Food and Agriculture Organization of the United Nations

Annex 3

Economic and Financial Analysis

For the GCF-FAO Project "Forest Landscape Restoration for Climate Benefits and Resilience (Fiji FLR)"

Contents

I. Summary

Economic analysis. An incremental cost-benefit analysis was conducted to assess the economic viability of the project comparing a with and without project scenario. This analysis considered the total cost of the project, a social discount rate of 7.40% , an evaluation period of 30 years, GHG emission reduction, soil erosion reduction, avoided damage to coral reefs linked with the tourist activities, and specific social price conversion factors estimated for this project. Results indicate that the project is likely to yield generally positive returns on investment. The Economic Net Present Value (ENPV) is estimated at USD 146.3 million, and the Economic Internal Rate of Return (EIRR) is 11.60%, with a benefit-cost ratio of 1.66 and switching values of benefit and cost of -39.68% and 65.78%, respectively. The following table shows the main economic indicators considering different evaluation periods, which demonstrate promising economic returns on the entire investment operation in the medium and long term. The project would not be economically viable with an evaluation period of 20 years.

	30 years	25 years	20 years
NPV	$146,344,789.06	$47,529,920.84	($21,279,304.44)
EIRR	11.603%	9.411%	6.244%
B/C	$1.66	$1.24	$0.88
Payback period	17.69	17.69	17.69
ENPV/ha	1813	589	-264
Switching value - benefit	-39.68%	-19%	14%
Switching value - cost	65.78%	24%	-12%

Financial analysis. A financial analysis was conducted based on the projected incremental costs and benefits of various agroforestry and forestry models to be financed under the project. This analysis considered an estimated capital cost for the sector in Fiji of 8.2 percent[1] and an evaluation period of 30 years, given that forestry investments are medium- and long-term. The following table shows the financial indicators for different models, which present mixed results. The most profitable activity would be

[1] Effective annual interest rate estimated for Fiji

agroforestry practiced in areas with less slope, where it is possible to have combined production of high-value annual crops, fruits, trees, and shrubs. Additionally, the non-timber activities associated with the preservation and protection of forest areas show promising returns on investment.

Investment models	Return per hectare (8.2%)	
	IRR (%)	B/C
Agroforestry - A	15.801%	1.22
Agroforestry - B	9.257%	1.03
Community planting of mixed species	10.045%	1.10
Community restoration of waterways and riparian zones	9.039%	1.07
Natural regeneration of degraded forests	7.578%	0.61
Natural regeneration of over logged primary forest	8.748%	1.18
Restoration of over logged plantation	10.138%	1.25
Restoration left aside degraded land	11.286%	1.42
Short Rotation Plantations	9.489%	1.04
Sustainable Forest Management	9.205%	1.14
Investment models	**Return per business (8.2%)**	
	IRR (%)	**B/C**
Forest Protection (SFM) - Non timber activity	11.3%	1.11
Forest Conservation (HFV) - Tourism activity	14.1%	1.21

Sensitivity and scenario analysis. The following table shows the investment returns considering hypothetical changes in key variables that may affect the investment. The results indicate that the project would generally have positive returns on investment, even in the face of adverse situations that cannot be directly controlled by the project.

Sensitivity and scenario analysis				
	Δ%	Risk analysis	IRR (%)	NPV (USD M)
Base scenario		Considering different assumptions and projections for the medium and long term	11.60%	146.34
Project benefits	-10%	Combination of risks affecting output prices, yields and adoption rates	10.85%	109.5
Project benefits	-20%		9.94%	72.6
Switching value - benefits			-39.68%	
Project costs	10%	Increase of input prices	10.95%	124.7
Project costs	20%		10.31%	103.1
Switching value - benefits			65.78%	
Evaluation period (25 years)		Risk related to uncertainty of medium- and long-term investments	9.41%	47.5
Evaluation period (20 years)			6.24%	-21.3
Social discount rate (6%)		Risk related to the economic, political and social stability of the country	na	241.4
Social discount rate (10%)			na	38.5
Without considering indirect costs		Scenario considering the effect of net investment in the forestry and agroforestry models.	11.64%	147.21

Decrease in the success rate of the agroforestry/forestry systems (-20%)	Risk of failure to adopt/apply the technologies and/or practices promoted by the project	11.50%	117.1
Without considering ecosystem services	Effect of ecosystem services	7.63%	7.83
Considering ecosystem services – only GHG emission reduction		9.02%	54.55
Considering ecosystem services – only soil erosion reduction		10.07%	93.49
Considering ecosystem services – only avoided damage to the tourist sector		7.82%	13.96

II. Introduction

The Forest Landscape Restoration for Climate Benefits and Resilience project aims to address the challenge of reducing the exposure and vulnerability to climate change of communities across landscapes while reducing GHG emissions and increasing carbon removals and stock. Climate adaptation is enhanced by proposed investments both in terms of increased resilience of communities and the ecosystems they depend on directly and indirectly (e.g. downstream communities). Restoring and enhancing the ecosystems services and productive capacity of forest landscape is vital for climate resilience of communities across landscapes and for the development of the country as each ecosystem in Fiji is highly interlinked and impacts upstream (e.g. ridge: forests and agriculture areas) will have immediate and severe consequences downstream (e.g. reef: coastal areas and seascapes).

The investments will be oriented to reduce exposure to climate-related adverse impacts and to adopt more climate resilient and sustainable livelihoods while generating ecosystem services, diversifying production (e.g. agroforestry) and increasing their adaptive capacity. This includes facilitating access to finance including from carbon trading and landscape restoration and management. The project will improve household income and reduce poverty through the support to communities and small-holder farmers that will be able to diversify their revenue streams through FLR and SFM activities and the new financial mechanisms developed in collaboration with the FDB. In addition, the activities will be instrumental in contributing to livelihood and therefore resilience of all those communities downstream of the intervention areas. As costal ecosystems (e.g. mangroves, coral reefs and seagrass beds) largely depend on environmentally stable and resilient upstream ecosystems (e.g. forests and grasslands) and being Fiji's economy dependent on ecosystems (e.g. tourism and agriculture), project investments along the watersheds will also increase the overall resilience of coastal communities involved in coastal based tourism (e.g. diving, snorkeling and surfing that are the primary target of tourists arriving in Fiji). Furthermore, as studies have shown , upstream landscapes with high erodibility will exacerbate river flooding events in downstream coastal areas. It is therefore of utmost importance to protect watersheds with FLR approaches

Considering the above-mentioned characteristics of the proposal, an ex-ante incremental cost-benefit analysis was conducted to evaluate the economic and financial viability of the proposal. This annex presents the detailed methodology, approach, and results of that analysis.

III. Methodological approach

1. The incremental ex-ante cost-benefit analysis involved calculating key economic and financial metrics, such as NPV, IRR, B/C ratio, payback period, and switching values to assess potential returns across the entire project, its components, and primary activities comparing a with and without project scenario. The financial analysis offers insights into the returns generated by activities supported by the project, examining them from the perspectives of private enterprises, producer organizations, and beneficiaries. In contrast, the economic analysis highlights the genuine societal benefits, which hold particular significance for policymakers and organizations operating within the public investment framework.

