Extended Cost Benefit Analysis
PS, PES and MUK

Background

The forestry sector in Indonesia is at a crossroads. Forest concessions are seeing continuous contraction. Their contributions to the country's economy are dwindling, even as Indonesia is home to one of the largest tropical forests in the world. Where it is possible to do so at all, increasing production from these concessions may be destructive and unsustainable, even when it may be financially beneficial to the concession holders.

To increase the economic contribution from the forestry sector, Indonesia needs to examine all options, including monetizing forest ecosystem services. This study examines the broader economic value of forests, exploring key questions about the true worth of Indonesia's natural forests, the trade-offs of converting them into production forests, and the potential of social forestry and payments for ecosystem services.
The study was conducted at two levels, or "tiers," for three forest-based business models: (1) payment for ecosystem services (PES); (2) social forestry (perhutanan sosial, or PS), and multipurpose forestry business (multi usaha kehutanan, or MUK).

TIER 1

The Tier 1 study considered a generalized, or typical, case for each model based on current conditions in Indonesia as a whole.

TIER 2

The Tier 2 studies considered actual, site-specific examples of the three business models.

Cost Benefit Analysis

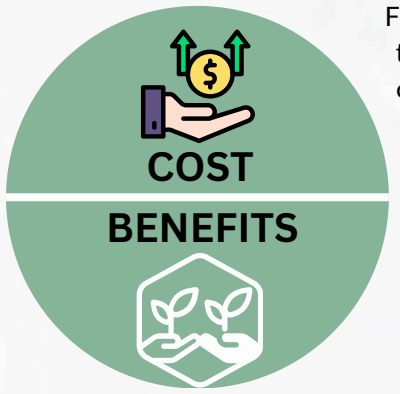
A cost-benefit analysis (CBA) is an economic appraisal methodology to assist decision-making in establishing the desirability of an initiative or project. It compares the costs incurred with the benefits provided over time, based on an assumed discount rate.

A private CBA usually uses a combination of inflation and interest rates. The comparison is reflected in a net present value (NPV). When the NPV is positive, the initiative is considered as desirable, whereas when it is negative it is the opposite. An extended cost-benefit analysis (ECBA) includes social and environmental costs and benefit affecting not only the project owners but also the wider public.

Appraising the Costs and Benefits of Forestry Initiatives

Operational Cost
Labor, rent, maintenance.

Capital Cost
Setting up costs, including licensing, cost of construction; purchase of land, when applicable



