost of carbon might be seen as an optimum value in the sense that if all emissions were priced at the global SCC, the policy would yield an economically optimum amount of mitigation.[46] As the Climate Advisors advocate, "using the global social cost of carbon recognizes the global nature of climate change and demonstrates the globally shared benefits of unilateral action." It is important to note that the standards for MCC's economic analysis do not examine global costs and benefits of their projects/grants and limit all costs and benefits to those that occur within the border of the country where their projects/grants are operating.

Therefore, this section presents the results of the three grants evaluated in this report, while looking at different values for the cost of carbon. Specifically, the table below shows the ex-ante CBA criteria, along with evaluation-based criteria under three scenarios: (1) without the SCC, (2) with the social cost of carbon estimated at the Indonesia-level (CSCC), and (3) with the global value for the social cost of carbon (GSCC). The criteria reported are ERR and ENPV. To calculate the global value of the reduced GHG footprint attributable to the GPF peatland grants, the estimated reduced GHG emissions are valued at $90 per tonne, which is the average of expert opinions for the value of the social cost of carbon in a recent study. [47]

Clearly, using the GSCC indicates a significant amount of benefits at the global level, much more than at the country level.

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[46] Wolosin, Michael (2014). Measuring Green Prosperity in Indonesia Technical and Policy Considerations for Including Avoided Climate Impacts in the Millennium Challenge Corporation's Cost-Benefit Analyses. Climate Advisors. Discussion Draft, January 27, 2014.

[47] Pindyck, Robert S. "The social cost of carbon revisited." Journal of Environmental Economics and Management 94 (2019): 140-160.

Table 35: Examining the GSCC and the impact on the ERRs and ENVPs for all grants

Grant	Evaluation-based CBA ERR (ENPV in 2016 USD @ 10% discount rate)		
	Without SCC	With CSCC (Country)	With GSCC (Global)
BGPP	8.63% -$1.09 million	12.76% $2.33 million	122.38% $130.39 million
Rimba Corridor	1.51% -$3.95 million	7.26% -$1.34 million	147.55% $96.46 million
PSDABM	24.20% $2.09 million	27.25% $2.40 million	168.43% $14.28 million

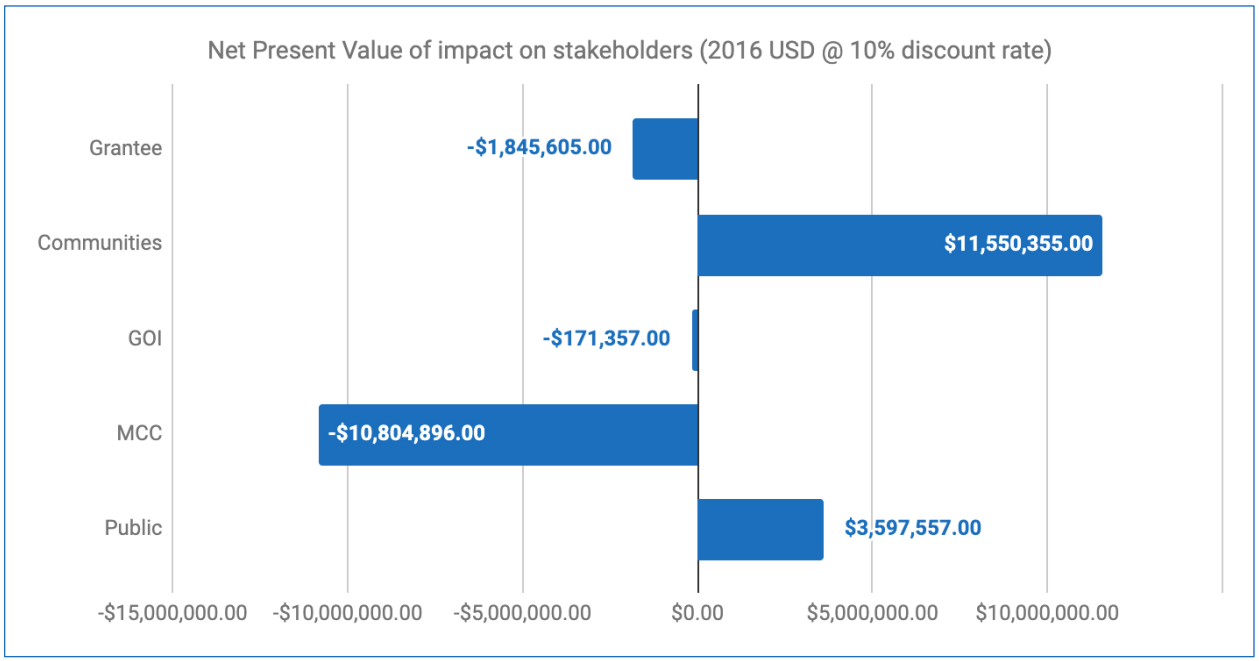
The results from the GSCC values cannot be compared to ERRs associated with other MCC projects, due to the deviation from MCC standard methodology for economic analysis.

STAKEHOLDERS ANALYSIS

The integrated approach to CBA enabled the team to conduct a stakeholder impact assessment. The figures below indicate the present value of the net benefits to each stakeholder (in 2016 USD). These figures illustrate the stakeholder analysis with the inclusion of the estimated country level benefits to reduced GHG emissions, which is a benefit that accrues to the "public" stakeholder, which represents the perspective of the Indonesia society. Even without the benefits from GHG emissions, the public benefits under all peatland grants although to a much lesser extent. As can be seen in the figures below, the public (economy) and the communities are the stakeholders that have a net positive gain in all activities under the GP Peatland portfolio. The communities, especially, gain the most.

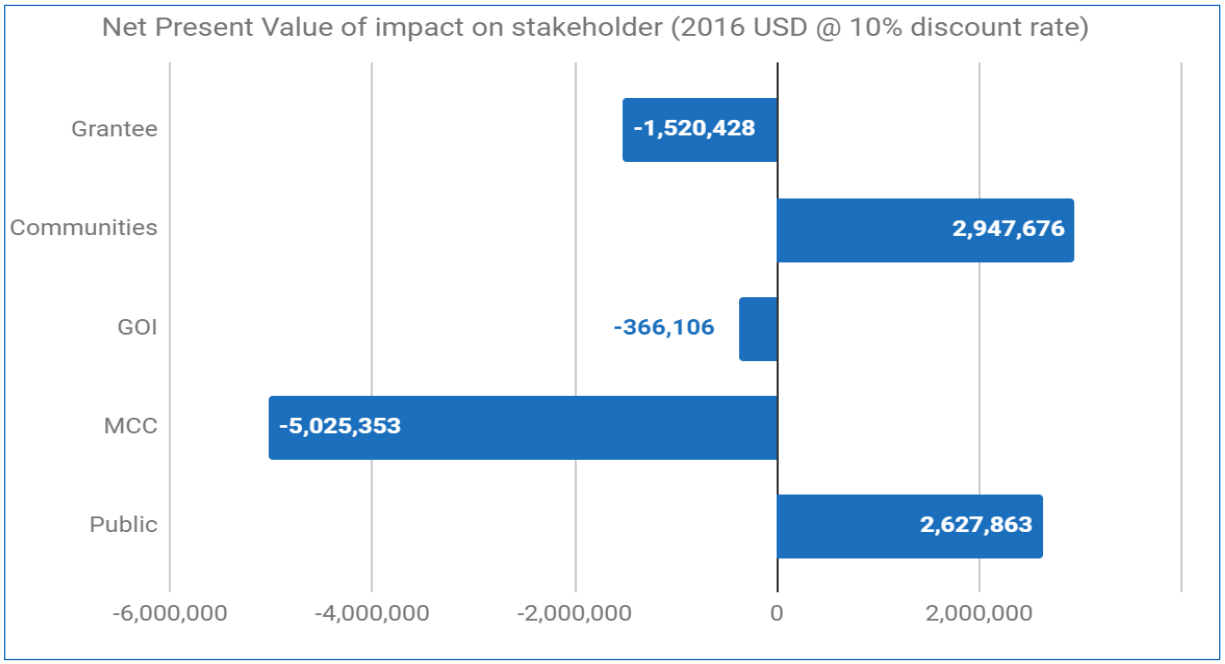
The grantees, GoI, and MCC all have net losses. This is not surprising, as these entities are responsible for funding various aspects of the investment costs (MCC and the grantees) and the ongoing maintenance costs (GoI). Figure 8, Figure 9, and Figure 10 summarize the impact on each stakeholder.

Figure 8: Stakeholders Impact Assessment for BGPP (2016 USD), with CSCC



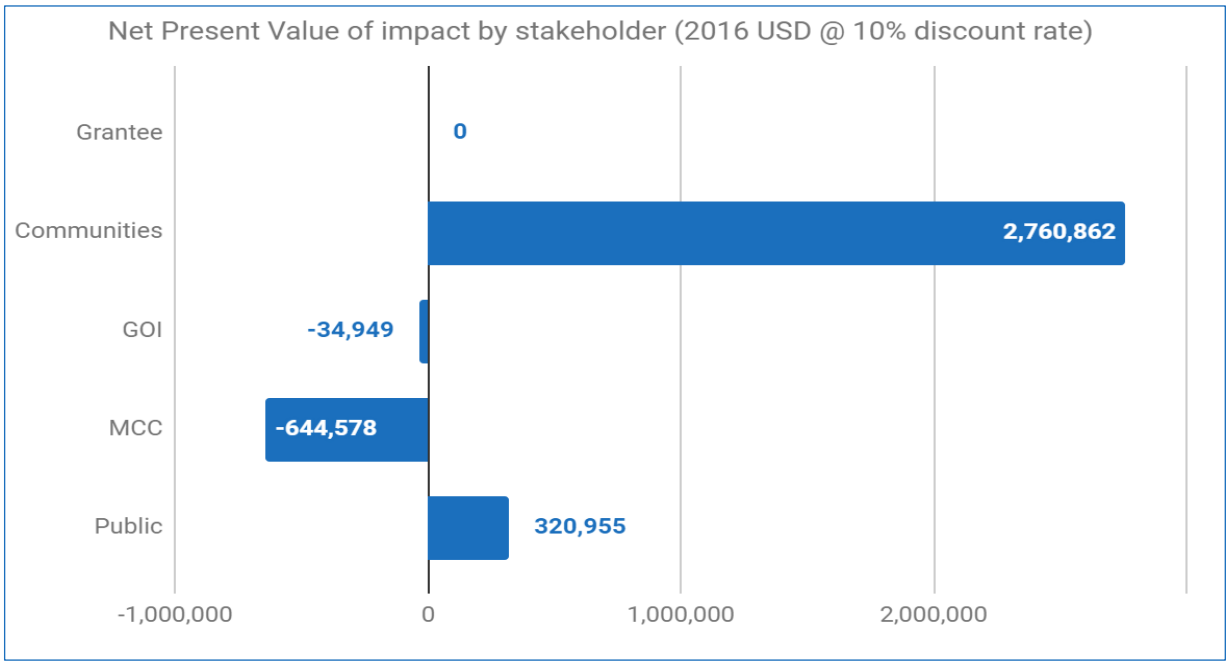
Note: without GHG emissions included as a benefit, the Public's benefit has a net present value of $178,940 USD (2016).

Figure 9: Stakeholders Impact Assessment for Rimba Corridor (2016 USD), with CSCC



Note: without GHG emissions included as a benefit, the Public's benefit has a net present value of 17,357 USD (2016).

Figure 10: Stakeholders Impact Assessment for PSDABM (2016 USD), with CSCC



Note: without GHG emissions included as a benefit, the Public's benefit has a net present value of 3,862 USD (2016).

EVALUATION-BASED CBA METHODOLOGY & SPECIFICATIONS

This report illustrates the approach for the calculation of each benefit, cost, and transfer using Tables 36 through 46 below. Each table includes a narrative, which explains the key assumptions, along with applicable timeframe, inputs required, and the formulas for calculation.