2. **The analysis considered the following general investment parameters as the base scenario, reflecting the main characteristics of the investments:** i) an evaluation period of 30 years, ii) a social discount rate of 7.40 percent and a cost of capital of 8.20 percent, iii) a 7-year effective project implementation timeline, and iv) conversion factors from private to social prices estimated exclusively for Fiji using macroeconomic data. To assess the robustness of the results, sensitivity and scenario analyses were performed. These evaluations examined the potential impact of changes in key variables, including benefits, production costs, evaluation period, and social discount rates.

3. The analysis considered both the direct investment costs and operational costs of the project, as well as expected contributions from beneficiaries, detailing these expenses in the cash flow. To ensure an accurate evaluation of the project's benefits and costs, adjustments were made to reflect the timing of all financial flows. These adjustments accounted for disbursement delays, projected adoption rates, and the distribution of benefits throughout the project's implementation phase, particularly in relation to the characteristics of the forestry and agroforestry systems expected to benefit directly from the project. Additionally, the analysis incorporated the value of reducing GHG emissions, using a social price of carbon recommended by the World Bank.

3.1 Derivation of general investment parameters

Several estimates were made to determine general investment parameters, as shown in the following tables:

a) Derivation of the general investment parameters

Table 1. Summary of the general investment parameter assumptions

Parameters		Values
Standard Conversion Factor	SCF	0.927
Shadow Exchange Rate	SERF	1.079
Shadow Wage Rate Factor - Unskilled (adjusted SWRF)	SWRF - adj	0.731
Shadow Wage Rate Factor - skilled (adjusted SWRF)	SWRF - adj	0.811
Shadow Wage Rate Factor - unskilled labor (SWRF)	SWRF	0.789
Shadow Wage Rate Factor - skilled labor (SWRF)	SWRF	0.875
Conversion factor for non-tradable goods/services	CF	0.917
Cost of capital (%)	**r**	**8.20%**[2]

[2] Value estimated using the Weighted Average Cost of Capital (WACC)

Social discount rate (%) - Estimated	**SDR**	**7.40%**[3]
Social discount rate (%) - used by ADB	SDR	10.0%
Social discount rate (%) - used by WB	SDR	6%

Source: prepared by the authors

b) Derivation of the conversion factors

Table 2. Derivation of the conversion factors

Variables	Values
SERF = ((M + Tm - Sm) + (X - Tx + Sx)) / (M + X)	
M = imports (LCU)	5,173,071,001
Tm = taxes on imports (LCU)	755,691,658
Sm = subsidies on imports (LCU)	0
X = exports (LCU)	4,411,276,923
Tx = taxes on exports (LCU)	0.00
Sx = subsidies on exports (LCU)	0
M + Tm - Sm (LCU)	5,928,762,660
X - tx + Sx (LCU)	4,411,277
SERF	**1.08**
SCF = 1/SERF	**0.9269**
VAT (%)	9%

Source: prepared by the authors

c) Derivation of the shadow price of labor

Table 3. Derivation of the shadow price of labor

Methodology	Market Wage (USD/hour)	Adjustment Factor Calculation	Unemployment Rate	Social Adjustment Factor	Productivity Adjustment Factor	Wage Differential	Training and Integration Cost	Adjustment Factor	Shadow Price Formula	Shadow Price (USD/hour)	Conversion factor
B.1 Unskilled labour											
Economic Opportunity Cost Approach	4	1 - Unemployment Rate	0.086					0.914	Market Wage * (1 - Unemployment Rate) * Adjustment Factor	2.57	0.64
Social Cost-Benefit Analysis Approach	4	1 - Social Adjustment Factor		0.15				0.85	Market Wage * (1 - Adjustment Factor)	3.4	0.85
Productivity Loss Approach	4	Productivity Adjustment Factor			0.75			0.75	Market Wage * Adjustment Factor	3	0.75
Wage Differential Approach	4	1 - Wage Differential				0.2		0.8	Market Wage * (1 - Adjustment Factor)	3.2	0.80
Replacement Cost Approach	4	1 - Training and Integration Cost					0.1	0.9	Market Wage - (Market Wage * Adjustment Factor)	3.6	0.90
Average	4									3.154	0.79
B.2 Skilled labour											
Economic Opportunity Cost Approach	6	1 - Unemployment Rate	0.086					0.914	Market Wage * (1 - Unemployment Rate) * Adjustment Factor	4.94	0.82
Social Cost-Benefit Analysis Approach	6	1 - Social Adjustment Factor		0.1				0.9	Market Wage * (1 - Adjustment Factor)	5.4	0.90
Productivity Loss Approach	6	Productivity Adjustment Factor			0.85			0.85	Market Wage * Adjustment Factor	5.1	0.85
Wage Differential Approach	6	1 - Wage Differential				0.15		0.85	Market Wage * (1 - Adjustment Factor)	5.1	0.85
Replacement Cost Approach	6	1 - Training and Integration Cost					0.05	0.95	Market Wage - (Market Wage * Adjustment Factor)	5.7	0.95
Average	6									5.248	0.87

Source: prepared by the authors

[3] Value estimated using the Weighted Average Approach

3.1 Forestry and agroforestry models

1. **Investment/forestry and agroforestry models considered for the EFA.** The analysis relied on tailored investment/farm models described in the following table, each proposed to align with the technical specifications of every project component.