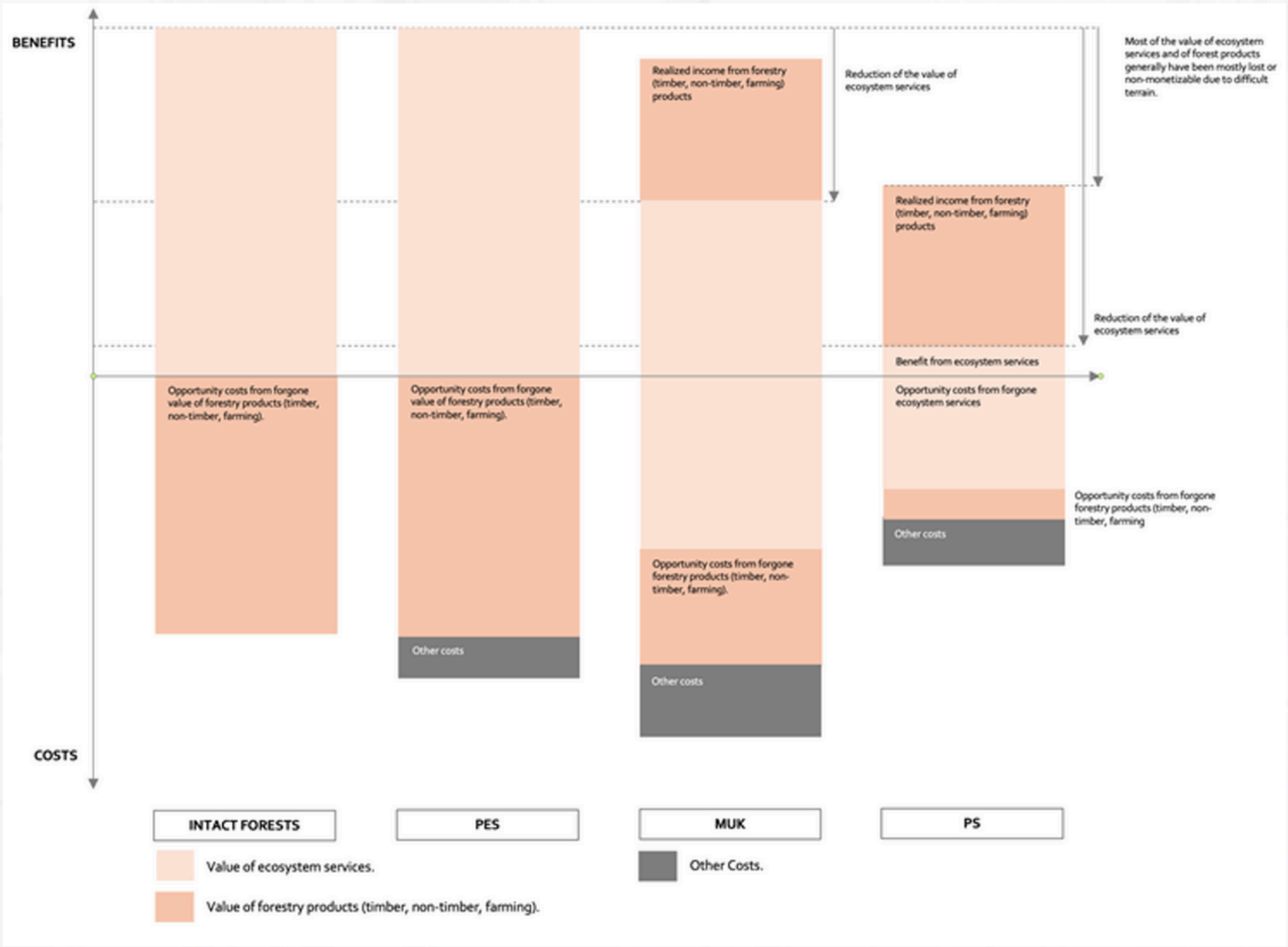
Opportunity Cost
Forgone forest products (timber, non-timber, and other commodities) that could have been harvested; forgone ecosystem services.

Direct Benefits
Income from harvesting forest products; income from the monetization of ecosystem services.

Indirect Benefits
Non-monetized ecosystem services enjoyed by beneficiaries such as food, water, air quality, flood and landslide controls, biodiversity, carbon sequestration and storage

"Cost-benefit analysis cannot overcome its fatal flaw: it is completely reliant on the impossible attempt to price the priceless values of life, health, nature, and the future"

Comparisons of ECBAs between the three business models compared with the ECBA of intact forests



TIER -1

The Tier-1 study considered a generic case for each of the three forestry business models.

Cost-Benefit Components	NPV (US$)		
	PES	MUK	PS
Costs			
Direct costs			
• Direct costs: capital	54.55	909.09	90.91
• Direct costs: operational	18.05	19.99	11.99
• Timber products	0	4,607.81	767.97
• Non-timber forest products	10.26	10.26	5.13
• Ecotourism	38.56	38.56	30.84
Indirect (opportunity costs)			
• Benefits forgone from lost ecosystem services	0	6,109.59	1,524.71
• Benefits forgone from unrealized incomes from forest products	15,359.37	7,679.68	0
Total Costs	**$ 15,480.78**	**19,374.98**	**$ 2,431.55**
Benefits			
Direct benefits			
• Timber products	0	7,679.68	1,535.94
• Non-Timber Forest Products	64.48	48.36	48.36
• Ecotourism	385.56	269.89	23.13
• Monetized benefit from water purifier function	13.88		
Indirect benefits			
• Carbon	15,288.19	11,466.14	955.51
• Biodiversity conservation	1,319.77	989,83	82.49
• Water regulation	1,032.88	785.07	65.42
• Benefits from ecosystem services	6,826.67	4,239.78	421.29
Total Benefits	**$ 24,931.44**	**$ 25,478.76**	**$ 3,132.14**
Benefits/Costs	**1.61**	**1.32**	**1.29**

Analysis and Findings

- PES has a benefit-cost-ratio (BCR) of 1.61, meaning this business model is economically feasible, based on the potential to monetize the value and benefits of the ecosystem services. The BCR of MUK 1.32 is lower than PES but still economically feasible. This depends on the high cost of the original permits, the high fixed and variable costs for selective logging, and the fact that logging drives down ecosystem benefits to levels lower than what we see in PES. The BCR of PS 1.29 is lower than PES or MUK but still feasible. It also has high social value because a greater portion of the benefits go directly to poor, forest-dependent communities.