Table 36: Increased Revenue: Existing Farm Activities (Evaluation-based CBA)

Narrative		
Increased revenues were calculated as an incremental difference between the "with project" and the counterfactual scenario. Sufficient data did not exist to analyze the impact of varying yields and prices over time, so once revenues increase, they remain constant for the rest of the operational period in all models. Incremental revenues are attributed to increased yields. In addition, in the Rimba Corridor grant, coffee farmers also reported higher price premiums for higher quality fruit. In the BGPP grant, higher premiums are expected for the certified palm oil producers (in Year 8). This specification is applied to the following smallholder activities in the following models: • Rubber (BGPP, Rimba Corridor) • Coffee (Rimba Corridor) • Palm Oil (BGPP, Rimba Corridor)		
Timeframe		
Operational phase (Year 3 and onwards in the model)		
Inputs	Definition	Units
HA^{crop}	Total area for crop	ha
Q^{crop}	Incremental yield per hectare for crop	tonnes/ha
$Q^{coffee,w}$	Total with project yield per hectare - coffee	tonnes/ha
$Q^{coffee,w/o}$	Total without project yield per hectare - coffee	tonnes/ha
P^{crop}	Price of crop per tonne	USD/tonne
$P^{coffee,w}$	Price of coffee per tonne with project	USD/tonne
$P^{coffee,w/o}$	Price of coffee per tonne without project	USD/tonne
Calculation		
Benefit (all crops except those below)	$B1_t^{crop} = Q^{crop} \times HA^{crop} \times P^{crop}$	
Benefit (coffee and BGPP palm oil)	$B1_t^{coffee} = [(Q^{coffee,w} - Q^{coffee,w/o}) \times HA^{crop} \times P^{coffee,w}] + [Q^{coffee,w/o} \times HA^{crop} \times (P^{coffee,w} - P^{coffee,w/o})]$ * "Coffee" can also denote palm oil in the BGPP grant	

Table 37: Increased Revenue: Existing Farm Activities (Evaluation-based CBA): Rice and Horticulture

Narrative		
In the PSDABM model, the rice and horticulture interventions were modeled differently than the other existing farm activities due to data availability. The only data available were incremental net incomes - already taking into account costs and revenues. Therefore, the calculation includes the amount of incremental net incomes that were earned per farmer - multiplied by the estimated number of farmers who have adopted the practices promoted by the PSDABM. There are no associated estimated incremental farm production costs (C2) since these incremental costs are already included in this figure.		
Timeframe		
Operational phase (Year 3 and onwards in the model)		
Inputs	Definition	Units
HH^{crop}	Total number of horticulture farmers	#
i^{crop}	Incremental income per year	USD/year
Calculation		
Benefit	$B1_t^{crop} = HH^{crop} \times i^{crop}$	

Table 38: Increased Revenue: Jelutong (Evaluation-based CBA)

Narrative		
This was also calculated as an incremental increase in the Rimba Corridor and PSDABM models, and uses the same assumption as the ex-ante analysis that this work does not displace any other revenue generating activities (a strong assumption but unable to verify in the FGDs as Jelutong trees have not begun to harvest). Thus, this implicitly models the "with project" scenario as the same as the incremental analysis (and the counterfactual is zero revenue). In the final year, a residual value is calculated for the remaining value of the trees by calculating the present value (in Year 20) of the revenue from another 20 years of jelutong harvests (discounted at MCC's 10 percent rate). As in the ex-ante CBA, expected incremental incomes attributable to the jelutong plantations are due to productive harvests once the jelutong trees mature in Year 13 (10 years after the trees are planted). Year 13 and onwards assumes a constant yield. The price and number of hectares do not vary over time.		
Timeframe		
Yield years for jelutong (Starting in Year 13 and onwards in the model)		
Inputs	Definition	Units
$HA^{jelutong}$	Total jelutong cultivation area	ha
$Q^{jelutong}$	Incremental jelutong yield per hectare	tonnes/ha
$P^{jelutong}$	Price of jelutong per tonne	USD/tonne
Y_t	Productive years remaining of jelutong	years
$R_t{}^{jelutong}$	Residual value of jelutong in year t	
Calculation		
Benefit:	$B1_t^{jelutong} = Q^{jelutong} \times HA^{crop} \times P^{crop} + R_t{}^{jelutong}$ where $R_t{}^{jelutong}$ = -PV(10%,Y_t,$Q^{jelutong} \times HA^{crop} \times P^{crop}$)	

Table 39: Reduction in Fire Risk (Evaluation-based CBA)

Narrative		
The incremental benefit was calculated by using the mean annual fire damage estimates from the NREL study.[48] However, the scale that was used in the NREL study was changed to more closely match the area of land that was rewetted for each of the GP grants. In the NREL study, it was assumed that the 6,000 hectares that were rewetted as part of the BGPP grant will protect the 160,000 area in the Berbak National Park from protection, which seemed unreasonable. To be more conservative, the team used the same methodology to scale the benefits but scaled it instead to the number of hectares that have been rewetted under each grant. Note: for Rimba Corridor and PSDABM, the calculation below was additionally reduced by 92 percent to avoid double counting.		
Timeframe		
Operational phase (Year 3 and onwards in the model)		
Inputs	Definition	Units
$F^{w/o}$	Mean economic cost due to forest fire in Jambi without intervention	USD
F^{w}	Mean economic cost due to forest fire in Jambi with intervention (assuming the grant has a 20 percent reduction on the mean value of fire costs in any given year, per NREL's methodology)	USD
$HA^{97\ fire}$	Total number of hectares burnt in Jambi in 1997-1998 fires	ha
$HA^{rewetted}$	Rewetted area due to the canal blocks	ha
Calculation		
Benefit:	$B2_t = \frac{HA^{rewetted}}{HA^{97\ fire}} \times (F^{w/o} - F^{w})$	

[48] See Macknick J., et al. (2014).

Table 40: Reduction in GHG Emissions (Evaluation-based CBA)

Narrative		
For the peatland grants, the revegetation and rewetting leads to reduced carbon and other GHG emissions. The GHG emissions associated with these activities are, therefore, avoided and can be considered a benefit. The figures for the quantity of GHG emissions reductions come straight from the ICF report for each peatland grant. The only adjustments that were made were to decrease the amount of estimated GHG emissions when the number of mature trees that survived are lower than the number projected in the ICF report. Any reductions were done by linearly scaling down the amount of GHG emissions reduced. The correct value for the global social cost of carbon (SCC), as well as that for other GHGs, such as methane, is debated in the literature. In the majority of studies, it is calculated based on its cost to the entire globe as opposed to the population in any specific country. Our evaluation-based CBA recommends the inclusion of the social cost of GHG emissions for two reasons. First, new literature[49] has estimated the cost of carbon from the perspective of a single country, factoring for the trade-offs and vulnerabilities of each country when faced with climate change. Second, the GP Project, the facility that funded the grants evaluated under this study, reducing the volume of carbon emissions as one of its main pillars. The team, however, appreciates the sensitivities associated with the integration of debatable parameters in the calculation of investment criteria result (ERR, ENPV, etc.), and will report them with and without the recommended values for the social cost of carbon.		
Timeframe(s)		
Operational phase (Year 3 and onwards in the model)		
Inputs		
$CSCC$	The country social cost of carbon per tCO_2	USD/tCO_2
$GSCC$	The global social cost of carbon per tCO_2	USD/tCO_2
CE	Estimated reduced carbon emissions - from ICF report	tCO_2
Calculation		
Benefit:	$B3_t^{CSCC} = CSCC \times CE$ $B3_t^{GSCC} = GSCC \times CE$	

[49] Ricke, Katharine, et al. "Country-level social cost of carbon." Nature Climate Change 8.10 (2018): 895.

Table 41: Incremental Costs for Farm Maintenance (Evaluation-based CBA)

Narrative		
Increased costs for farm production were calculated as an incremental difference, rather than using a "with project" and counterfactual scenario. Sufficient data did not exist to analyze the full production costs of each crop over time, so once incremental costs increase, they remain constant for the rest of the operational period in all models. Incremental production costs are attributed to changed behavior to increase yields, which does not always lead to an increase in costs. This specification is applied to the cash flows in the following models: • Rubber (BGPP, Rimba Corridor) • Coffee (Rimba Corridor) • Palm Oil (BGPP, Rimba Corridor) • Jelutong (BGPP, Rimba Corridor, PSDABM) Note that in the BGPP grant, minimal maintenance is required to ensure the trees reach maturity. The expectation is that the government will perform weeding and other limited maintenance until the forest begins to reforest on its own, which is estimated to last until 10 years after the trees are planted. Incremental production costs are expected to continue for Rimba Corridor and PSDABM as these communities are expected to be harvesting the fruit in perpetuity		
Timeframe(s)		
Operational phase (Year 3 and onwards in the model) Except: Year 3 until Year 13 for the BGPP grant for jelutong)		
Inputs		
HA^{crop}	Total area for crop	ha
C^{crop}	Annual incremental cost for crop per hectare	USD/ha
Calculation		
Cost:	$C1 = C^{crop} \times HA^{crop}$	

Table 42: Cost for Canal Block Maintenance (Evaluation-based CBA)

Narrative		
The replacement costs occur every five years for wooden box dams (Rimba Corridor and PSDABM). Maintenance costs are not modeled in these years; instead in years when the canal blocks are not replaced, the maintenance costs are incurred. For BGPP, peat dams are not expected to require meaningful levels of maintenance over the operational period. However monthly monitoring is nevertheless required to ensure there are no issues and comprises nearly all of the maintenance cost of the peat dams.		
Timeframe(s)		
Operational phase (Year 3 and onwards in the model)		
Inputs		Units
B	Number of canal blocks	block
RC_t	Replacement cost per canal block in period t	USD/block
M_t	Annual maintenance cost per block non-replacement years	USD/block
Calculation		
Cost:	Rimba Corridor and PSDABM: $C2_t = B \times RC_t + B \times M_t$ BGPP: $C2_t = B \times M$	

Table 43: C3: Estimation of Investment Costs (Evaluation-based CBA)

Narrative		
The investment cost is an exogenous parameter, which is equally distributed over three years according to the financial records on hand. This is the total cost of the investment, which includes MCA-I's grant investments and the cash contributions made by the grantee.		
Timeframe(s)		
Investment period		
Inputs		
I_t^{MCA}	Annual MCA-I investment cost in period t	USD
$I_t^{grantee}$	Annual grantee investment cost (varies)	USD
Calculation		
Cost:	$C3_t = I_t^{total}$ where: $I_t^{total} = I_t^{MCA} + I_t^{grantee}$	

Table 44: C4: Estimation of MCA-I Overhead Costs (Evaluation-based CBA)

Narrative		
The MCA-I overhead cost is estimated as a fixed percentage of the total MCA-I investment cost in each year.		
Timeframe(s)		
Investment period		
Inputs		
I_t^{MCA}	Annual MCA-I investment cost in period t	USD
O	Overhead cost as a percentage of MCC's investment cost	%
Calculation		
Cost:	$C4_t = O \times I_t^{MCA}$	

Table 45: T1: MCA-I Grant to Grantee (MCA to Grantee) (Evaluation-based CBA)

Narrative		
The grantee in all peatland grants bears the costs of all grant expenditures. They are partially reimbursed by MCA-I via a grant, which is treated as a transfer in the stakeholder analysis. This is a negative cash flow from the perspective of MCA-I and a positive cash flow from the grantee's perspective.		
Timeframe(s)		
Investment period		
Inputs		
I_t^{MCA}	Annual MCA-I investment cost in period t	USD
Calculation		
Transfer:	$T1_t = I_t^{MCA}$	

Table 46: T2 Government Regulation and Canal Block Maintenance (GoI to Communities) (Evaluation-based CBA)

Narrative		
The costs for maintaining and replacing the canal blocks seems to be the responsibility of the government, and maintaining the revegetated areas is the responsibility of the government if it is on protected lands. **For the canal blocks**, both the Rimba Corridor and PSDABM grants training the communities to perform this maintenance and, in theory, this should involve a budgetary transfer from the government to the communities trained and responsible for the canal block repair and maintenance work. In these models, this is treated as a cost from the community's perspective (modeled as cost C2), which is reimbursed as a transfer from the GoI to the communities. Overall, this is reflected as a zero cost to the communities and a cost to the government. The replacement costs occur every five years for wooden box dams (Rimba Corridor and PSDABM). Maintenance costs are not modeled in these years; instead in years when the canal blocks are not replaced, the maintenance costs are incurred. **For the revegetated areas,** it is assumed that the GoI will maintain the revegetation on protected areas until the jelutong plants begin to harvest. At which point, the communities will take responsibility for the maintenance and this is no longer modeled as a transfer once that happens. This transfer is only valid in the Rimba Corridor, where 200 hectares of the revegetated land is on protected lands. For PSDABM, the revegetated areas are on community lands and their responsibility to maintain (modeled as Cost C1). For BGPP, this is a direct cost to the government (modeled as cost C1).		
Timeframe(s)		
Operational phase (Year 3 and onwards in the model)		
Inputs		Units
B	Number of canal blocks	block
RC_t	Replacement Cost - per canal block in period t	USD/block
M_t	Cost per block for annual maintenance -non-replacement years	USD/block
$HA^{protected}$	Number of hectares of revegetation - protected lands	Ha
$C^{jelutong}$	Annual costs for maintenance per hectare	USD/ha
Calculation		
Transfer	In Years 3-12: $T1_t = B \times RC_t + B \times M_t + HA^{protected} \times T$ In Years 13 onward: $T1_t = B \times RC_t + B \times M_t$	

SENSITIVITY AND SCENARIO ANALYSES

The sensitivity analysis was performed primarily using one-way tables on all three estimated ERRs (which are: not including the averted GHG emissions, including GHG emissions valued at the country cost of carbon, and including GHG emissions valued at the global cost of carbon). Insufficient data prevented more sophisticated analysis using Monte Carlo simulations.