Table 4. Project Investment Models

Investment models/	Incremental benefits/Costs
1.A Agroforestry A – Slope (12 – 15 grades)	Benefits: Increased yields Increased productivity per hectare of agricultural crop due to diversification of production, reduced soil erosion and increased carbon sequestration per hectare Costs: Production costs are increasing due to the use of new technologies in the agroforestry system. Indicative cropping pattern: taro, cassava, ginger, banana, pineapple, citrus, Gliricidia and Calliandra
1.B Agroforestry B – Slope (16 – 21 grades)	Benefits: Increased yields Increased productivity per hectare of agricultural crop due to diversification of production, reduced soil erosion and increased carbon sequestration per hectare Costs: Production costs are increasing due to the use of new technologies in the agroforestry system. Indicative cropping pattern and forestry species: taro, cassava, ginger, banana, pineapple, citrus, Gliricidia, Calliandra, Uto and Kavika.
2. Community planting of mixed species	Benefits: Increased yields of high-value commercial timber production, reduced soil erosion and increased carbon sequestration per hectare Costs: Increased cost of plantation installation and maintenance of forest area Indicative forestry species: vesi, vaivai, ivi and breadfruit
3. Community restoration of waterways and riparian zones	Benefits: Increased yields of commercial timber production, reduced soil erosion and increased carbon sequestration per hectare Costs: Increased cost of plantation installation and maintenance of forest area Indicative forestry species: kaudamu, kauvala, damanu, and dakua makadre
4. Natural regeneration of degraded forests	Benefits: Increased yields of high-value commercial timber production, firewood production, reduced soil erosion and increased carbon sequestration per hectare Costs: Increased cost of plantation installation and maintenance of forest area Indicative forestry species: kaudamu, kauvalu, damanu, dakua makadre
5. Natural regeneration of over logged primary forest	Benefits: Increased yields of high-value commercial timber production, firewood production, reduced soil erosion and increased carbon sequestration per hectare Costs: Increased cost of plantation installation and maintenance of forest area Indicative forestry species: kaudamu, kauvalu, damanu, dakua makadre
6. Restoration of over logged plantation	Benefits: Increased yields of high-value commercial timber production, firewood production, reduced soil erosion and increased carbon sequestration per hectare Costs: Increased cost of plantation installation and maintenance of forest area Indicative forestry species: kaudamu, kauvalu, dakua makadre, Kaunicina
7. Restoration left aside degraded land	Benefits: Increased yields of high-value commercial timber production, firewood production, reduced soil erosion and increased carbon sequestration per hectare Costs: Increased cost of plantation installation and maintenance of forest area Indicative forestry species: kaudamu, kauvalu, dakua makadre, Kaunicina
8. Establishment of High Conservation Value Forests	Benefits: Reduced deforestation, reduction of GHG emissions, reduced soil erosion, and increased income for communities through the promotion of non-timber activities and tourism, which depend on native forest areas. Costs: Increased costs in implementing and maintaining checkpoints, as well as in the implementation and maintenance of ecotourism infrastructure and equipment, and the collection and processing of non-timber products.

Investment models/	Incremental benefits/Costs
	Indicative activities: Handicraft products and ecotourism
9. Establishment of Permanent Forest Estate (SFM of Production Forests)	Benefits: Increased yields of high-value commercial timber production, firewood production, reduced soil erosion and increased carbon sequestration per hectare Costs: Increased cost of plantation installation and maintenance of forest area Indicative forestry species: kaudamu, kauvalu, dakua makadre
10. Short plantation rotation	Benefits: Increased bamboo production, reduced soil erosion and increased carbon sequestration per hectare Costs: Increased cost of plantation installation and maintenance of bamboo production Indicative forestry species: Bamboo

2. **The following table shows the hectares considered for each investment model, along with the investment per hectare for each model mentioned above**

Table 5. Area and investments for each forestry and agroforestry models

Action	Target (ha)	Total investment (USD/ha)
1. Model A. Forest Protection (SFM)	10,000	229.0
2. Model A. Forest Conservation (HFV)	12,000	246.9
3. Forest Restoration	26,562	849.3
i) Model 2. Community planting of mixed species	*6,000*	849.3
ii) Model 3. Community restoration of waterways and riparian zones	*5,000*	849.3
iii) Model 4. Natural regeneration of degraded forests	*7,000*	849.3
iv) Model 5. Natural regeneration of over logged primary forest	*6,000*	849.3
v) Model 6. Restoration of over logged plantation	*500*	849.3
vi) Model 7. Restoration left aside degraded land	*2,062*	849.3
4. Model 9. Sustainable Forest Management	24,375	475.8
5. Agroforestry	7,000	1277.6
a) Model A	3,500	1277.6
b) Model B	3,500	691.7
6. Short Rotation Plantations	800	9722.5
Total	80,737	695.2

Source: prepared by the authors

3.2 Main assumptions on forestry and agroforestry models in a without and with project situation used for cost-benefit analysis.

The following tables show the main assumptions used to estimate the project's financial and economic indicators for each forestry and agroforestry model included in this analysis.

i) Agroforestry A – Slope (12 – 15 grades)

Items		Unit	WOP	WP
A. Land use			**100%**	**100%**
Annual crops			89%	50%
	Taro	%	40%	20%
	Cassava	%	40%	20%

Ginger	%	9%	10%
Fruit		**6%**	**30%**
Banana	%	2%	10%
Pineapple	%	2%	10%
Citrus		2%	10%
Trees (shrubs)		**5%**	**20%**
Glyricidia	%	3%	10%
Calliandra	%	2%	10%
B. Yields	Kg/ha		
Annual crops	Kg/ha		
Yield increase (%)		0%	30%
Taro	Kg/ha	12000	15600
Cassava	Kg/ha	14000	18200
Ginger	Kg/ha	15000	19500
Fruit	Kg/ha		
Yield increase (%)		0%	30%
Banana	Kg/ha	10000	13000
Pineapple	Kg/ha	40000	52000
Citrus	Kg/ha	15000	19500
Trees (shrubs)	m3/ha		
Yield increase (%)		0%	20%
Glyricidia	m3/ha	3.075	3.69
Calliandra	m3/ha	3.075	3.69
C. Ecosystem services			
GHG emission reduction	tCO2eq/ha		3.03
Erosion reduction	ton/ha		11.9

ii) Agroforestry B – Slope (16 – 21 grades)

Items	Unit	WOP	WP
A. Land use		**100%**	**100%**
Annual crops		80%	50%
Taro	%	40%	25%
Cassava	%	40%	25%
Ginger	%	0%	0%
Fruit		**10%**	**30%**
Banana	%	4%	12%
Pineapple	%	4%	10%
Citrus		2%	8%
Trees (shrubs)		**10%**	**20%**
Glyricidia	%	3%	8%
Calliandra	%	3%	6%
Uto	%	2%	3%
Kavika	%	2%	3%
B. Yields	Kg/ha		
Annual crops	Kg/ha		
Yield increase (%)		0%	30%
Taro	Kg/ha	12000	15600
Cassava	Kg/ha	14000	18200
Ginger	Kg/ha	15000	19500
Fruit	Kg/ha		
Yield increase (%)		0%	30%
Banana	Kg/ha	10000	13000

	Pineapple	Kg/ha	40000	52000
Trees (shrubs)/native fruits		m3/ha		
Yield increase (%)			0%	20%
	Glyricidia	m3/ha	3.075	3.69
	Calliandra	m3/ha	3.075	3.69
C. Ecosystem services				
	GHG emission reduction	tCO2eq/ha	0	3.0
	Erosion reduction	ton/ha	0	11.9

iii) Community planting of mixed species

Items	Unit	WOP	Harvest 1	Harvest 2	WP Harvest 3	Harvest 4	Harvest 5
A. Land use							
Kauvula	%	5%	30%	30%	30%	30%	30%
Kaunicina	%	5%	20%	20%	20%	20%	20%
Dakua Salusalu	%	5%	30%	30%	30%	30%	30%
Dawa	%	5%	20%	20%	20%	20%	20%
Degraded land	%	80%	0%	0%	0%	0%	0%
B. Yields							
Kauvula	m3/ha	2.025	40.500	0.000	40.500	40.500	0.000
Kaunicina	m3/ha	0.720	14.400	0.000	14.400	14.400	0.000
Dakua Salusalu	m3/ha	4.725	0.000	94.500	0.000	0.000	15.000
Dawa	m3/ha	1.530	30.600	0.000	30.600	30.600	0.000
C. Ecosystem services							
GHG emission reduction	tCO2eq/ha	0	0	6	6	6	6
Erosion reduction	ton/ha	0	0	74	74	74	74