Conclusion and Recomendations

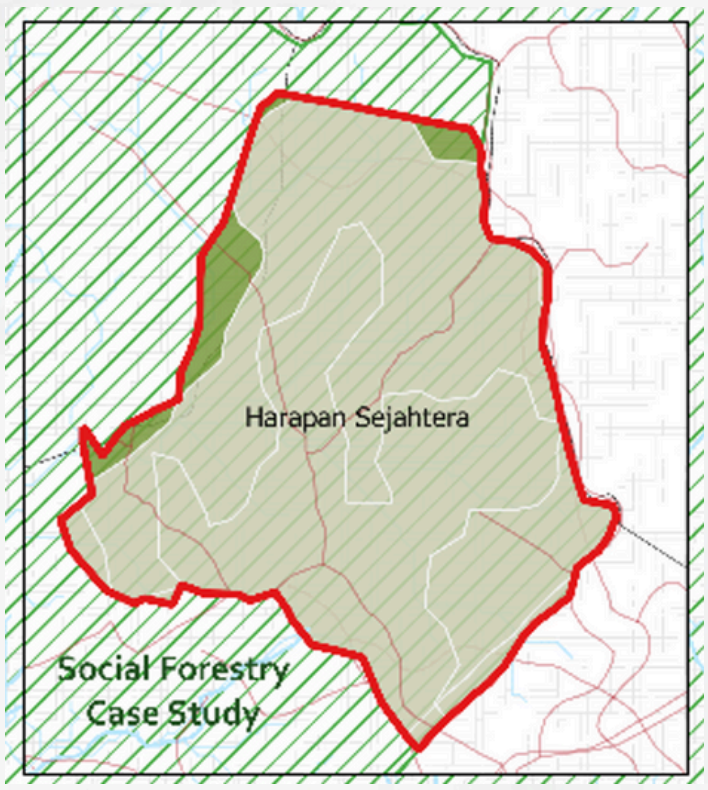
- PES has the highest benefit-cost ratio (BCR) but incurs significant operational costs. Current valuations often exclude key ecosystem benefits and forgone forest product income. Different services attract different buyers. PS is typically established in degraded or deforested areas, or in protection forest, meaning the opportunity costs of foregone logging are minimal. Well-managed PS can maintain or increase timber stock value. Multi-Use Forestry (MUK), depending on the mix of business activities (logging, carbon-trading, etc.), can be barely profitable and highly cost-sensitive. MUK is more expensive than traditional forestry but may suit business conglomerates managing diverse operations.

- Recommendations: Monetizing ecosystem services by expanding PES and PS to capture benefits beyond water should be enabled and encouraged. The approach to MUK should have greater flexibility, by allowing MUK concessions to prioritize either production or conservation based on net benefits, rather than having rigid land-use requirements. PS groups should be supported too participate in PES schemes.

TIER -2

The Tier 2 studies considered actual, site-specific examples of the three business models

Case Study for Social Forestry (PS)



DIRECT BENEFITS	NPV ($/ha)
Timber products	-
Non-timber products	
1. Pepper	33,958.21
2. Dragon fruit	12,280.10
3. Coffee	69,657.86
4. Honey	0.00
5. Avocado	0.00
6. Long an	116,096.44
7. Durian	0.00
8. Guava	15,237.66
9. Cacao	0.00
10. Rubber	6,965.79
SUB TOTAL	254,196.05

INDIRECT BENEFITS	NPV ($/ha)
Carbon	12,289.48
Biodiversity (improve ecosystem)	164.97
Disaster prevention	711.73
Support agriculture (soil protection)	9,732.78
SUB TOTAL	22,898.96

TOTAL BENEFITS	277,095.01

Capital Costs	NPV ($/ha)
Non-timber products	
1. Pepper	1,679.38
2. Dragon fruit	2,519.06
3. Coffee	2,854.94
4. Honey	1,119.58
5. Avocado	1,865.97
6. Long an	2,798.96
7. Durian	1,399.48
8. Guava	9,796.36
9. Cacao	1,679.38
10. Rubber	414.25
SUB TOTAL	26,127.36