No models were sensitive to assumptions around the cost of canal block maintenance and replacement or the costs for maintaining the revegetated plantations on degraded peatland. Additionally, no models were sensitive to assumptions around the residual value of jelutong trees at the end of the analysis period. Assumptions around the cost savings associated with reduced risk of fire are also not sensitive even when we assume actual cost savings are three times more than what is modeled in the CBAs. However, these figures are still nowhere near the estimates in the ex-ante models.

Sensitivity varied across the models and no one variable seemed to be particularly sensitive in all three models. The peatland grants are sensitive to the following variables:

BGPP: This model is most sensitive to deviations in palm and rubber yield and price, which is unsurprising given this is a main source of benefit. With palm, there was a lot of corroborating data regarding yields and prices and so deviations from this assumption are perhaps less likely in reality. With rubber however, changes in yield were based on forecasts by the rubber trainers as no formal evaluation on changes in farmers' yields was conducted. If biogas was included as a benefit (similar to the ex-ante, using the cost-savings from averted firewood use), the ERRs remained relatively unchanged meaning removal of this benefit did not dramatically underestimate the benefits to the communities.

Rimba Corridor: This model is sensitive to assumptions of averted GHG emissions and the country cost of carbon. As stated earlier, there are a number of uncertainties associated with this data, especially the estimated quantity of averted GHG emissions.[50] Additionally, this model is somewhat sensitive to the price of palm, fluctuations in price and productivity can have a major impact on livelihoods and the economic viability of this grant. Finally, if the jelutong (and other nontimber forest products) on the 200-ha plantation are well maintained and highly productive, this grant will be economically viable. Highly productive jelutong plantations yield as much as four tonnes per hectare, which would render this grant viable overall. This is unlikely however, given that the trees on this plantation are already showing signs of stunting at the time of the evaluation.[51]

PSDABM: This grant is viable under all reasonable variables that were examined. It is most sensitive to fluctuations in the GHG emissions and the country cost of carbon, as was the Rimba Corridor CBA.

Additionally, the CBA performed a scenario analysis to test the economic viability of all peatland grants under a realistic scenario that maintenance will not be performed on the revegetation and the canal blocks after three years (in the PSDABM CBA) or four years (in the Rimba Corridor and BGPP CBAs). The associated assumptions in all CBAs are costs are reduced to zero for canal block and revegetation maintenance and replacement. Similarly, benefits then reduce for jelutong revenue, and cost savings from averted GHG emissions and reduced fires. There is not enough data or evidence in the literature to estimate how these benefits ought to decrease with limited or no maintenance on these key investments. As a short-cut to examine the sensitivity to this scenario, the CBA scenario analysis assumed a linear reduction to all three benefits in the no-maintenance scenario (i.e., a 10 percent reduction in all three benefits, a 20 percent reduction in all three benefits, etc.). Unsurprisingly, ERRs in all models decrease in the no-maintenance scenario, with the following results in each grant (see next table).

[50] As acknowledged by the ICF report authors themselves, where the estimated amount of averted GHG emissions originates.

[51] The trees observed represent a very small percentage of the total trees in the plantation.

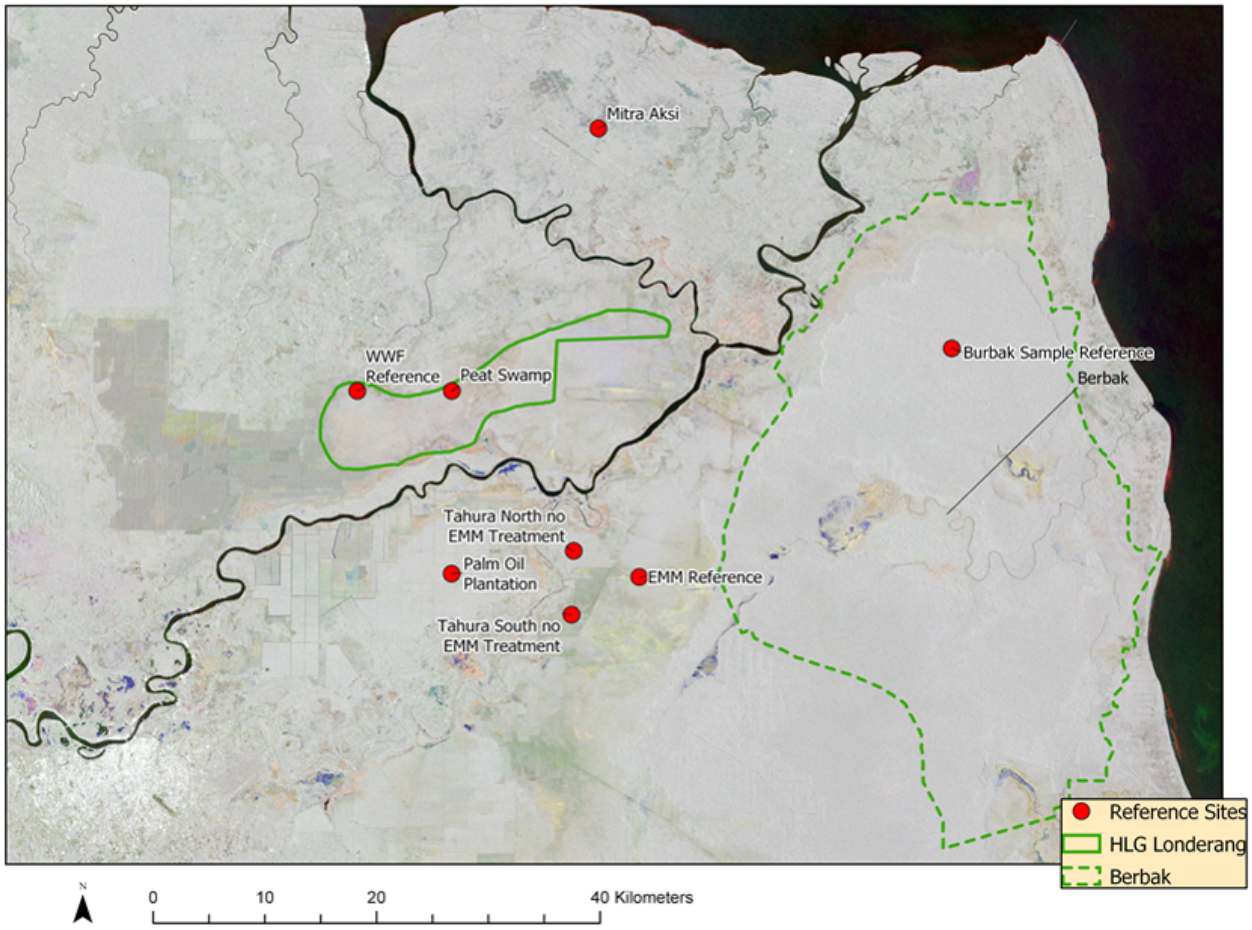
Table 47: Results of the "No Maintenance" Scenario

Grant	Baseline Model ERR (%) ENVP ($)	Sensitivity Analysis ERR (%) ENVP ($) (assumptions of % linear reductions in benefits from the baseline model)			
	CSCC	25%	50%	75%	100%
BGPP	12.76% $2.33 million	12.36% $1.94 million	11.82% $1.46 million	11.25% $0.98 million	10.65% $0.50 million
Rimba Corridor	7.67% -$1.14 million	6.17% -$1.75 million	4.49% -$2.29 million	2.33% -$2.83 million	0.85% -$3.37 million
PSDABM	27.7% $2.45 million	26.17% $1.95 million	24.63% $1.47 million	22.63 % $990,115	19.67% $510,665

- The BGPP grant remains viable even under the worst assumptions (100 percent reduction in all benefits after the initial years) in a no-maintenance scenario, suggesting the findings are robust. This is in part given that majority of the benefits, apart from the GHG emissions, are due to increased revenue through sustainable farming practices.
- The Rimba Corridor, while not economically viable in the baseline model using the country cost of carbon to value GHG emission reductions, has worse ERRs under the no-maintenance scenario. Under the worst assumptions for the consequences of no-maintenance (100 percent reduction in all benefits after the initial years), the ERR is just 0.61%. It is worthwhile to point out that the trees in the Rimba Corridor are already showing signs of stunting because the fields have not been weeded, which already suggests that the baseline model and the assumptions around the future gains from jelutong production and averted GHG emissions might be optimistic.
- The PSDABM grant remains viable even under the worst assumptions (100 percent reduction in all benefits after the initial years) in a no-maintenance scenario. This is likely because the grant focused more heavily on agroforestry and improved farm management practices, and expensive assets are relatively few in this grant. This limits the grant's overall vulnerability to a no-maintenance scenario.