iv) Community restoration of waterways and riparian zones

Items	Unit	WOP	Harvest 1	Harvest 2	Harvest 3	Harvest 4	WP Harvest 5	Harvest 6	Harvest 7	Harvest 8	Harvest 9
A. Land use											
Vesi	%	5%	20%	30%	30%	30%	30%	30%	30%	30%	30%
Vaivai	%	5%	20%	20%	20%	20%	20%	20%	20%	20%	20%
Ivi	%	5%	20%	30%	30%	30%	30%	30%	30%	30%	30%
Breadfruit	%	5%	20%	20%	20%	20%	20%	20%	20%	20%	20%
B. Yields											
Vesi	m3/ha	6120%	0%	0%	0%	0%	0%	0%	0%	6120%	0%
Vaivai	m3/ha	1500%	1500%	0%	1500%	1500%	0%	1500%	0%	1500%	1500%
Ivi	m3/ha	1500%	0%	0%	0%	0%	0%	1500%	0%	0%	0%
Breadfruit -timber	m3/ha	1500%	0%	0%	1500%	0%	0%	1500%	0%	0%	0%
Yield increase (%)											

Breadfruit - fruit	kg/ha	6000	6000	0	0	6000	6000	0	6000	6000	0
C. Ecosystem services											
GHG emission reduction	tCO2eq/ha	0	0	0	6	6	6	6	6	6	6
Erosion reduction	ton/ha	0	0	0	74	74	74	74	74	74	74

v) Natural regeneration of degraded forests

Items	Unit	WOP	WP				
			Harvest 1	Harvest 2	Harvest 3	Harvest 4	Harvest 5
A. Land use							
Kaudamu	%	2%	30%	30%	30%	30%	30%
Kauvula	%	2%	20%	20%	20%	20%	20%
Damanu	%	2%	30%	30%	30%	30%	30%
Dakua Makadre	%	2%	20%	20%	20%	20%	20%
Degraded land	%	92%	0%	0%	0%	0%	0%
B. Yields							
Yield increase (%)		0%	100%	100%	100%	100%	100%
Kaudamu	m3/ha	75.0	0.0	0.0	0.0	0.0	0.0
Kauvula	m3/ha	37.5	0.0	37.5	0.0	0.0	37.5
Damanu	m3/ha	45.0	0.0	0.0	0.0	0.0	0.0
Dakua Makadre	m3/ha	62.5	0.0	0.0	0.0	0.0	62.5
C. Ecosystem services							
GHG emission reduction	tCO2eq/ha	0	0	6	6	6	6
Erosion reduction	ton/ha	0	0	74	74	74	74

vi) Natural regeneration of over logged primary forest

Items	Unit	WOP	WP				
			Harvest 1	Harvest 2	Harvest 3	Harvest 4	Harvest 5
A. Land use							
Kaudamu	%	1%	30%	30%	30%	30%	30%
Kauvula	%	1%	20%	20%	20%	20%	20%
Damanu	%	1%	30%	30%	30%	30%	30%
Dakua Makadre	%	1%	20%	20%	20%	20%	20%
Degraded land	%	92%	0%	0%	0%	0%	0%
B. Yields							
Yield increase (%)							
Kaudamu	m3/ha	53.1	0.0	0.0	0.0	0.0	0.0
Kauvula	m3/ha	27.6	0.0	27.6	0.0	0.0	27.6
Damanu	m3/ha	31.9	0.0	0.0	0.0	0.0	0.0
Dakua Makadre	m3/ha	44.3	0.0	0.0	0.0	0.0	44.3
C. Ecosystem services							
GHG emission reduction	tCO2eq/ha	0	0	6	6	6	6
Erosion reduction	ton/ha	0	0	74	74	74	74

VII). Restoration of over logged plantation

Items	Unit	WOP	WP

			Harvest 1	Harvest 2	Harvest 3	Harvest 4	Harvest 5
A. Land use							
Kaudamu	%	1%	30%	30%	30%	30%	30%
Dakua Makadre	%	1%	20%	20%	20%	20%	20%
Kauvula	%	1%	30%	30%	30%	30%	30%
Kaunicina	%	1%	20%	20%	20%	20%	20%
Degraded land	%	96%	0%	0%	0%	0%	0%
B. Yields							
Yield increase (%)							
Kaudamu	m3/ha	0.60	0.00	0.00	0.00	0.00	0.00
Dakua Makadre	m3/ha	0.50	0.00	0.00	0.00	0.00	50.00
Kauvula	m3/ha	0.45	0.00	45.00	0.00	0.00	45.00
Kaunicina	m3/ha	0.24	0.00	0.00	0.00	0.00	0.00
C. Ecosystem services							
GHG emission reduction	tCO2eq/ha	0	6	6	6	6	6
Erosion reduction	ton/ha	0	74	74	74	74	74

VIII) Restoration left aside degraded land

Items	Unit	WOP	WP				
			Harvest 1	Harvest 2	Harvest 3	Harvest 4	Harvest 5
A. Land use							
Kaudamu	%	0%	30%	30%	30%	30%	30%
Dakua Makadre	%	0%	20%	20%	20%	20%	20%
Kauvula	%	0%	30%	30%	30%	30%	30%
Kaunicina	%	0%	20%	20%	20%	20%	20%
Degraded land	%	100%	0%	0%	0%	0%	0%
B. Yields							
Yield increase (%)							
Kaudamu	m3/ha	0.000	0.000	0.000	0.000	0.000	0.000
Dakua Makadre	m3/ha	0.000	0.000	0.000	0.000	0.000	69.250
Kauvula	m3/ha	0.000	0.000	62.325	0.000	0.000	62.325
Kaunicina	m3/ha	0.000	0.000	0.000	0.000	0.000	0.000
Ecosystem services							
GHG emission reduction	tCO2eq/ha	0	0	6	6	6	6
Erosion reduction	ton/ha	0	0	74	74	74	74

IX) Establishment of Permanent Forest Estate (SFM of Production Forests)

Items			WP				
	Unit	WOP	Harvest 1	Harvest 2	Harvest 3	Harvest 4	Harvest 5
A. Land use							
Kaudamu	%	3%	25%	25%	25%	25%	25%
Kauvula	%	3%	25%	25%	25%	25%	25%
Damanu	%	3%	25%	25%	25%	25%	25%
Dakua Makadre	%	3%	25%	25%	25%	25%	25%
No appropriate use	%	88%	0%	0%	0%	0%	0%