Operational Costs	NPV ($/ha)
Fertilizer	85,977.11
Labor	47,019.06
SUB TOTAL	132,996.17

Opportunity Costs	NPV ($/ha)
Timber	71,679.90
Agriculture land	938.59
SUB TOTAL	72,618.48

TOTAL COSTS	231,742.00

- The benefit-cost-ratio (BCR) of the PS case is 1.20
- The extended cost-benefit analysis of the social forestry business model in Sungai Wain, East Kalimantan, mainly focuses on the calculation of the direct benefits from forestry and agroforestry practices with multiple commodities and the indirect benefits from the ecosystem services of the remaining standing forest.
- The ECBA was done for one social group, KTH Harapan Sejahtera, the largest in Sungai Wain, covering 345 ha. It has 175 active members. The group has three objectives: 1) become a fruit garden forest; 2) optimize the use of HKm land ;and 3) support protection of biodiversity and the water catchment within Sungai Wain.

Analysis and Findings

- The Harapan Sejahtera Forest Farmer Group's social forestry initiative in Sungai Wain Protected Forest demonstrates successful, sustainable community-based forest management. By integrating agroforestry and transitioning from a history of illegal logging, PS enhances ecological balance and improves livelihoods.
- The initiative's benefit-cost ratio (BCR) of 1.597 (direct) and 1.196 (extended) shows its economic viability. This model highlights social forestry's potential for environmental sustainability and socio-economic benefits.

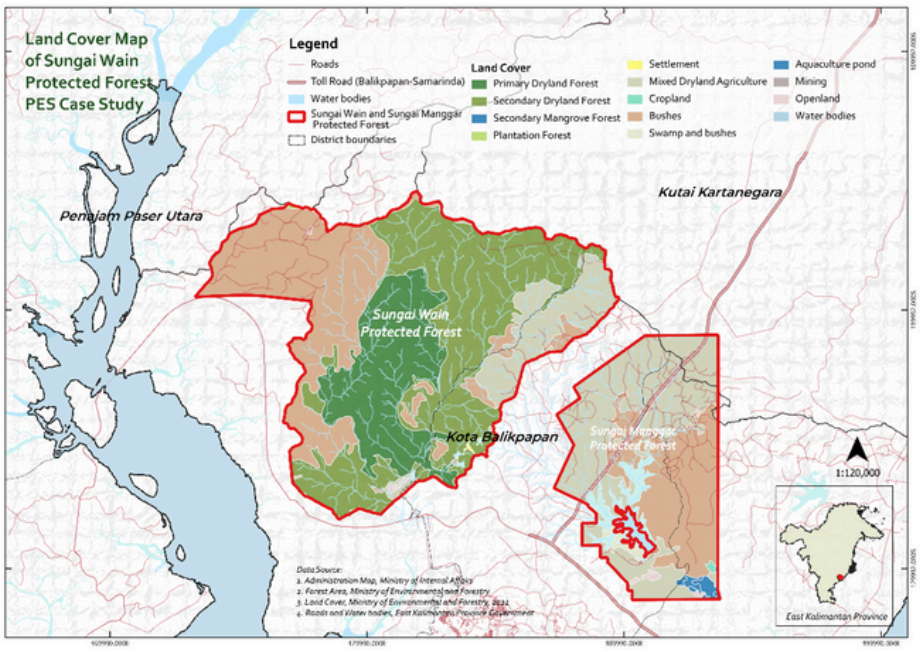
Conclusion and Recomendations

- Support from local authorities and NGOs has been key to this transformation.
- The Harapan Sejahtera Forest Farmer Group in Sungai Wain Protected Forest Serves as a benchmark for other forest communities in Indonesia, balancing biodiversity conservation and economic gains.

TIER -2

The Tier 2 studies considered actual, site-specific examples of the three business models

Case Study for Payment for Ecosystem Services (PES)



- The benefit-cost-ratio (BCR) of the PES case is 2.95
- Sungai Wain and Sungai Manggar Protected Forest are under the Protected Forest Management Unit Balikpapan with a total area 16.000 ha.
- Sungai Wain provides water to a large oil refinery operated by the state-owned oil company PERTAMINA. The Sungai Manggar reservoir, established to regulate the supply of water to the city of Balikpapan, managed by the Municipal-owned Drinking Water Company (Perusahaan Daerah Air Minum, PDAM) Balikpapan. Some 70,000 customers, or more than 70% of households in the city of Balikpapan, are supplied by the Sungai Manggar reservoir.