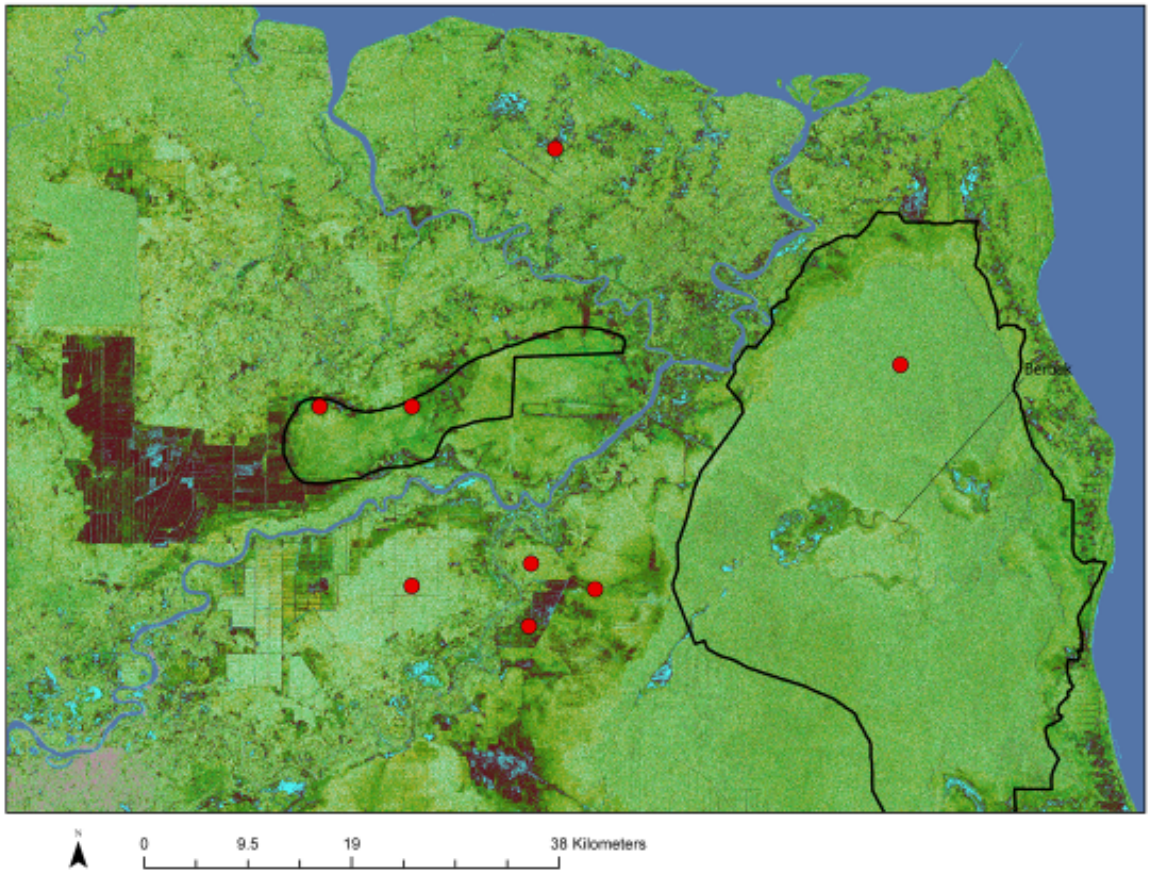
ANNEX III. GIS ANALYSIS

Figure 11: Site Locations Draped Over Sentinel 1 – SAR Background



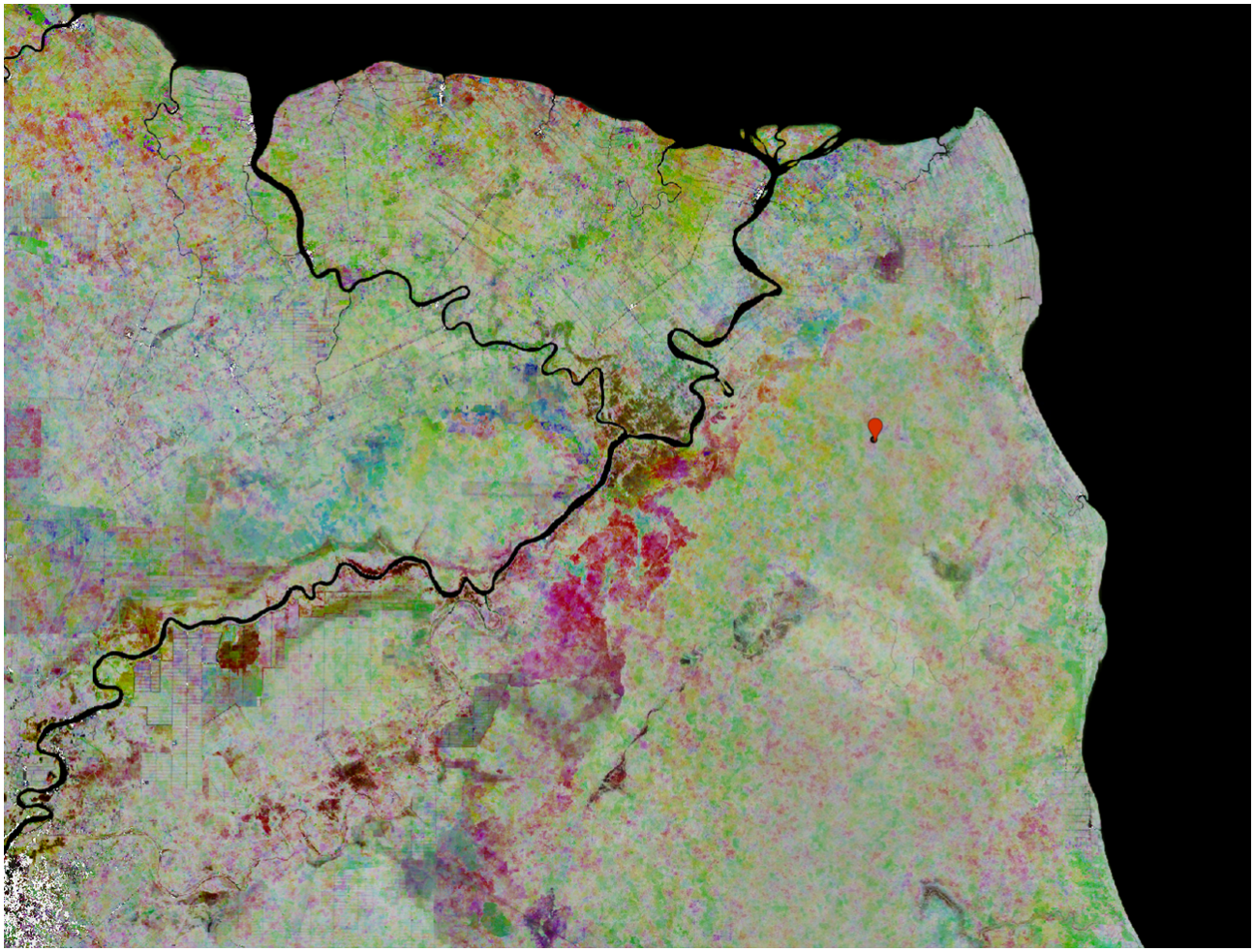
Grayness is indicative of moisture/foliage (Berbak NP). The radar imagery penetrates cloud cover and the upper levels of the soil.

Figure 12: Intermediate Classification Derived from the Radar Imagery



Note marked differences between speckle and color combinations. Light blue is multi-seasonal water, including land subsidence areas, whereas green is vegetated areas.

Figure 13: HSV/RGB Composite Image from the First-order Fourier Model



This false color Landsat 8 time series composite juxtaposes the wet, pristine tropical peat forest (green and yellow) around Berbak NP (red pin) with the less wet or degraded areas (magenta). Further field study will provide greater insight into these results.

Harmonic Models

The following charts[52] are used to linearize phase and amplitude with this model:

Acos(2πωt - φ) = β2cos(2πωt) + β3sin(2πωt)

β2 = Acos(φ)

β3 = Asin(φ)

A = amplitude = (β22 + β32)½

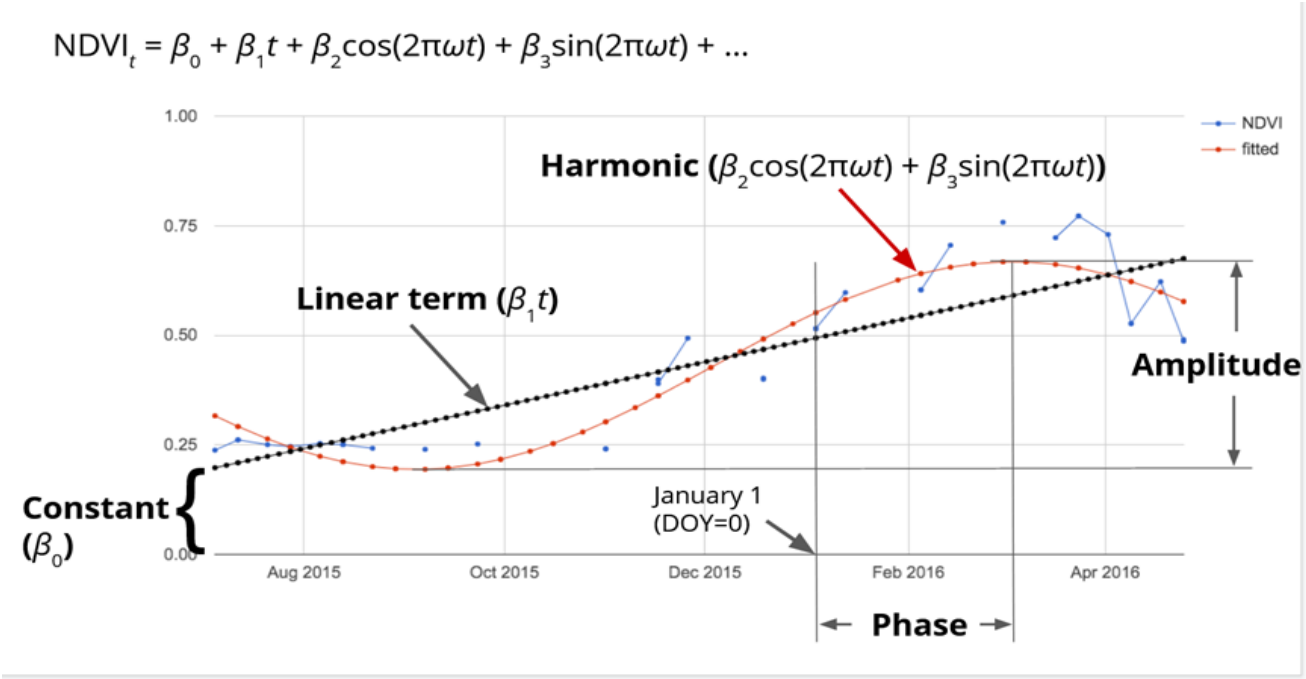
φ = phase = atan(β3/β2)

ω = angular frequency

2) The linear model is fit with w=1

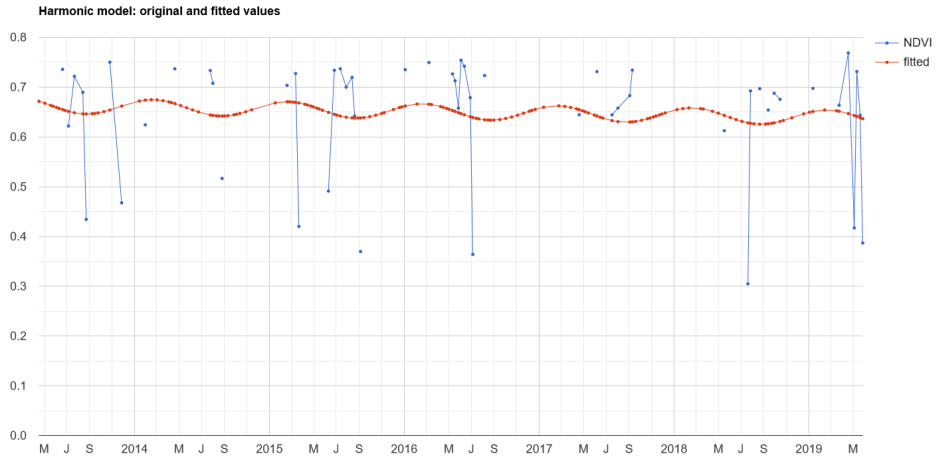
pt = NDVIt = β0 + β1t + Acos(2πωt - φ) + et

= β0 + β1t + β2cos(2πωt) + β3sin(2πωt) + et



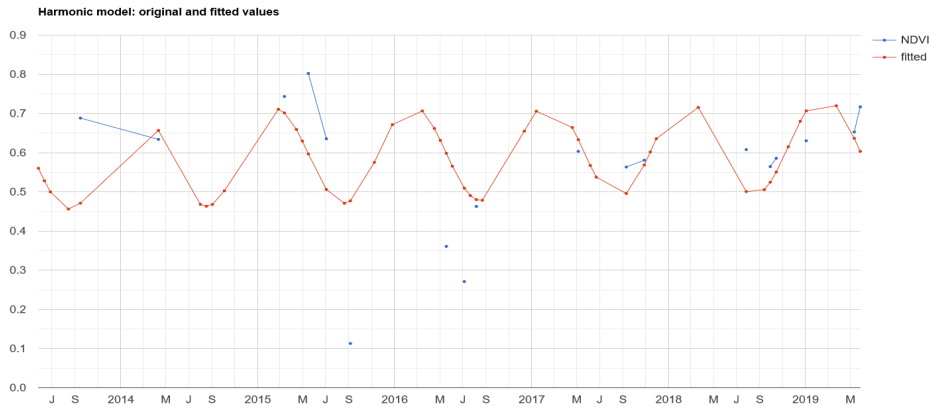
[52] from Shumway and Stoffer, 2017. Time Series Analysis and its Applications, 4th edition. Springer, retrieved from https://www.stat.pitt.edu/stoffer/tsa4/tsa4.pdf

Figure 14: Harmonic Model Showing Original and Fitted Values for Berbak NP



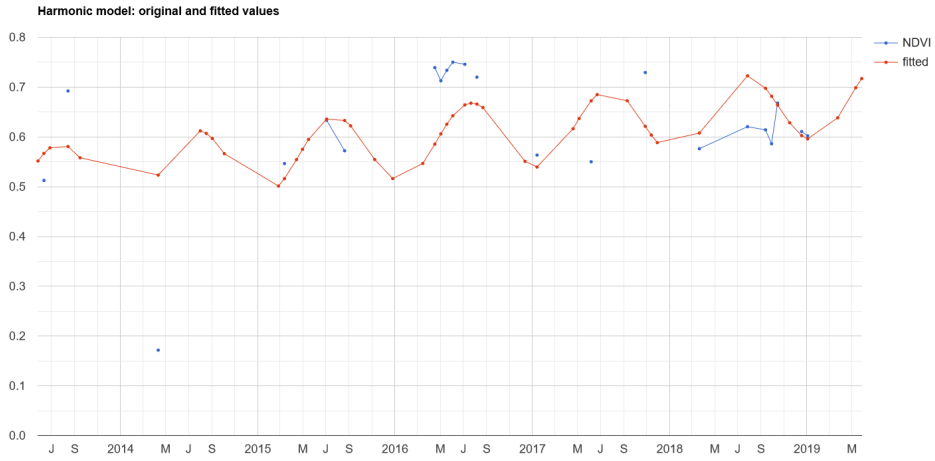
Note inter-annual resilience of the peat swamp forest.

Figure 15: Rimba Treatment Area



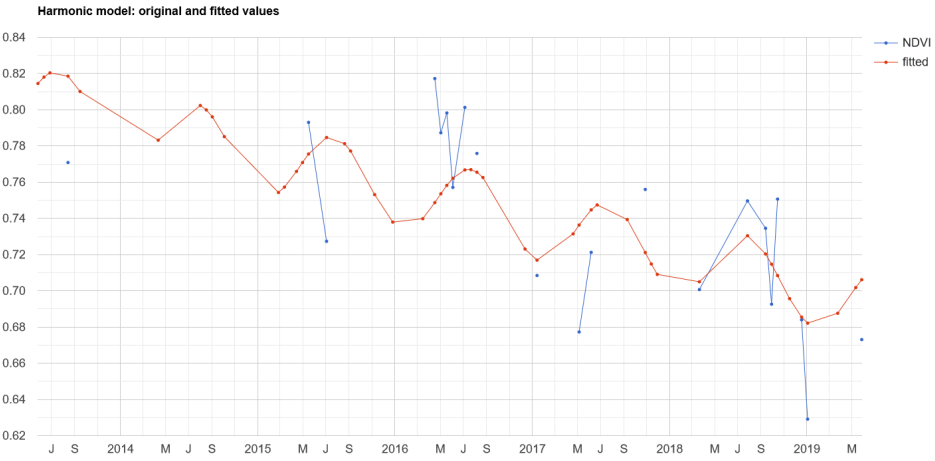
This area has a gradual increase in NDVI values but higher peaks and valleys, indicating a greater wet and dry season response.