B. Yields							
Yield increase (%)							
Kaudamu	m3/ha	63.360	0.000	0.000	0.000	0.000	0.000
Kauvula	m3/ha	32.947	0.000	32.947	0.000	0.000	32.947
Damanu	m3/ha	38.016	0.000	0.000	0.000	0.000	0.000
Dakua Makadre	m3/ha	52.800	0.000	0.000	0.000	0.000	52.800
C. Ecosystem services							
GHG emission reduction	tCO2eq/ha	0	2	2	2	2	2
Erosion reduction	ton/ha	0	8	8	8	8	8

X) Establishment of High Conservation Value Forests

Items	Unit	WOP	WP
A. Handicraft (from waste wood)			
Handicraft Products (Average)	%	10%	100%
B. Production			
Production (%)			
Handicraft Products (Average)	unit	100.000	527
Reduction of soil erosion for avoiding deforestation (%)		3%	1%
Reduction of soil erosion for avoiding deforestation (%)		3%	1%
C. Ecosystem services			
GHG emission reduction	tCO2eq/ha	0.00	0.01
Erosion reduction	ton/ha	0	7
D. Tourism			
Tourist	Visitors	1000	1540
Emission reduction	%	0%	29%
GHG emission reduction	tCO2eq/ha	0	1.89
Erosion reduction	ton/ha	0	3.58

XI. Short plantation rotation

Items	Unit	WOP	WP Harvest 1	Harvest 2	Harvest 3	Harvest 4	Harvest 5
A. Land use							
Bamboo	%	0%	100%	100%	100%	100%	100%
Degraded land	%	100%	0%	0%	0%	0%	0%
B. Yields							
Yield increase (%)		0%	60%	100%	100%	100%	100%
Bamboo	m3/ha	0.000	4.000	4.000	4.000	4.000	4.000
Ecosystem services							
GHG emission reduction	tCO2eq/ha	0	0	0	0	0	0
Erosion reduction	ton/ha	0	6	9	9	9	9

3.2 Ecosystem services

a) Emission reduction analysis

The economic analysis included the greenhouse gas reduction benefits estimated for each forestry and agroforestry model using NEXT tool, as shown below.

Table 6. GHG emission

Action	Target (ha)	Target (kt CO_{2eq})	Reference Activity(s)
Forest Protection	10,000	-477	Activity:1.3.2
Forest Conservation	12,000	-454	Activity:2.2.2
Forest Restoration	26,562	-3,011	Activities: 2.2.1 & 3.3.1
Sustainable Forest Management	24,375	-883	Activity: 3.3.2
Agroforestry	7,000	-2,118	Activity: 3.3.3
Short Rotation Plantations	800	-2	Activity: 3.3.2
Total	**80,737**	**-6,945**	

These results were calculated to estimate the benefits of emission reductions, using the shadow carbon prices recommended by the World Bank, adjusted to 2023 USD with the US Consumer Price Index (CPI).

Table 7. Shadow price of carbon

	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
Low	55	56	57	58	59	61	62	63	64	66	68	69	71	72	74	76	78	79	81	83	84	87	88	90	93	94	97
High	108	110	113	116	119	121	124	126	130	133	135	139	141	145	149	151	155	159	162	166	170	173	177	181	185	190	193

Source: World Bank

b) Avoided damage to the tourism sector

As part of the cost-benefit analysis, It was estimated the avoided damage to Fiji's tourism sector by implementing integrated watershed management activities to protect the marine coral reef ecosystems, which is directly connected to the country's tourism industry. The respective estimates are shown below.

Table 8. Derivation of the avoided damage in the tourism sector

Variables	Value
Total economic value of the tourist sector linked to the coral reefs (MUSD/year)	486.3
Loss to the value of tourism associated to the coral reef degradation (%)	8%
Loss to the value of tourism associated to the coral reef degradation (MUSD/year)	36
Coral reef degradation due to sediment damage (%)	22%
The avoided cost in the tourism sector for implementing improved watershed management in the project intervention (MUSD/year)	8.02395
Coral reefs in Fiji	5,460
The avoided cost in the tourism sector for implementing improved watershed management in the project intervention (USD/year/km2)	1470
Coral reefs impacted directly by the project	350
The avoided cost in the tourism sector for implementing improved watershed management in the project intervention (USD/year)	**514,356**

Source: prepared by the authors based on different information sources

c) Soil erosion

The economic analysis also considers the economic benefits from reduced soil erosion rates resulting from the implementation of improved forestry and agroforestry systems. The results of this estimate are shown in the following table.

*Table 9. Reduction of soil erosion

Models	Erosion rate (ton/ha/year)
Forest Protection	-7.162
Forest Conservation	-3.581
Forest Restoration	-73.9
Sustainable Forest Management	-7.8
Agroforestry	-59.5
Short Rotation Plantations	-9.46

Source: prepared by the authors based on the use of google earth engine

The shadow price of soil was calculated using secondary information and different assumptions, as presented in the following table

Table 10. Shadow price of soil

Category	Value (USD/ton)	Sources
Economic Loss	3	Assumed value for lost productivity per ton (Pimentel et al., 1995; FAO Reports)
Environmental Impact	2.74	Calculated based on environmental costs per hectare and erosion rate (Lal, 1998; World Bank Publications)
Social and Cultural Impact	2.74	Calculated based on social costs per hectare and erosion rate (UNCCD, 2020; FAO and World Bank Reports)
Total Social Price	8.48	Sum of Economic Loss, Environmental Impact, and Social and Cultural Impact

Source: prepared by the authors based on the secondary information and using AI platform for the iteration of the results

IV. Results

i) Aggregated results

3. The table below presents the estimated economic indicators for the overall project investment.

Table 11. Ex-ante cost-benefit analysis – Summary of results of the Economic indicators

NPV (USD million)	EIRR (%)	B/C	Payback period (year)	ENPV/ha	Switching value – benefit (%)	Switching value – cost (%)
146.34	11.603%	1.66	17.69	1813	-39.68%	65.78%

4. **The project's EFA points to a promising return on investment. This analysis takes into consideration the overall project cost, which includes contributions from beneficiaries.** Key economic indicators, such as NPV, IRR, B/C ratio, and the payback period, have been calculated at US$146.34 million, 11.60 percent,

1.66, and 17.69 years, respectively. These findings include an assessment of specific ecosystem services, such as the reduction in GHG emissions, reduction in soil erosion, and avoided damage to the coral reefs in Fiji. The following table provides details on the aggregate economic flow for the entire project.