DIRECT BENEFITS	NPV ($/ha)
Timber products	-
Non-timber products	217.06
Tourism	149.08
Water supply	2,000.60
SUB TOTAL	2,366.73

INDIRECT BENEFITS	NPV ($/ha)
Flood reduction	508.40
Carbon	1,911,02
Biodiversity (improve ecosystem)	164.97
Disaster prevention	711.73
Support agriculture (soil protection)	9,732.78
SUB TOTAL	13,028.90

TOTAL BENEFITS	15,395.64

Capital Cost	NPV ($/ha)
Establishment	90.91
Dredging License and Regulatory	25.98
SUB TOTAL	116.89

Operational Cost	NPV ($/ha)
Operational	67.69
Maintenance and Monitoring	60.62
SUB TOTAL	128.30

Opportunity Cost	NPV ($/ha)
Timber	6,371.08
Agriculture land	25.37
SUB TOTAL	6,396.44

TOTAL COST	6,641.63

BCR	2.318

Analysis and Findings

Monetizing ecosystem services PES schemes or watershed protection and carbon trading, presents a significant opportunity to enhance funding for forest conservation.

Engaging local communities in sustainable forestry and ecotourism initiatives can further strengthen economic benefits while promoting environmental stewardship.

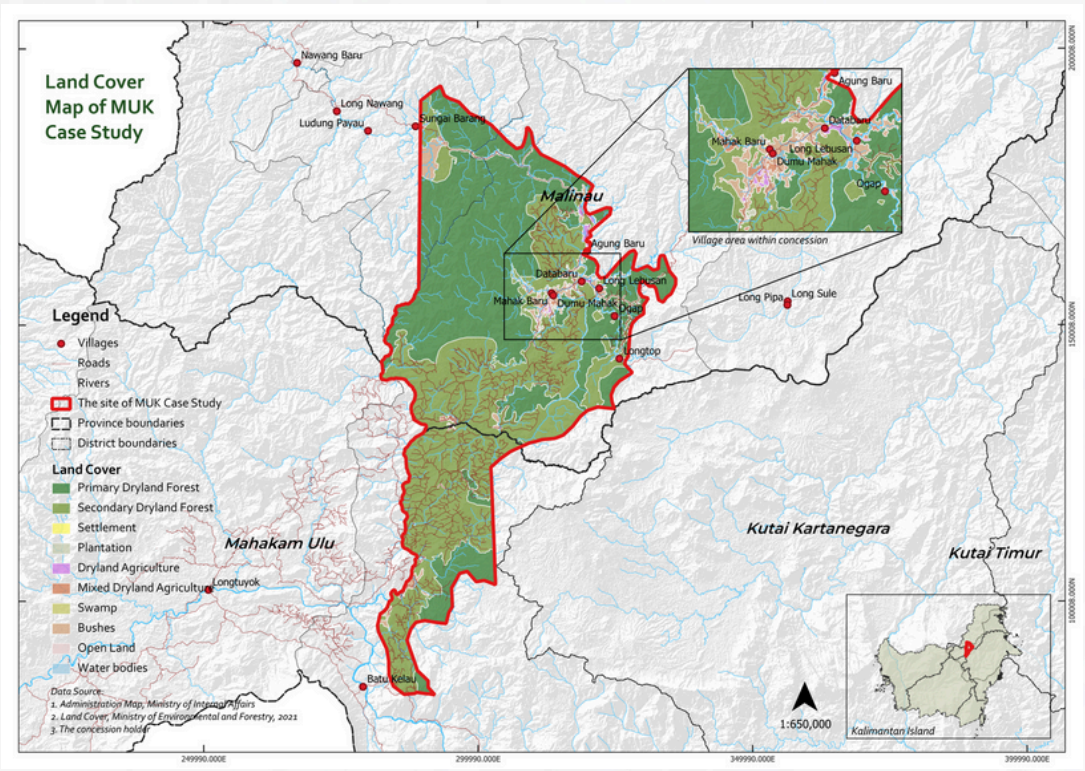
Additionally, improving policies and fostering strong partnerships can help maximize the economic potential of these forests, ensuring the preservation of biodiversity and vital ecosystem functions.