Figure 16: BGPP Treatment Area



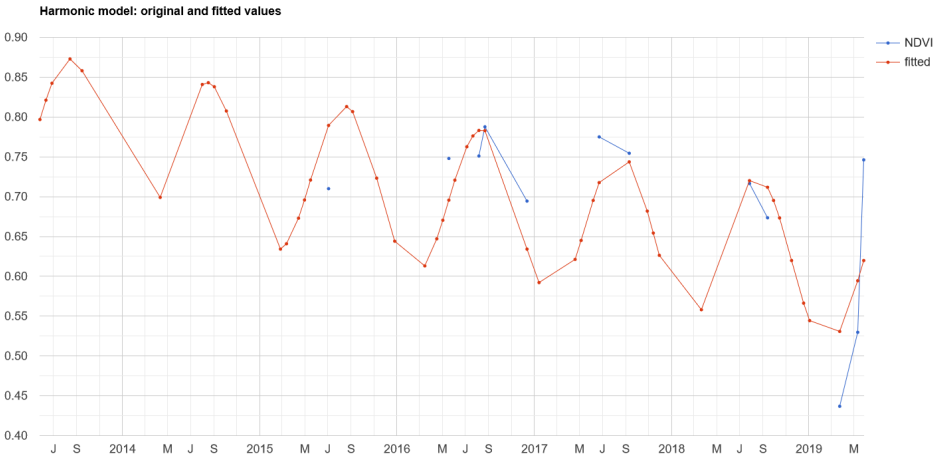
The multi-year trend is indicative of gradual increase in vegetative activity.

Figure 17: Palm Plantation West of BGPP



The site reflects a downward trend in NDVI.

Figure 18: PSDABM Treatment Area



This chart indicates a decline in vegetation in the region.

ANNEX IV. STAKEHOLDER FEEDBACK

Documentation of the comments/feedback from stakeholders.

MCC FEEDBACK

Page Number	Comment	Evaluator Responses
1	First para: " . . . USD $600M . . ." USD $ is redundant, use one or the other, write million; compact agreement". . . compact agreement . . ." compact will suffice; "facilities" - Do you mean projects?	Corrected
1	Last para: "Harberger and Jenkins" needs footnote.	Inserted relevant footnote
1	Please used completed instead of successful grants for the entire report (see comment in word doc)	Corrected throughout the report
1	2nd to last para: What, specifically is the methodology? Please specify this. Would this be considered an ex post evaluation? Is the quantitative pre-post?	Reworked. The quantitative remote sensing is fully pre-post.
2	1st para: "grantee . . . Their grant." Proper pronoun is "its."	Corrected
2	See Ishani's comment on "successful." If you want to keep this terminology, the footnote should appear above.	Corrected throughout the report
2	Findings Table: The flow of this section might be a little clearer if it was mapped to the sub-questions.	Integra feels this would be redundant with the full report for the purpose of an executive summary. However, labeling was adjusted to improve flow
2	Grant Implementation: None of the seem to be lessons learned, but rather implementation findings.	This section is rewritten
2	"This will be addressed further" - I'm not sure what is meant by this. Addressed further in the report? By the stakeholder?	This is clarified
3	last para: "BGPP project" Do you mean grant or sub-activity? Project in this contect would refer to the GP Project.	Corrected

3	"The evaluation team found that the merits of compacted peat dams compared with other forms of construction was a misguided question. The choice of construction is not a straightforward either-or question, but rather, it depends upon a variety of factors. The grantees selected the method most appropriate for the specific context in which they were working that would advance peatland rewetting" - This finding is unclear. Perhaps reword. "Misguided question" - I don't follow. What question was misguided?	The team was asked in the kickoff meeting to advise on which was the soundest methodology. This has been rewritten to explain that there isn't one supreme method.
3	"As far as the overall viability of the three grants evaluated under the peatlands portfolio, only two (BGPP and PSDABM) were found to be viable," - In what sense? Based on the ERR?	That's right - added clarification that this is economic viability based on the CBA results. Note the BGPP model was amended based on the feedback and it is no longer viable without CSCC.
3	"Discrepancies between the ex-ante and evaluation-based CBAs can be attributed to changes in methodological approaches (e.g., calculation of fire risk reductions), deviations in project implementation, inclusion of new benefits (e.g., GHG emissions), inclusion of new costs (e.g., the cost of maintaining the canal blocks), and other refinements to parameter values." - Is this a finding?	No - not a finding. Removed from findings section.
4	first para: Rimba Corridor is also a sub-activity.	Corrected throughout the report
4	What are the main findings from the CBA? (Include in this table)	Created new row for CBA findings and migrated text from effectiveness row into this new row to focus only on the CBA
5	First point: This is difficult to understand out of context.	This has been revised.
5	What recovery processes?	Peatland restoration - revised and no longer referred to
5	What is the potential multipler effect?	The process of scaling up through leveraging other investment - no longer used
6	2nd para: "2 million Hectares (ha)"	Corrected
7	"this cluster of projects" Grants are sub-activites.	Revised to refer to grants
8	1st para: "compact agreement" compact will suffice; "facilities" see above; "Through these programs . . ." projects or investment. Program refers to the overall compact;.	Revised throughout to clarify

8	TAO: The TAO provided technical assistance and project oversight for grants issued under the compact. Here "project" is not necessary; 'project sponsors" should be activity sponsors.	Noted and corrected
9	2nd para: "after the entry into force" - "the" is unnecessary.	Corrected
9	last para: "project" is misused repeatedly in the context of this activity or sub-activity.	Corrected
10	Table 1: No data on hecatares rehabilitated/replanted for PSDABM - it does not allow for comparative assessment of the use of funds	PSDABM did not report any replanting
10	Table 1: In any case the presentation of hectares is misleading since ifthe aim of GP is securing carbon stored in peat a true comparison would require calculating the area x thickness of peat profile x the carbon density (this later soil bulk density x it carbon fraction)	No such data was made available to us. This aim seems inconsistent with information provided (see 2.4.3 and 2.4.4).
10	Please keep lines in the tables or format it so it's easier to read	Corrected
12	Is there a better resolution of the Project Logic image?	We do not have one and since this was taken from MCC's own documentation we have asked if MCC has a higher resolution copy.
13	"3. Mapping of peat hydrology." Period after hydrology unnecessary	Corrected
14	1st para: "MCC funded two contracts that included light detection and ranging (LiDAR) mapping and engineering designs . . ." It might be better to write "The compact funded . . ." "MCC funded" may be misconstrued to imply that MCC had an implementing role.	Corrected
14	In 1st paragraph under 2.4.4. Project Description the word "project" is misused several time. In this context "project" refers to GP, which consisted of numerous activities, which were further subdivided into sub-activities.	Corrected
14	first para: ". . .grantee must have conducted rewetting activities as part of their grant." See above.	Integra requests clarification on this comment.
15	"BGPP project's" It's not a project it's a grant. This section repeatedly uses "project" when grant or sub-activity is the correct label. I realize this gets complicated. WWF indonesia implemented its Rimba Project, which was funded by a GP grant.	Corrected

15	"The establishment of sustainable palm oil and rubber production was reviewed in the CBA but not evaluated " - Reviewed in the CBA as part of the counterfactual?	The palm oil and rubber interventions as part of the GP peatland portfolio was not part of the scope of the evaluation team (based on MCC guidance), but the decision was made to keep it in scope for the CBA to allow for maximum comparability between the ex-ante CBA analysis and the evaluation-based CBA. Therefore, only the CBA team examined aspects of the grantees' efforts on palm oil and rubber plantations. These aspects are included in both the with project and counterfactual scenarios of the CBA.
16	"They proposed the PSDABM Project . . . The antecedant - Mitra Aksi Foundation - is singular, therefore "It proposed . . ."; "the foundation focused on three core components to achieve their objective" its objective; "The project constructed 15 . . ." The grantee . . .	Understood and corrected
17	"The ex-ante CBAs for BGPP, Rimba Corridor, and PSDABM projects assessed the feasibility of these projects . . ." In an MCC context these are not projects. They are grants or sub-activities.	Corrected
18	W2 PSDABM has the the highest ERRs. This is a community based coalition with expertise, perhaps that lead to its better results than others? Did this grantee establish and community based organization (CBO) for continuing the O&M support? Who will provide on-going O&M, making sure structures are maintained and regenaration, rewetting continues?	Yes, this is discussed in the revised sustainability discussion.
18	Table 2: What are all of the acronyms in this table. Define these	We have redefined them again closer to the table for easier reference
18	Table 2: The parentheses might make this NPV seem negative. Perhaps reformat this.	Reformatted
21	first para: "The primary purpose of the PE was to identify project results . . . For clarity just say " to identify results . . ."; "assess project implementation" do you mean grant implementation or overall project implementation?	Corrected
21	bottom: "The evaluation questions focus on common issues faced across all projects in the peatland portfolio . . ." grants or sub-activities not projects.	Corrected

21	one of the lessons learned should be on how to ensure sustainability, is organizing CBOs to provide O&M is enough? Or support from BRG, together with Village government is necessary? Ishani: As the independent evaluator, it is up to you to decide what should be a lesson learned.	Addressed in the sustainability section.
21	Evaluation type should refer to ex post (not just mixed methods)	Corrected
23	"Overview of Methodology" - I don't see this as a methodology, but more as a work plan. I think you need to spend a bit of time on the data and how it was analyzed to get to the findings.	Revised
24	"Model-specific changes due to changes during project implementation . . . " during implementation will suffice; "The evaluation-based CBAs downwardly adjusted the cost savings attributable to the project to . . ." attributable to the grant.	Changed to grants or sub-activities throughout document as appropriate
24	On New Benefit--the residual value of jelutong trees; "The evaluation-based CBAs have included this benefit in the final year of the analysis to account for the future benefits of the jelutong trees.": How was this benefit estimated? The residual value needs to include adjustments for long-term discounted risks, such as the probability of the tree dying OR needs to be bounded by the salvage value (value of its wood?) in the last year of the analysis. At a minimum, you need to calculate sensitivities around this parameter. Sarah Lane: On page 94, this is estimated by taking the NPV of the last 20 years of productive life in the last year of analysis. Perhaps bring a description from the annex into a footnote or the body of the text here.	We brought in a discussion about how this parameter was estimated into the body of the text. We also conducted a sensitivity analysis for this parameter and reported the results in the Annex (it is not sensitive to wide assumptions around this parameter)
24	On Methodology adjustment--reduction in fire risk; "The evaluation-based CBAs downwardly adjusted the cost savings attributable to the project to less than 1 percent of the ex-ante value.": Given the importance of this estimate, an explanation for the updated valuation is warranted. How did the valuation fall to 1% of the previously estimatated value? Sarah Lane: The methodology for this estimate is on page 94. Please note	We have brought some text from below into this section to make it clearer how this estimate was calculated.

	in the body where to find this and perhaps how the estimate was parameterized.	
24	"The evaluation-based CBAs following the compact differed from the ex-ante CBAs in a number " - This jumps right into the differences, but it would be useful to provide a bit of context.	Added some context about the ex-ante CBA before discussing the deviations
25	" . . .to finance and profit from the MCC interventions." It would be more accurate to write MCC-funded interventions. My fear is that "MCC interventions" may imply that MCC had an implementing role, which it does not; ". . . changes during the course of the project implementation . . ." just write implementaion.	Corrected
25	On New Cost--maintenance and replacement for canal block dams; "Estimates for these costs are not very sensitive in the CBAs.": What about the risk that maintenance will not be performed? To what extent is ideal maintenance conducted currently? What is the cost of this risk if it is realized?	Hopefully the new language makes it a bit clearer that we have included a scenario analysis to account for the possibility that maintenance might not be performed. The results of the scenario analysis, and the risk that no maintenance is done, is provided below under the section dedicated to the evaluation-based CBA.
25	On BGPP: Palm oil certification; "In the evaluation-based CBA, prediction is based on the remaining training requirements and when a premium is likely.": Given the uncertainties implied by this statement, a sensitivity test needs to be conducted for the possibility that certification is never completed or significantly delayed. Sarah LAne: I'm confused by this sentence. Does this mean that the benefit kicks in after some predicted time when the training is complete? Also, if another donor is completing the training, what is the counterfactual? Is that donor only doing the training because of the MCC investment or would they have done it regardless?	This certainly posed an issue. In the end we decided to treat this as a stranded asset, especially given the limited data to meaningfully project when a premium may be accrued, and its value.