Table 12. Aggregated economic cash flow

Year	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Incremental benefits	**(579,509.73)**	**(3,547,142.13)**	**(11,006,198.09)**	**(18,848,515.06)**	**(25,561,668.78)**	**(29,432,630.40)**	**(23,936,403.47)**
Year 1	-1093865.503	-1087588.39	-1324538.373	-1161043.895	-364835.3046	195680.13	-318252.5486
Year 2	0	-2973909.509	-2956843.821	-3601043.502	-3156548.469	-991883.5345	531998.6759
Year 3	0	0	-7239171.661	-7197629.899	-8765758.336	-7683756.403	-2414469.961
Year 4	0	0	0	-7403153.536	-7360670.769	-8964320.486	-7857809.02
Year 5	0	0	0	0	-6428211.672	-6391323.578	-7783784.207
Year 6	0	0	0	0	0	-6111382.302	-6076312.324
Year 7	0	0	0	0	0	0	-532129.8547
Incremental cost	**803127.506**	**2442572.27**	**6454146.736**	**8740101.296**	**11134314.46**	**14074066.8**	**14094360.03**
Year 1	803127.506	259096.7699	434660.6011	408214.5165	674726.4418	586743.5734	878516.3858
Year 2	0	2183475.5	704410.5016	1181718.676	1109819.286	1834389.489	1595189.068
Year 3	0	0	5315075.633	1714695.261	2876571.842	2701552.386	4465320.94
Year 4	0	0	0	5435472.842	1753536.575	2941732.01	2762748.009
Year 5	0	0	0	0	4719660.317	1522608.47	2554327.146
Year 6	0	0	0	0	0	4487040.876	1447563.169
Year 7	0	0	0	0	0	0	390695.3111
Investment	**246650.5516**	**670572.7703**	**1632326.532**	**1669302.029**	**1449467.005**	**1378026.651**	**119987.4407**
Year 1	246650.5516	0	0	0	0	0	0
Year 2	0	670572.7703	0	0	0	0	0
Year 3	0	0	1632326.532	0	0	0	0
Year 4	0	0	0	1669302.029	0	0	0
Year 5	0	0	0	0	1449467.005	0	0
Year 6	0	0	0	0	0	1378026.651	0
Year 7	0	0	0	0	0	0	119987.4407
Operation cost	**79662.90597**	**201496.242**	**216682.2351**	**175315.5081**	**169947.2303**	**136004.33**	**173390.9356**
Year 1	79662.90597	0	0	0	0	0	0
Year 2	0	201496.242	0	0	0	0	0
Year 3	0	0	216682.2351	0	0	0	0
Year 4	0	0	0	175315.5081	0	0	0
Year 5	0	0	0	0	169947.2303	0	0
Year 6	0	0	0	0	0	136004.33	0
Year 7	0	0	0	0	0	0	173390.9356
Incremental cash flow	**- 1,708,950.70**	**- 6,861,783.41**	**- 19,309,353.59**	**- 29,433,233.90**	**- 38,315,397.48**	**- 45,020,728.19**	**- 38,324,141.88**
Aggregated cash flow	- 1,708,950.70	(8,570,734.11)	(27,880,087.70)	(57,313,321.59)	(95,628,719.07)	(140,649,447.26)	(178,973,589.14)

Year	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15
Incremental benefits	**(15,705,687.59)**	**(7,262,559.07)**	**3,483,074.56**	**11,213,643.22**	**15,340,958.41**	**21,774,645.89**	**24,838,436.50**	**46,734,780.65**
Year 1	571562.6401	726056.7588	819282.844	753064.5576	767402.038	1340147.197	1356208.03	1911573.08
Year 2	-865238.2562	1553916.423	1973942.036	2227397.274	2047368.568	2086348.103	3643479.46	3687144.302
Year 3	1295005.691	-2106186.569	3782585.752	4805023.559	5421991.213	4983760.425	5078645.474	8869057.105
Year 4	-2469162.587	1324340.188	-2153895.953	3868268.967	4913867.057	5544810.277	5096652.675	5193687.062
Year 5	-6822992.112	-2143991.704	1149934.148	-1870243.409	3358845.876	4266746.248	4814598.801	4425460.319
Year 6	-7400142.29	-6486705.259	-2038320.084	1093256.968	-1778064.111	3193297.341	4056449.73	4577300.096
Year 7	-529076.244	-644344.6748	-564809.9492	-177480.4646	95191.99467	-154819.4746	278046.564	351202.9088
Incremental cost	**16568730.63**	**19384005.59**	**22298037.26**	**24714889.43**	**27202971.48**	**28335049.09**	**28290328.2**	**28413180.94**
Year 1	777384.5942	1028284.242	995708.3284	1172401.162	704621.8158	1108224.271	705004.1743	1440536.139
Year 2	2388436.445	2113487.837	2795612.693	2707048.039	3187425.65	1915666.517	3012946.919	1916706.041
Year 3	3883052.749	5813997.156	5144709.754	6805156.688	6589570.192	7758918.477	4663167.698	7334197.59
Year 4	4566469.488	3971011.745	5945695.946	5261247.832	6959307.246	6738837.28	7934673.668	4768797.875
Year 5	2398914.046	3965098.429	3448058.172	5162690.723	4568379.483	6042816.733	5851381.07	6889734.441
Year 6	2428431.189	2280677.985	3769669.327	3278112.601	4908235.497	4343216.27	5744982.449	5562982.138
Year 7	126042.1196	211448.1916	198583.0349	328232.3855	285431.5924	427369.5398	378172.225	500226.7123
Investment	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Year 1								
Year 2								
Year 3								
Year 4								
Year 5								
Year 6								
Year 7								
Operation cost	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Year 1								
Year 2								
Year 3								
Year 4								
Year 5								
Year 6								
Year 7								
Incremental cash flow	**- 32,274,418.22**	**- 26,646,564.65**	**- 18,814,962.69**	**- 13,501,246.21**	**- 11,862,013.07**	**- 6,560,403.20**	**- 3,451,891.70**	**18,321,599.71**
Aggregated cash flow	(211,248,007.36)	(237,894,572.01)	(256,709,534.70)	(270,210,780.91)	(282,072,793.98)	(288,633,197.18)	(292,085,088.89)	(273,763,489.18)