Conclusion and Recomendations

- The Sungai Wain and Sungai Manggar Protected Forests provide vital ecological, economic, and social benefits, including water catchment, biodiversity conservation, and ecotourism. Sustainable management and monetization of ecosystem services, such as NTFPs ($23.03/ha/year), tourism ($6,067.76 annually), and water supply, ensure long-term conservation.
- A cost-benefit analysis shows total benefits of $15,395.64 far exceed costs of $6,641, with a total BCR of 2.31 and a direct BCR of 9.65, making social forestry highly viable.

TIER -2

The Tier 2 studies considered actual, site-specific examples of the three business models
Case Study for MUK (Multi-Usaha Kehutanan)



- The benefit-cost-ratio (BCR) of the MUK case is 1.09, 1.43, and 2.62
- MUK is the newest type of forestry license in Indonesia, enacted in 2021 . Previously, forest concession licenses were issued for conducting one business activity in each concession, mainly logging natural forest, planting and harvesting wood from industrial plantations, and ecosystem restoration.
- The case considered in this study is in Malinau district, North Kalimantan. Malinau houses the catchment areas of many large rivers in North and East Kalimantan, such as the upper Mahakam, Kali Marau, Sesayap, Kayan, Sembakung, and Simanggeris. It is sparsely populated and contains a relatively large portion of intact forest, much of it in remote and difficult terrain. Malinau declared itself to be a ‘conservation district’ in 2007

The ECBA compared three scenarios, which differ from one another according to the proportion of selective logging vs. protecting forest for tradeable carbon credits.

- The first scenario assumes that the entire concession will continue to be selectively logged, without carbon trading.
- The second scenario assumes that half the concession will continue to be logged, while the remaining half will be preserved for forest carbon, with the value of the resulting emissions reductions being sold.
- The third scenario assumes that logging will cease, and the entire concession will instead be set aside for forest carbon s, with the value of the resulting emissions reductions being sold.

Analysis and Findings

Benefit

DIRECT BENEFITS	NPV ($/ha)
Timber products	844.20
Community Payment Logs	25.16
Non-timber products	-
Tourism	-
Water supply	-
SUB TOTAL	869.36

INDIRECT BENEFITS	NPV ($/ha)
Flood reduction	-
Carbon	-
Community Payment Carbon Trust Fund	-
Biodiversity (improve ecosystem)	-
Disaster prevention	-
Support agriculture (soil protection)	-
SUB TOTAL	-
TOTAL BENEFITS	869.36

Cost

Capital Costs	NPV ($/ha)
Asset Due Diligence Cost	-
Legal Cost	0.42
Statutory Costs	2.35
FPIC, Participatory Mapping and Community Project Design	-
Road Construction/Upgrade	164.16
SUB TOTAL	166.93

Operational Costs	NPV ($/ha)
CSR and Community Programs	10.07
Assisted Natural Forest Reforestation & Rehabilitation	2.91
Compliance Costs	4.06
Salaries & Management Costs	78.74
Vehicle Running	6.64
Fire Prevention and Control Equipment & Non-staff	4.87
Harvesting Costs	166.62
Transport Costs	54.51
Resource Tax	-
Road Maintenance	232.51
Carbon Costs (from carbon model)	11.06
Other Overheads	571.97
SUB TOTAL	1,143.95

Opportunity Costs	NPV ($/ha)
Timber	-
Agriculture land	-
SUB TOTAL	-
TOTAL COSTS	1,310.88

Scenario 1:
Continued selective logging across the whole concession, yields an extended benefit-cost ratio (BCR) of 1.09, indicating feasibility. Over a 30-year period (with a 10% discount rate), costs amount to $1,337.73 per hectare, while benefits reach $1,463.79 per hectare. However, logging reduces environmental benefits to about one-fifth of their potential. From a purely financial perspective, excluding indirect benefits and opportunity costs, the BCR increases to 1.60.