25	On Rimba Corridor: Rubber producers; "...the ex-ante analysis assumes that incremental revenues increase by 380 percent; this was considered to be quite high and was adjusted downward to 20 percent (see parameter values table below).": What is the basis for the 20% estimate? Sarah: I assume the 20% is from the FGD. It would be interesting to know where the original 380% came from.	There has not been any measure of rubber increase as a result of the project, so we based the 20% assumption on estimates from stakeholder interviews (and verified it with a literature review). We've added some more information here (in addition to the details in the parameter tables below). Unfortunately, the assumptions driving the 380% yield increase are not clear in the ex-ante analysis.
25	"Estimates for these costs are not very sensitive in the CBAs." - Are you saying that the ERRs are not sensitive to these costs?	Yes, we clarified in the text.
26	" . . . original design of the GPF and peatland projects" peatland grants or sub-activities.	Corrected throughout the report
26	On PSDABM: Rice miscalculation; "The ex-ante analysis mistakenly assumed there would be 1,000 rice farmers in the counterfactual and 737 rice farmers in the "with project" scenario": What are the actual numbers? Why are the with/without numbers different? Are benefits based on number of hectares, beneficiaries or some other unit in the original analysis? Sarah: I'm guessing this is an arithmetic error in the original CBA that Limestone corrected.	Correct - it seems to me that it was an arithmetic error, there was no justification provided in ex-ante analysis for the difference between the with project and the without project. I've changed the word "assumed" since that sounds like intent, with "estimated". The original calculations were based on the number of farmers, all of whom were assumed to own 1 hectare (which serves as the scale variable = price * quantity per hectare * # of farmers)
26	"Averted GHG emissions due to reduced fire are also not included in the evaluation-based CBA.": It is not clear to me that this is an economic benefit regardless. The critical economicly relevant parameters are the stocks of carbon in the air and sequestered in the peat, respectively. If we are measuring, at any level, the stock of carbon sequestered, then this benefit is already effectively being included in the measurement, at least to first order (i.e. ignoring transient changes in the stocks as a result of the delay in the period needed for regrowth).	Thanks for pointing this out! We do not believe there is any double counting in our model (discussed in response to another comment), but agree that there is a risk IF we had included this benefit. We have removed this from the 'excluded benefit streams'.
27	" . . . Data collected by MCC and GP Project grantees . . ." Project is redundant; " . . . that imagery for the project area . . ." implementation area	Corrected

28	Table 5: Fix table and add table headings	apologies - headings were present but were white on white due to a formatting error. Throughout, tables have been fixed
28	Timeframe: Please specify the period over which the completed grants' have been operational. That may mean reporting different time frames (2 per grant). It's important for the reader to understand how long these programs had been around before we collected data. We want the exposure period to be explicit especially for the results/effectiveness reporting – exposure period is the time between intervention and data collection.	A graphic has been inserted to capture this.
29	" . . .Green Prosperity Peatland Project activities . . ." delete Project; " . . . to determine precise project locations . . . Implementation or sub-activity locations; "Om addition, data sets across . . ." ? "As the grants themselves were implemented only in the last 18 months of the project . . ." last 18 months of the compact	Corrected and clarified.
30	" . . .in discussing behavior change with villages (who are sometimes not aware of who the donor is) as well as delimiting where MCC's impact ended and the other donor's impact begins." villages (which . . .). It's not MCC's impact, it's the compact's impact. "MCC's impact" incorrectly implies MCC had implementing responsibilities	Revised for clarity
33	" . . . MCC contracted with ICF International to evaluate the potential of the 65 projects . . ." Footnote leads me to believe that it was MCA-I that contracted ICF.	Corrected
34	" . . . peatland rehabilitation must rely upon on remote sensing . . ." upon or on, pick one.	Corrected
35	" . . .The PLUP product was intended to be used to inform the design of eatland management grant proposals. PLUP implementation was also delayed by MCA-I. As a result, the PLUP product . . ." PLUP activity or grant.	Corrected
35	First sentence 2nd para: I assume this is referring to the Peatland grants and not the GP portfolio as a whole.	Corrected
36	" . . . both Mitra Aksi PSDABM and WWF Rimba projects . . ." They are not projects, they are grants or sub-activities.	Corrected

36	"The major challenge, discussed below under sustainability, is the labor and material requirements for such work, which is unsustainable for the affected communities.": Is this judgment reflected in the CBA? If so, how?	Revised for clarity
38	" . . . Rimba Corridor project of WWF . . ." grant ot sub-activity	Corrected
38	Reference to Figure 6 in EQ2b: Where are the figures referenced in this section? In an appendix?	Yes - reference has been added
39	"in NDVI or pronounced seasonal response" - Is there any statistical analysis to back up this change or was this observational?	Yes - this has been edited for clarity here and in Annex III.
40	"Regional government cooperation with the project was strong." Project is the right word if the reference is GP. If not, use another word; ". . . which the province is unwilling to finance . . ." was; "Fire management – all projects claimed to provide . . ." grants or sub-activities	Corrected for clarity
41	"Both the PSADABM and the Rimba projects . . ." grants or sub-activites; ". . . WWF demonstrated adoption in their final report." its final report; "In Mitra Aksi's PSDABM project area . . ." I think intervention area would be better; "Focus group in PSDABM project area." Ditto; " . . . is a systemic problem for MCA-I, the projects, and the governments." grants or sub-activities	All references to grant areas or project areas have been changed to intervention areas
41	Did EMM provide any training to men and women of the communies? If yes, how many? What were the training? Ishani: No need to make changes in report if this was not in your scope of work.	Sorry for omission. This has been added. The figures are not disaggregated by gender in reporting.
41	Did PSADBM farmers report any production increase? If yes, which production? Any information on proportion of increase? Increase in income? Ishani: No need to make changes in report if this was not in your scope of work.	This is discussed at EQ2E and in Annex II
41	any community members trained in O&M of the structures? Ishani: No need to make changes in report if this was not in your scope of work.	Answered in EQ2E

41	"suggesting that adoption is probably not universal." - Is there any indication on what the adoption rates might be?	Text added to make it clear that Mitra Aksi has not measured adoption levels. And how it was addressed in the CBA.
41	This is an important finding, but how does this relate to the skills of the grant implementers?" - The issues of poor government coordination and poor MCA-I management systems were beyond the manageable interests of the grantees"	Revised for context
42	" . . . Delays in acknowledging compliance with contractual condition . . . Conditions; " . . . and in the case of the Rimba and PBMASP projects, community members . . ." grants or sub-activities; "- Community leader, Rimba Project" grant of sub-activity; "Costs varied widely between projects." widely across grants; " . . . monitoring dams in the PBMASP and Rimba project sites." PBMASP and Rimba sites	Edited for clarity
42	"Each dam must be monitored monthly to mitigate any major damages if there are any leaks, weathered wood, or cracks. Annual maintenance and monitoring are estimated to cost roughly $200 per canal block (for a 3 m dam) to include monthly monitoring and light repairs to the wood and other damages. It is estimated that the dam would need replacing every 5-10 years, costing about $940 (2016 values) for tools, materials, and labor.20 This is a substantial drain on human resources for a small community.": Is there any incentive for the community to make these investments? If maintenance is not expected to be sustainable, this fact should be reflected in the CBA.	Added a paragraph below to address the CBA component of this question.
42	"Community members are monitoring dams in the PBMASP and Rimba project sites. However, they lack the resources for maintenance, and, without a plan to support maintenance, it is reasonable to question an erosion of the commitment of communities over time.": Given this: Can we expect the communities to invest in even a single maintenance cycle? If so, why?	Edited for clarity
42	WWF structures 3 times more than Mitra, will the durability of these be same or WWF structure will last 3 times more? Ishani: No need to make changes in report if this was not in your scope of work.	Good question. WWF structures are superior to Mitra Aksi, but the materials will degrade at the same rate.

42	community monitoring of the structures - are members doing this voluntarily or they were given responsibility by village govt or Mitra? Are they getting paid for monitoring? Ishani: No need to make changes in report if this was not in your scope of work.	Communities are monitoring voluntarily and out of self-interest.
43	"Community members in the Rimba Project . . ." You know by now that project is not applicable in this context' "The advantage of using heavy equipment are threefold." advantages; "Village Secretary, Berbak GP Partnership Project." drop Project	Corrected
43	"All of the canal construction and use was by and for illegal timber extraction outside the community, and the communities adjacent to the Tahura saw no benefit.": What is the risk that the parties responsible for timber extraction will destroy the dams? Was this risk even explored?	This risk was explored. The section has been revised to clarify this excellent question.
43	EQ3B Response - I'm not sure this fully answers the EQ. Can you elaborate?	Edited for clarity
43	"The community perception was positive." - This is confusing. The canal was used for illegal logging, but community perception was positive? Did the blocking stopped the logging?	Edited for clarity - yes the communities were not beneficiaries of the illegal logging - they had no "skin in the game" so were positive that it ended
43	EQ3D Response - This is pretty technical. Can you explain this to a more general audience?	Revised for clarity
44	Is the reference to "project" the overall GP pProject or the peatland portfolio? If the latter, use another word; " . . .Rimba Corridor program . . . In MCC-speak the compact is the program, so please use another word.	Corrected
45	" . . . especially in the Rimba project . . ." grant or sub-activity	Corrected
45	"potential to scale " - Is there any evidence that this is happening?	It is too early to answer this decisively
46	"In the Rimba project both success and failure . . ." grant or sub-activity; "In Mitra Aksi's PSDABM grant . . ." Yes!	No revision necessary.

46	Both Mitra and BGPP beneficiaries reported increase in income, what about WWF/Rimba? Was alternate livelihood a total failure?	This is tricky. WWF/Rimba's alternative livelihood schemes did increase income, but these were not funded through the grant, and they could not disaggregate. Success stories were initially reported here but were deleted when it became clear that this was not as a result of MCA-I support
46	"and FGDs and KIIs confirmed increased .... " - should this be reported instead of confirmed?	Yes. This has been changed to “reported”.
46	"25 percent " - That is pretty precise. What is this based on?	Rounding of data from FGDs. This was deleted because of lack of agreement in the team on interpretation
46	What is paludiculture?	Swamp agriculture (defined earlier in text)
47	bottom: "BGPP project" appears twice. It should be BGPP sub-activity	Corrected
47	On EQ 3G; ERR and ENPV with the global social cost of carbon (GSSC): I recommend excluding this estimate to reduce confusion. This is not a benefit of the project to Indonesia (per MCC's methodology)	During a follow-up call with MCC, it was suggested by MCC that we keep the GSCC for informational purposes. The evaluation team does not have a strong preference in either direction so we have opted to leave it.
48	"The Rimba Corridor is no longer a viable project . . ." sub-activity; "Both EMM (BGPP) and WWF (Rimba Corridor) contributed significantly to the total project investments . . ." Is Project areference to the GP Project?	No, it’s a reference to the grant. Corrected.
48	"Threats to the effectiveness of this program should be considered . . . I think it would be better to say "these investments" instead of this program; " . . . key investments of the GFP to ensure . . . I think you meant GPF; " . . . the PSDABM project remains viable . . . Why not simply "PSDABM remains viable?	Corrected to read "grant".
48	"The additional benefit of averted GHG emissions is a significant economic value in all models. Certainly, it is the largest benefit when accounting for savings using the global cost of carbon, and even when considering the country cost of carbon, it is one of the largest benefit streams in value (see Table 9 below)": Please remove this discussion: the GSSC is not an economic benefit according to MCC's standard methodology: these are not benefits that accrue to Indonesia.	During a follow-up call with MCC, it was suggested by MCC that we keep the GSCC for informational purposes. The evaluation team does not have a strong preference in either direction.

	Sarah: It is up to the evaluator if they want to remove this section. If this is in the EDR and was agreed to at that time, it should remain.	
48	On Table 9: Present Value of Reduced GHG Emissions (2016 USD): It's unclear to me that 1) revegetation, 2) fire risk reduction, and 3) GHG reduction are entirely independent. Can you discuss the risks of double-counting and mitigation strategy for this risk?	We have added a note in the evaluation-based CBA section of the report on double-counting noting where we accounted for double counting and why we do not think our models have any double counting at this point.
48	"The communities benefit the most from all the grants. They are financially viable, which is an indication that they are financially incentivized to maintain the investments that benefit them.": This is an important point regarding the likelihood of continued maintenance, but is not sufficient: are the communities 1) resourced and 2) capacitated to continue maintenance? Being motivated to continue maintenance is not the same as being incentivized; being incentivized pre-supposes 1) and 2) above. A community does not have well-defined preferences, but if the community designates a trained individual to do maintenance, then that individual will be incentivized if he/she is paid to conduct said maintenance. More to the point, this bulletpoint states that the projects are "financially viable" while at other points the evaluation notes that there is no mechanism for the financial transfer.	Fair points – we've added that nuance in the text here.
49	"If the canal blocks or the trees in the revegetated areas are not properly maintained, future benefits from the reduced fire risk, averted GHG emissions, and alternative livelihoods from wettolerant plant species will be jeopardized and the economic viability for each project will decrease. In the scenario analysis, the PSDABM project remains viable even under the worst assumptions about the lack of maintenance of the 440 revegetated hectares or the 15 canal blocks. It is worth pointing out that the trees in the Rimba Corridor are showing signs of stunting, which already suggests that some of the future gains from jelutong production and averted GHG emissions might be optimistic.": Please conduct a full-sensitivity analysis or at least show your scenario analysis in this section. This issue is a major risk and potential lesson for future projects.	We have brought more information on the scenario analysis in the annex into this section.