Year	Year 16	Year 17	Year 18	Year 19	Year 20	Year 21	Year 22	Year 23
Incremental benefits	**81,543,365.46**	**155,579,334.99**	**164,592,068.67**	**150,656,859.45**	**156,312,628.64**	**81,413,200.64**	**########**	**########**
Year 1	1900998.422	1689034.843	1709203.08	894199.3225	1200104.9	940744.7423	966091.842	1550503.425
Year 2	51967093.29	5168274.59	4592005.842	4646837.547	2431071.894	3262745.85	2557617.665	2626529.228
Year 3	8975347.253	12649716.3	12580755.01	11177985.9	11311458.73	5917786.397	7942570.17	6225822.699
Year 4	9069959.18	9178657.015	12936590.6	12865734.55	11431189.88	11567686.14	6051836.224	8122165.96
Year 5	4509715.978	7875511.048	7969894.163	11232872.1	11171410.21	9925784.717	10044305.41	5254853.092
Year 6	4207341.21	4287444.132	7487348.161	7577079.384	10679246.3	10620801.26	9436569.321	9549248.442
Year 7	398554.3556	366341.3212	373316.0373	651937.8583	659750.9291	9298615.752	924773.6686	821660.3076
Incremental cost	**28075115.61**	**28661273.34**	**29642930.01**	**29142906.93**	**30380942.07**	**29613843.77**	**31795334.55**	**31806877.05**
Year 1	817357.9407	1114674.468	776406.5412	1180008.997	1296144.14	1208283.507	758455.3514	1161866.627
Year 2	3916408.469	2222164.009	3030483.173	2110828.789	3208109.192	3523847.65	3284979.553	2062024.604
Year 3	4665698.137	9533428.345	5409252.256	7376884.818	5138237.027	7809266.919	8577846.089	7996186.85
Year 4	7500331.994	4771385.633	9749379.772	5531782.757	7543986.174	5254628.485	7986162.604	8772151.646
Year 5	4140781.629	6512592.429	4143028.598	8465456.854	4803286.911	6550497.669	4562631.856	6934442.655
Year 6	6550157.847	3936693.571	6191604.157	3938829.793	8048217.115	4566545.739	6227641.148	4337751.928
Year 7	484379.5938	570334.8885	342775.5089	539114.9265	342961.5138	700771.8009	397617.953	542252.7369
Investment	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Year 1								
Year 2								
Year 3								
Year 4								
Year 5								
Year 6								
Year 7								
Operation cost	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Year 1								
Year 2								
Year 3								
Year 4								
Year 5								
Year 6								
Year 7								
Incremental cash flow	**53,468,249.85**	**126,918,061.64**	**134,949,138.66**	**121,513,952.51**	**125,931,686.57**	**51,799,356.87**	**78,122,785.51**	**75,957,747.88**
Aggregated cash flow	(220,295,239.33)	(93,377,177.69)	41,571,960.97	163,085,913.49	289,017,600.06	340,816,956.92	418,939,742.43	494,897,490.31

Year	Year 24	Year 25	Year 26	Year 27	Year 28	Year 29	Year 30	Year 30	Year 25	Year 20	Year 10
Incremental benefits	**95,931,553.53**	**########**	**########**	**########**	**########**	**180,359,138.66**	**217,577,841.91**	$368,826,120.90	$249,440,444.98	$150,229,518.78	($89,239,982.54)
Year 1	2088726.402	2327836.96	1640905.809	1953451.272	1989211.612	1190729.239	4673548.46				
Year 2	4255378.277	5678653.628	6328106.16	4461156.673	5310884.423	5408101.189	3237254.485				
Year 3	6393569.104	10261188.81	13823133.59	15404546.35	10859469.29	12927899.76	13164547.46				
Year 4	6366850.171	6538396.371	10493625.48	14136255.51	15753490.7	11105458.22	13220742.82				
Year 5	7052534.88	5528381.977	5677336.781	9111690.776	12274612.74	13678695.3	9642949.563				
Year 6	4995855.43	6704934.05	5255902.807	5397516.027	8662599.894	11669629.89	13004674.2				
Year 7	831471.4962	434998.7765	583815.561	457641.6037	469972.1401	754269.2955	1016097.202				
Incremental cost	**31805951.97**	**31497458.31**	**30030447.09**	**30135319.87**	**30599918.73**	**29978624.08**	**30356091.6**	$216,244,727.03	$195,673,919.34	$165,272,218.41	$70,632,589.94
Year 1	862927.4334	1412924.24	776597.7205	1180008.997	758455.3514	1161866.627	1314215.287				
Year 2	3158785.245	2346054.512	3841339.563	2111348.551	3208109.192	2062024.604	3158785.245				
Year 3	5019436.549	7689201.222	5710829.9	9350693.564	5139502.246	7809266.919	5019436.549				
Year 4	8177521.18	5133136.936	7863377.176	5840191.744	9562505.679	5255922.363	7986162.604				
Year 5	7616922.616	7100600.688	4457139.866	6827827.182	5071080.662	8303192.73	4563755.34				
Year 6	6592662.513	7241504.861	6750631.061	4237459.357	6491301.831	4821140.651	7893950.555				
Year 7	377696.4342	574035.8518	630531.8076	587790.4782	368963.7664	565210.1816	419786.0235				
Investment	**0**	**0**	**0**	**0**	**0**	**0**	**0**	$5,368,325.69	$5,368,325.69	$5,368,325.69	$5,368,325.69
Year 1											
Year 2											
Year 3											
Year 4											
Year 5											
Year 6											
Year 7											
Operation cost	**0**	**0**	**0**	**0**	**0**	**0**	**0**	$868,279.12	$868,279.12	$868,279.12	$868,279.12
Year 1											
Year 2											
Year 3											
Year 4											
Year 5											
Year 6											
Year 7											
Incremental cash flow	**64,125,601.56**	**87,784,695.03**	**76,496,034.86**	**########**	**########**	**150,380,514.58**	**187,221,750.31**	$146,344,789.06	$47,529,920.84	($21,279,304.44)	($166,109,177.29)
Aggregated cash flow	559,023,091.87	646,807,786.90	723,303,821.76	883,246,035.05	1,050,262,126.91	1,200,642,641.49	1,387,864,391.80				

	30 years	25 years	20 years	10 years		
NPV	$146,344,789.06	$47,529,920.84	($21,279,304.44)	($166,109,177.29)	**Sensitivity**	
EIRR	11.603%	9.411%	6.244%	#NUM!	Benefit	0%
B/C	$1.66	$1.24	$0.88	($1.16)	costs	0%
Payback period	17.69	17.69	17.69	17.69		
ENPV/ha	1813	589	-264	-2057		
Switching value - benefit	-39.68%	-19%	14%	-186%		
Switching value - cost	65.78%	24%	-12%	-216%		

5. **Sensitivity and scenario analyses were conducted to evaluate the potential variations in crucial parameters that could affect the project's returns, particularly considering the substantial uncertainty in the investment parameters employed.** As part of these analyses, one specific scenario involved reducing the evaluation period from the base scenario of 30 years to just 20 years. This was done to test the potential reduction in the return on investment according to changes in production dynamics in the short, medium, and long term. The results, as displayed in the table, reveal a substantial decrease in the economic return on investment when the evaluation period is shortened.

Table 13. Sensitivity/scenario analysis – Effects of a change in the evaluation period

Indicators	20 years	25 years	30 years (base scenario)
	Economic indicators		
NPV (US$ million)	($21.28)	47.53	146.34
IRR (percent)	6.24%	9.41%	11.60%

6. **The table below illustrates the effects of variations in the social discount rate on the estimated economic indicators, assessing the risks associated with the macroeconomic context that may affect the economic viability of the project.** A higher social discount rate leads to a lower NPV, which could affect the return on investment of the project. The results show that the project would maintain its economic viability even if the social discount rate increases up to 10 percent.

Table 14: Sensitivity/scenario analysis – Effects of a change in social discount rate

Scenario	ENPV (US$ million)
Economic indicators	
Base scenario – social discount rate (7.40 percent)	146.34
High social discount rate – 6 percent	241.4
Low social discount rate – 10 percent	38.5

7. **A sensitivity analysis was conducted to assess the impact of changes in key parameters on the estimated Economic Internal Rate of Return (EIRR).** Table 15 presents the results of this analysis, showing how the EIRR responds to progressive decreases and increases in the values of key parameters, such as crop yields, prices, and production costs, as well as combined effects of these variables. This analysis offers insights into the robustness of the project's estimated returns against potential changes in crucial parameters.