TIER -2

The Tier 2 studies considered actual, site-specific examples of the three business models

Case Study for MUK (Multi-Usaha Kehutanan)

Benefit

DIRECT BENEFITS	NPV ($/ha)
Timber products	168.84
Community Payment Logs	5.03
Non-timber products	-
Tourism	-
Water supply	508.40
SUB TOTAL	682.27

INDIRECT BENEFITS	NPV ($/ha)
Flood reduction	508.40
Carbon	162.04
Community Payment Carbon Trust Fund	-
Biodiversity (improve ecosystem)	164.97
Disaster prevention	711.73
Support agriculture (soil protection)	1,216.60
SUB TOTAL	2.763.74

TOTAL BENEFITS	3,446.01

Cost

Capital Costs	NPV ($/ha)
Capital Expenditure	10.56
Legal Cost	0.42
Road Construction/Upgrade	104.39
FPIC, Participatory Mapping and Community Project Design	0.19
Statutory Costs	12.68
SUB TOTAL	128.24

Operational Costs	NPV ($/ha)
CSR and Community Programs	10.07
Assisted Natural Forest Reforestation & Rehabilitation	2.91
Compliance Costs	4.06
Salaries & Management Costs	86.22
Vehicle Running	13.28
Fire Prevention and Control Equipment & Non-staff	4.87
Harvesting Costs	99.97
Transport Costs	32.71
Resource Tax	-
Road Maintenance	139.51
Carbon Costs (from carbon model)	109.53
Other Overheads	11.06
SUB TOTAL	514.17

Opportunity Costs	NPV ($/ha)
Timber	1,535.94
Agriculture land	973.28
SUB TOTAL	2,509.21

TOTAL COSTS	3,151.62

Scenario 2: Protecting half of the concession (129,205 hectares) for its carbon value could sequester 33 MtCO2e over 30 years, averaging 1.1 MtCO2e per year. Carbon credit uptake by the market could be limited, as buyers may perceive risks of illegal logging. Only 40% of potential carbon credits are expected to be sold. The carbon price is projected to start at $10 per ton in 2025, rising to $24 by 2031, then remain stable.

The benefit-cost ratio (BCR) is 1.43, indicating feasibility. While the Conventional BCR (excluding indirect benefits and opportunity costs): 1.12. While financially viable, the success of Scenario 2 depends on carbon market trust, rigorous monitoring, and securing buyer confidence.

Benefit

DIRECT BENEFITS	NPV ($/ha)
Timber products	-
Community Payment Logs	-
Non-timber products	-
Tourism	-
Water supply	508.40
SUB TOTAL	508.40

INDIRECT BENEFITS	NPV ($/ha)
Flood reduction	508.40
Carbon	6,077.11
Verra Credit	36.65
Biodiversity (improve ecosystem)	164.97
Disaster prevention	711.73
Support agriculture (soil protection)	2,433.20
SUB TOTAL	9,932.06

TOTAL BENEFITS	10,440.46

Cost

Capital Costs	NPV ($/ha)
Asset Due Diligence Cost	-
Legal Cost	0.42
Statutory Costs	12.68
FPIC, Participatory Mapping and Community Project Design	0.19
PDD Preparation, PDD Audit, Monitoring Reports & 10 Yr	1.57
SUB TOTAL	16.86

Operational Costs	NPV ($/ha)
CSR and Community Programs	26.81
Assisted Natural Forest Reforestation & Rehabilitation	2.91
Compliance Costs	2.02
Salaries & Management Costs	42.04
Vehicle Running	6.31
Fire Prevention and Control Equipment & Non-staff	4.87
Marketing Cost	1.12
Other Overheads	11.06
SUB TOTAL	97.14

Opportunity Costs	NPV ($/ha)
Timber	2,303.90
Agriculture land	1,459.92
SUB TOTAL	3,763.82

TOTAL COSTS	3,875.82

Scenario 3: Logging comes to an end and the entire 258,409-ha concession is dedicated to forest carbon, with 127.9 MtCO2e sequestered over 30 years, averaging 4.3 tCO2e per ha per year. Carbon price projections follow previous forecasts, stabilizing at $24 per ton after 2031.

The extended benefit-to-cost ratio (BCR), including ecosystem services and opportunity costs, is 2.62,the highest among the three scenarios. The conventional BCR (excluding indirect benefits and opportunity costs) is 6.15, which is highly profitable. Scenario 3 offers the highest economic return, making a carbon-only model the most financially viable approach as well as provididing the greatest social and environmental benefits. However, success depends on stable carbon market demand and strong enforcement to prevent illegal logging.