	Sarah: On pages 99-100 in the annex. Perhaps note where to find the detail below.	
50	"The Berbak GP partnership project led by EMM . . ." I think Berbak GP partnership will do	Corrected
52	". . . (as is the case in both the BCPP and Rimba projects) . . . Grants; "During the project design process, MCA-I encouraged WWF and EMM . . ." Does project refer to the GP Project? "BRG senior staff did not acknowledge any training from MCC." MCA-I not MCC would have contracted training for BRG.	Corrected
53	"The section of the evaluation was intended to answer whether the Peatlands portfolio was designed to achieve the GP objectives." This section? " . . . and begin implementation shortly after . . ." after what? Entry into force; "Lastly, the PLUP product . . ." activity	Corrected
54	"The adoption of organic fertilizers was inconsistent across WWF and Mitra Aksi's project areas." intervention areas; "This evaluation determined that each of the grantees demonstrated the skills required to successfully implement their respective grantees." respective grants	Corrected
54	On Section 6.4 Sustainability: "Sustainability is a major concern in this evaluation; none of the grant recipients put in place measures for long-term management of the blocked canal areas.": Indeed this is a major concern, if fact I suggest that a single paragraph does not fully capture the range of issues highlighted in other parts of the evaluation report. Can you combine all the observations in the report vis-a-vis sustainability into this section for future reference?	This is been revised per your recommendation.
55	"The Peatland portfolio projects have demonstrated . . ." portfolio grants or sub-activities; " . . . and to return of peatland to ecological functionality." and return peatland to; "For example, the failure to address this distinction resulted in confusion in the BGPP project . . . grant or sub-activity	Changed to grants or sub-activities throughout document as appropriate
60	"All three " . . . projects engaged in canal blocking . . . Grants or sub-activites; " . . . adjustments due to changes in the project design . . . Not sure what "project" refers to: GP, GPF, peatland portfolio. Please be specific: "The ex-ante CBAs for BGPP, Rimba Corridor, and PSDABM projects assessed the feasibility of these projects . . . They are grants or sub-activites not projects.	Changed to grants or sub-activities throughout document as appropriate

61	"The case of Rimba Corridor 25 looks similar to the BGPP project . . . Similar to BGPP; "The PSDABM 26 project . . ." grant or sub-activity; "The ex-ante analyses of peatland projects use . . ." peatland grants or sub-activities	Changed to grants or sub-activities throughout document as appropriate
61	On comparing ex ante/ex post CBAs; BGPP; "Benefit: Cost-savings from biogas digesters as a result of not needing to collect firewood": On the issue of the counterfactual cost of energy (i.e. cost of firewood collection), it must be noted that the beneficiaries are (presumably) relatively money-poor and time-rich. Therefore, wages will overestimate the opportunity cost of collecting firewood. To the extent that the money-cost of firewood collection is an overestimate, this may also be an issue for the sustainability of the project as it may predict beneficiaries switching back to firewood at a higher rate than otherwise might be expected.	This is a fair point to raise, there were no additional data to inform any other assumption. However upon review of the feedback on this benefit stream we elected to exclude it given the fact that POME was no longer being provided to the communities, and it is unclear what the cost and time savings are for communities to switch from firewood to manure. However, we have left this particular reference here in the report since it was included (and valued this way) in the ex-ante CBAs.
61	On comparing ex ante/ex post CBAs; BGPP; "Benefit: Cost-savings from biogas digesters as a result of not needing to collect firewood": Is there a risk that the biodigesters will leak methane or other powerful GHGs? If so, this risk needs to be discussed.	See comment above, we have removed the biodigesters benefit from the model due to data limitations and changes in project implementation.
62	" . . . ex-ante CBAs of the peatland projects." grants or sub-activities; "Relevant Projects" Grants (Note: Relevant Projects appears in the header of numerous tables in this section.)	Corrected throughout the report
62	On Ex-Ante Methodology & Specifications: Please be more careful with units throughout this section. For example, "Yield for rubber with project per hectare", should have units tonnes/ha rather than tonnes.	Corrected throughout the report
64	On BGPP Palm Oil narrative parameter Q^(extract,w): why are these unit different from the above (% vs. tonnes)?	This has been corrected throughout.

66	On BGPP Biodigesters narrative; "The counterfactual assumes a fixed cost per household for cooking fuel expenses.": What did you do to verify that this was a reasonable counterfactual?	The ex-ante models did not have accompanying narratives so this was inferred based on how this was modeled in the ex-ante CBA. For the evaluation-based CBA, we have elected to remove this benefit due to issues raised in feedback and data limitations (especially on the counterfactual)
68	On MCA-I Overhead costs: Overhead needs to be pro-rated so that it sums over the GP portfolio to equal the total administration budget of GP. Was this calculation performed? On simple possibility is to use the grant size to pro-rate the overhead cost.	Yes, this was performed using the information on actual administration costs, from the Social Impact evaluation of the GP portfolio
69	On New Benefit--residual balue of jelutong trees; "It was estimated that jelutong trees can produce latex until they are at least 40 years old (i.e., 20 years of residual value following the end of the 20-year period of analysis in the evaluation-based CBA).": While this may be true, it is also true that uncertainties increase as the trees age. To what extent can productivity be expected to decline? Is it possible that new threats emerge, which may wish to cut the tree down? Given these uncertainties, it is imperitive to include a sensitivity analysis around this parameter.	We have done a sensitivity analysis on this and reported the results here and in the Annex.
70	" . . . 6,000 rewetted hectares in the BGPP project . . . BGPP intervention area; " . . . the planting of trees in all three peatland projects . . . Grants or sub-activities; " . . . GHG emissions each of the peatland projects . . . Grants or sub-activites; " . . . Rimba Corridor and BGPP projects . . ." grants or sub-activities	Corrected throughout the report
71	In Table 20, column labeled "Project" should be labeled "Grant"	Corrected throughout the report
72	" . . . built in the Rimba Corridor and PSDABM projects . . . Grants or sub-activites; " . . . compacted peat dams under the BGPP project." grant or sub-activity	Corrected throughout the report
73	"In all projects, stakeholders were not able . .. " grants or sub-activities; "A number of changes occurred during project implementation . . ." just write during implementation	Corrected throughout the report
73	"In all projects, stakeholders were not able to definitively say who was responsible for maintaining these canal blocks.": This issue is as serious as the previously noted lack of finance available for maintenance. A community does not have well-defined preferences, but the community	Agreed – discussed in the sustainability section.

	rather must be able to incentivize agents to maintain these assets on their behalf.	
73	On BGPP: Changes during project implementation; Palm Oil Certification: "... however, it is unclear (1) when this will occur, and (2) what proportion of the premium they will receive.": Given this information, this training must be viewed as resulting in stranded assets which we cannot attribute to the project. Any benefit is solely attributable to L'Oreal's intervention.	This is a fair concern and we had issues projecting the benefit to the farmers. For this reason we have decided to remove this benefit (and as recommended, treat as a stranded asset).
74	"ISCC premium ranges from $20-$30 USD": To what unit of production does this premium apply? kg? tonnes?	We have removed this benefit (see comments above) (it was per tonne).
74	On Table 23, Q^rubber, explanation for deviation; "Rubber experts with SNV did not have any data yet on these increases…": Do you know when such data might become available?	Unfortunately it does not appear that there is any planned follow up with the farmers. There may be some monitoring of SNV's demonstration plot, but it seemed that once the projects closed, they were no longer monitoring the participant's yields.
75	On Table 23, HH, inputs: Does this imply that there is an excess of POME that is not being used for fuel? If so, this is a powerful greenhouse gas that could reduce the ERR.	It is unclear whether there is an excess of POME. What we do understand is that there is sufficient supply of POME that the mills have retained it for their own use. Whether they are continuing to use it for bioenergy is unclear.
75	On Table 23, C^cooking: Givent the issues identified with a) counterfactual cost of collecting firewood b) the fact that POME is not being provided, and c) the fact that manure is being collected as a replacement for POME (which should presumably have the same cost in the counterfactual as firewood), I suggest removing this as a benefit stream. It is poorly founded and imprecisely estimated.	We agree, it was tenuous and there was very little reporting on the implications on households. For this reason, this benefit has been removed.
75	On Table 23, C^cooking, explanation for deviation; "It was revealed that POME is no longer provided by the mills...": This is a major problem for the assumptions in the CBA. What is happening now with the effluent (POME)? As noted, this is a powerful GHG.	The mills are using the POME for bioenergy (or at least that is what they elected to do at the time of evaluation). Note again we have removed this benefit.
75	On Table 23, C^rubber, explanation for deviation; "...SNV developed materials on best management practices (BMP) in rubber and reported	The rubber trainers seemed optimistic that the farmers understood the value of using higher

	that BMP requires additional/more expensive inputs": Are project-affected farmers using these more expensive inputs?	quality inputs. However there was no follow up or evaluation (at the time of the KII at least) regarding uptake and sustainability of new practices (including using higher quality inputs).
76	On Table 23, Overhead cost as a percentage of investment cost: Please clarify: Is this the portfolio average applied to the total investment cost (i.e. GP funds + co-financed)?	It's applied only to GP funds. Clarified here as well as in the annex.
77	"RIMBA CORRIDOR: CHANGES DURING PROJECT IMPLEMENTATION" Again, DURING IMPLEMENTATION will suffice	Done.
77	On Rimba corridor: Changes during project implementation; Rubber producers; "Note: Additionally, the ex-ante analysis assumes that incremental revenues increase by 380 percent; this was considered to be quite high and was downward adjusted to 20 percent": On what evidence is the 20% number based?	There has not been any measure of rubber increase as a result of the project, so we based the 20% assumption on estimates from stakeholder interviews (and verified it with a literature review). We've added some more information here (in addition to the details in the parameter tables below).
77	In Table 24, in Explanation for Deviation column, several explanations begins with the words "project achieved . . ." It should be Grant or sub-activity achieved	Corrected throughout the report
78	On Table 24, P^coffee, source of verification for deviation: Wouldn't it make sense to benchmark the estimates to the world price of coffee? This is a value that should be available.	We are looking specifically for the farmgate price in this region, which we anticipate should deviate from global coffee prices. We could not find farmgate coffee prices in the literature. We also did not meet with coffee producers in order to ask them. Questions to the implementer have gone unanswered on this topic. However, this metric is not sensitive to the ERR results so we felt comfortable relying on estimates from the ex-ante analysis.

79	On Table 24, Q^jelutong, explanation for deviation; "CBA team took a more conservative assumption given the fact that these trees are not being well maintained and unlikely to be highly productive": This point seems to contradict other assumptions that the jelutong trees will survive for 40 years. It would seem to be an important sensitivity whether these trees are long-lived or not. Did the evaluation team look into the reasons for the decline in yield and do these reasons correlate with a shorter lifetime? Presumably, these trees are private assets so that the owners should internalize the benefits of maintenance, especially as it affects short-term yields.	The residual value of the trees are based on this lower estimate for yields, and we have done a sensitivity analysis to test if the ERRs are sensitive to this assumption (they are not). There is no reason to believe the trees won't survive all 40 years once they reach maturity (except if the land is drained or the trees are cut down), even with no maintenance the trees should produce fruit (if they survive into maturity), just not as much as a well maintained plantation (as any fruit tree in the wild would produce). Not surviving into maturity is tested in the scenario analysis. 200 out of 212 hectares of the Rimba Corridor revegetation is on protected land, not private land, with no plan in place to maintain these trees – hence the more conservative assumption if these trees do reach maturity, and the scenario analysis which assumes these trees do not reach maturity (and therefore are not productive, nor do they have any residual value for the remainder of their 40-year life).
81	"PSDABM: CHANGES DURING PROJECT IMPLEMENTATION" DURING IMPLEMENTATION will suffice	Corrected
82	In Table 25, in Explanation for Deviation column there are several references to "shorter project timeline" shorter timeline will suffice	Corrected
88	On Averted GHG emissions from reduced fire: As noted elsewhere, Since there is likely a great deal of double-counting, this is a reasonable omission. To first order, what matters about emissions from fire and other forms of emission are the change in the stock of carbon sequestered. By including both benefits separately, you risk counting the (change in) carbon stock twice.	Thanks for raising this. We have removed this discussion from the 'excluded benefits', you're correct that this would result in double counting.

89	"Table 32 summarizes the investment criteria for the four grants studied . . ." Table only lists 3 grants; "The BGPP project remains . . ." grant or sub-activity; "Rimba Corridor is no longer a viable project . . . Rimba Corridor is no longer viabale; " . . . the box dams built under the Rimba Corridor and PSDABM projects)" grants or sub-activity	Corrected throughout the report
89	On Revegetated Plants; "All plants are treated as if they are jelutong trees.": Please clarify; are you referring to the ex-ante or ex-post models? If the latter, what is the justification?	Clarified in the report (for the evaluation-based CBAs). There was not sufficient data to include separate models for each specifies of trees so jelutong is used as a proxy for the value of all trees planted as part of this project.
92	"In addition, in the Rimba Corridor project . . ." in the Rimba Corridor; " In the BGPP project . . ." In the BGPP	Corrected throughout the report
93	" . . . the practices promoted by the PSDABM project." promoted by the PSDABM will suffice.	Removed the word project
94	" . . . rewetted for each of the GP projects." GP grants; " . . . part of the BGPP project . . ." grant or sub-activity; " . . . hectares that have been rewetted under each project. " under each grant or sub-activity	Corrected throughout the report
95	"For the peatland projects, the revegetation . . . " peatland grants or sub-activites; " . . . from the ICF report for each peatland project." each peatland grant; "Second, the Green Prosperity Project, the grant facility that funded the projects evaluated under this study . . ." the facility that funded the grants; "Under the BGPP grant . . ." Thank you.	Corrected throughout the report
96	"Note that in the BGPP project . . ." grant or sub-activity	Corrected throughout the report
98	"The grantee in all peatland projects bears . . ." The peatland portfolio grantees bear . . .; " . . . For the canal blocks, both the Rimba Corridor and PSDABM projects . . ." grants or sub-activites	Corrected throughout the report
99	In box beginning "For the revegetated areas . . ." drop the word "project" after the name of each grant	Corrected throughout the report
100	" . . . this project will be economically viable." this grant of sub-activity; " . . . render this project viable overall." this grant or sub-activity; "PSDABM: This project is viable under . . ." PSDABM: This grant	Corrected throughout the report

102	On Figures 6-8: The color-coding on each of these figures needs to be explained. As-is, it is unclear how to read/interpret these maps.	This has been added
105	On figure 9: You need to show the form of the model being fitted here. The harmonic shown does not in any clear way predict the data.	This has been added
Overall	Report should indicate authorship and expertise involved. If the intention is to inform future GOI peatland management, a consultaton and vetting of these results with Indonesian and US peatland experts is warranted before dissemination. The assessment appears limited to mostly economic data provided by grantees. While it is understandable that under the small grants scientific data would be sparse, there is little evidence of knowledge of GHG emission or peatland ecology factoring in the evaluation across the board.	The evaluation team has tried to make clear, as tactfully as possible, that these grants do not constitute ecological restoration best practice. Please note that the Team Leader is a member of the Ecosystem Restoration Thematic Group of the IUCN Commission on Ecosystem Management, a high-level advisory group of IUCN, and is well versed in the principles of restoration ecology and GHG emissions reductions from biomass and best management practices. The team also included an expert in peatland geography who was responsible for the first comprehensive mapping of peat resources in Sumatra. It is important to note that had we addressed GHG reductions as a result of rewetting after a 12-month exposure period, it would have been meaningless, as we tried to point out. Finally, in the project logic, the operant output is sustainable land use management, which is not addressable in the short time-frame, Further, GHG reduction is not recorded as an outcome, only as a higher-level hypothesized impact. To be clear, this would be a different evaluation if it this was a portfolio of activities managed explicitly for GHG reduction and conducted after an appropriate exposure period. This was not the case.
Overall	Title of report makes reference to mapping though I have not been able to determine whether, where and how the mapping effort was evaluated	27 references - the sad truth is that very little was done - PLUPs were delinked, and LiDAR was not well handled. One grantee hired another firm to provide maps because of this.

		There was effectively no mapping effort to evaluate.
Overall	Are the communities incentivized to protect the canal blocking structures? What were the incentives?	The incentives stem largely from aversion to fire/smoke impact - there are no incentives as a result of policies.
Overall	Can village govt pay for O&M cost from village funds? Can central government provide such designated budget for O&M?	No. We point out that the default option for maintenance of the canals falls on the proximate communities, while the beneficiaries exist across the landscape. This is a high burden that could involve a large proportion of the communities' labor force. Central government, via BRG, we point out has this mandate but no procedures in place.
Overall	What were the views of community women? Were there no separate FGDs with women? Did they understand the benefits of rewetting the peatland? Are they incentivized to protect the peatland? Are they active participants in monitoring the structures? Or women are busy with alternate livelihood?	Women are highly incentivized and are outspoken on the subject. This has been added to the lessons learned discussion in the Exec Sum.
Peatland CBA EMM, Inputs and Sensitivity Analysis, B3	On Total estimated emissions for EMM activities: Given the importance of this estimate, you need to check that the ICF analysis is fully taking into account issues such as attribution to the project and completion of objectives. The evaluation report underlines numerous risks to this estimate.	The ICF report created values for averted GHG emissions that are attributable to the project. Figures were adjusted where the completed objectives diverged from the planned objectives at the time of the ICF report (see Table 39).
Peatland CBA EMM, Q&Vs and Results, B1	On KUDs trained n ISCC (Certified): Judging from the report, this benefit requires L'Oreal to invest. To include this benefit, you must either add the cost of L'Oreal's investment, or you must drop this benefit stream as these assets are stranded until someone completes the process of certification. This benefit stream is not attributable to MCC's investment. If zero'd out, the ERR (w/o CO_2 benefits) is < 9%.	We address this point at different points in the report. Given that we have no information regarding L'Oreals costs, and the inability to project the portion of the component attributable to the BGPP grant, we have elected to drop this benefit.
Peatland CBA EMM, Q&Vs and Results, B2	On Expected annual value of fire risk reduction of rewetting BGPP: Given it's importance, you need to show this calcuation.	Added in all models

Peatland CBA EMM, Q&Vs and Results, B3	On Annual value of reduced emissions (global): As noted elsewhere, this is not a valid benefit of the project. Please do not include this benefit stream in the model.	During a follow-up call with MCC, it was suggested by MCC that we keep the GSCC for informational purposes. The evaluation team does not have a strong preference in either direction so we have opted to leave it.
Peatland CBA EMM, Q&Vs and Results, B4	On Averted annual firewood use per household (USD): Concerns were raised about this estimate in the report.	Thank for noting this, we have elected to remove this benefit given issues around the estimation and the deviations in implementation (where POME is no longer provided by the mills).
Peatland CBA EMM, Q&Vs and Results, B4	On the Value of cost savings for cooking/lighting: Why is the cost of the POME not subtracted? What about the cost of collecting manure which the report noted has replaced POME?	We have since removed this benefit from the analysis in response to previous comments on this.
Peatland CBA, other	Please apply comments above to other ERR models as appropriate.	Done

GRANTEE FEEDBACK

Reviewer Name / Institution	Page Number	Comment	Evaluator Responses
Wicher Boissevain / Euroconsult Mott MacDonald	3, 56 and 57	*The revegetation activities were less supported by economics or ecological science.* Comment: The plant species selected by BGPP for replanting in the 53 ha are peat-adapted species, able to tolerate rewetted conditions. This choice was based on ecological science (Giesen 2015, Giesen et al 2018) and less on economics, as it emerged during project implementation that products from trees planted in the Tahura could not be legally harvested by local communities in the area area assigned for rewetting and replanting. Nevertheless, four out of six species planted are of potential economic benefit, including jelutung (latex), sago (starch), gelam (poles, honey, etheric oils) and meranti rawa (wood). References: 1) Giesen, W. (2015) – Utilising non-timber forest products to conserve Indonesia's peat swamp forests and reduce carbon emissions. Journal of Indonesian Natural History Vol 3 No 2: 10-19. 223. 2) Giesen, W., Wijedasa, L.S. & Page, S.E. (2018)- Unique Southeast Asian peat swamp forest habitats have relatively few distinctive plant species. Mires and Peat, 22(01), 1-13. (Online: http://www.mires-and-peat.net/pages/volumes/map22/map2201.php); 10.19189/MaP.2017.OMB.287	The evaluation team did not question the species, but rather the decision made to replant the 53 HA PLOT. Language has been revised to clarify, stating: The peatland activities were designed to achieve GP Project objectives, and they were based on solid logic that could be expected to lead to desired outcomes. The exceptions to this are the revegetation activities, which were less strongly supported by economics or ecological science. Specifically, whether it made sense in regards to the design, to spend a significant amount of time and resources to plant a 53 ha plot, from an ecological restoration perspective."

Wicher Boissevain / Euroconsult Mott MacDonald	3	*The evaluation team .... is concerned that there is no concrete mechanism in place to support ongoing maintenance*. Comment: Local communities are not responsible for the Tahura, this is managed by UPTD Tahura, part of the provincial Forestry Dept. Hence it is the UPTD's responsibility to manage canal blocks and replanted area (a formal handing over was signed in February 2018). In order to secure maintenance funds, the UPTD needs approved Zoning and Management Plans. The BGPP has prepared draft zoning and management plans for the UPTD and organized public consultations at the provincial level. However, due to time limitations, the BGPP could not support finalizing these plans at Central Government level, which requires two workshops at national level. BGPP has gone beyond MCA-I funding, with EMM implementing canal block maintenance in the dry seasons of 2018 and 2019.	Revised to clarify, adding: The UPDT Tahura is the unit of the provincial Forestry Department responsible for maintenance, with financial support from the BRG. In order to secure these funds, the UPDT needs approved zoning and management plans. The BGPP prepared such plans for the UPDT and organized required consultations at the provincial level. However, the BGPP had insufficient time to conduct two required workshops at the national level before the project closed. It is important to recognize, however, that EMM conducted its own canal block maintenance in the dry seasons of 2018 and 2019, even without the support of MCA-I or the BRG. This is not sustainable over the long term and it remains unclear what the ultimate dispensation will be for support to the UPDT.
Wicher Boissevain / Euroconsult Mott MacDonald	15	Correction needed … in the Taman Hutan Raya Orang Kayo Hitam (~~*Orang Kayo Hitam*~~*Taman Hutan Raya* translates to Grand Forest Park)	Corrected.
Wicher Boissevain / Euroconsult Mott MacDonald	15	The REDD+ component was dropped because it would take 1-2 years to develop REDD+ financing and after the initial year of delay, there was not enough time available anymore.	Language revised to clarify, replacing paragraph with the following: The grant was originally intended to be a payment for the ecosystem services REDD+ grant, but the REDD+ component was dropped when matching private sector funding did not materialize as anticipated as a result of delays. Complications related to the original scope of work and partners, ultimately led to a delayed start for the canal blocking activities (intended for 2015 but not initiated until the fall of 2017) with a period of performance end of March 2018.

Wicher Boissevain / Euroconsult Mott MacDonald	42	The BGPP has supported BRG from June 2017 to February 2018, mainly in donor coordination (under Deputy 1) and technical issues (under Deputy 2). However, the evaluation team could find only limited evidence of direct capacity augmentation. Unfortunately, the evaluation report does not include a list of persons interviewed, as a possible explanation might be that the team interviewed BRG staff who were not involved in the BGPP activities.	The BRG was not accommodating to the Evaluation Team, which only secured an interview shortly before departure from Jakarta. The group interviewed was involved in the BGPP activities. Language revised to state: The evaluation team could find only limited recognition of direct capacity augmentation in the central government, specifically the BRG. Senior staff interviewed in Jakarta were unaware of any training that had taken place, nor of training materials provided. However, there was considerable difficulty in gaining access to BRG senior staff, which may account for the lack of acknowledgement of contributions especially from BGPP, despite direct questions posed.
Wicher Boissevain / Euroconsult Mott MacDonald	43	EMM received all government permits and clearances for canal blocking in September 2017, which would have allowed 6 months for implementation. However, the MCA-I approval of the ESMS and ESMP was delayed till December 2017, leaving only 3 months for implementation.	The evaluation team believes the EMM could have done a lot more if they had more time for implementation, but in their case, administrative barriers prevented them from doing so. Language has been revised to state, following "An additional major obstacle reported was in working with MCA-I.": EMM reported that they received their permits and clearances from government in September 2017, which would have allowed them six months for implementation. However, delays on the part of MCA-I in approval of the ESMS and ESMP until December 2017 left them only 3 months for implementation.