Table 15: Sensitivity analysis – Effects of changes in selected key parameters.

Parameter	EIRR values (percent)						
	-20%	-10%	-5%	0%	5%	10%	20%
Benefits (income, outcome prices, yields)	9.94%	10.85%	11.24%	11.60%	11.93%	12.24%	12.78%
Production costs (input prices)	12.96%	12.27%	11.94%	11.60%	11.27%	10.95%	10.31%
Combined effect (income, outcome prices, yields, input prices) – Changes in the same direction of benefits and costs	**(-)20%/-20%**	**(-)10%/-10%**	**(-)5%/-5%**	**0%/0%**	**5%/5%**	**10%/10%**	**20%/20%**
	11.53%	11.57%	11.58%	11.60%	11.62%	11.63%	11.65%

Combined effect (income, outcome prices, yields, input prices) – Changes in the same direction of benefits and costs	(-)20%/20%	(-)10%/10%	(-)5%/5%	0%/0%	5%/-5%	10%/-10%	20%/-20%
	8.41%	10.14%	10.90%	11.60%	12.25%	12.86%	13.96%

8. **The following table presents the economic indicators under different scenarios, considering ecosystem services related to greenhouse gas reduction, soil erosion reduction, and avoided damage to the tourism sector.**

Table 16: Sensitivity/scenario analysis – Effects of the ecosystem services in selected key parameters.

Scenario	ENPV (US$ million)	IRR (%)
Base scenario – social discount rate (7.40 percent)	146.34	11.60%
Without considering ecosystem services	7.83	7.63%
Considering ecosystem services – only GHG emission reduction	54.55	9.02%
Considering ecosystem services – only soil erosion reduction	93.49	10.07%
Considering ecosystem services – only avoided damage to the tourist sector	13.96	7.82%

9. **The results of the sensitivity and scenario analysis demonstrate the robustness of the assessment. Even without accounting for ecosystem services, the project remains economically viable, though within a limited range of acceptability to confirm viability.** Additionally, the analysis reveals that changes in benefits, whether from crop yields, prices, or variations in production costs, could significantly impact the EIRR of the project. This indicates that economic returns may be vulnerable to market fluctuations and weather events affecting forestry and agroforestry activities. Monitoring these factors and adjusting the project plan as necessary is crucial to mitigate potential adverse effects on profitability, particularly in the medium and long term.

ii) Disaggregated results

10. **To determine the profitability of different types of investment/forestry/agroforestry models from the perspective of the private sector, financial indicators were calculated separately, assuming a cost of capital of 8.20% percent.** Financial returns for different investment models are shown in Table 17.

Table 17: Financial Internal rate of return

Investment models	Return per hectare (8.2%)	
	IRR (%)	**B/C**
Agroforestry - A	15.801%	1.22
Agroforestry - B	9.257%	1.03
Community planting of mixed species	10.045%	1.10
Community restoration of waterways and riparian zones	9.039%	1.07
Natural regeneration of degraded forests	7.578%	0.61
Natural regeneration of over logged primary forest	8.748%	1.18
Restoration of over logged plantation	10.138%	1.25
Restoration left aside degraded land	11.286%	1.42

Short Rotation Plantations	9.489%	1.04
Sustainable Forest Management	9.205%	1.14
Investment models	**Return per business (8.2%)**	
	IRR (%)	**B/C**
Forest Protection (SFM) - Non timber activity	11.3%	1.11
Forest Conservation (HFV) - Tourism activity	14.1%	1.21

11. **The different forestry, agroforestry, and non-timber activities would have mixed financial indicators.** The most profitable activity would be agroforestry practiced in areas with significant slopes, where it is possible to combine high-value annual crops, fruits, trees, and shrubs. Although positive benefits are expected to begin in the medium term as a significant incremental investment is required to establish this type of production system during the first years. Additionally, the non-timber activities associated with the preservation and protection of forest areas show promising returns on investment, considering the potential of using these areas to develop non-timber and tourist activities.

12. **The following tables present the economic indicators for the investment models, taking into account the total investment cost and the different ecosystem benefits associated with each in different scenarios.**

Table 18. Economic indicators for agroforestry – model A

	30 years	20 years	10 years
NPV	$27,889,409.75	$14,953,105.45	($10,914,352.87)
FIRR	16.984%	11.552%	#NUM!
B/C	$1.41	$1.29	$0.46
Payback period	12.94	12.94	12.94
EFNPV/Beneficiary	7968	4272	-3118
Switching value - benefit	-29%	-22%	115%
Switching value - cost	41%	29%	-54%

Table 19. Economic indicators for agroforestry – model B

Economic indicators	30 years	20 years	10 years
NPV	$28,672,528.73	$15,736,224.42	($10,131,233.89)
EIRR	17.950%	12.595%	#NUM!
B/C	$1.43	$1.31	$0.48
Payback period	12.94	12.94	12.94
EFNPV/Beneficiary	8192	4496	-2895
Switching value - benefit	-30%	-24%	107%
Switching value - cost	43%	31%	-52%

Table 20. Community planting of mixed species

	30 years	20 years	10 years
NPV	$22,857,152.35	$14,255,870.82	($6,514,132.63)
FIRR	19.700%	18.215%	-24.40%

B/C	$2.63	$2.14	$0.21
Payback period	12.07	12.07	12.07
FNPV/Beneficiary	3810	2376	-1086
Switching value - benefit	-62%	-53%	379%
Switching value - cost	163%	114%	-79%

Table 21. Community restoration of waterways and riparian zones

	30 years	**20 years**	**10 years**
NPV	$18,772,708.76	$6,789,825.23	($840,458.65)
FIRR	17.375%	14.005%	3.85%
B/C	$2.14	$1.50	$0.90
Payback period	17.08	17.08	17.08
FNPV/Beneficiary	3755	1358	-168
Switching value - benefit	-53%	-33%	12%
Switching value - cost	114%	50%	-10%

Table 22. Natural regeneration of over logged primary forest

	30 years	**20 years**	**10 years**
NPV	$305,099.81	($17,668,952.32)	($26,295,925.06)
FIRR	7.469%	-0.967%	#NUM!
B/C	$1.05	($2.42)	($7.89)
Payback period	21.15	21.15	21.15
FNPV/Beneficiary	44	-2524	-3757
Switching value - benefit	-4%	-141%	-113%
Switching value - cost	5%	-342%	-889%

Table 23. Restoration of over logged plantation

	30 years	**20years**	**10 years**
NPV	$20,301,199.31	$3,734,655.43	($10,214,788.44)
FIRR	15.435%	10.402%	#NUM!
B/C	$4.15	$1.73	($2.48)
Payback period	16.48	16.48	16.48
FNPV/Beneficiary	3384	622	-1702
Switching value - benefit	-76%	-42%	-140%
Switching value - cost	315%	73%	-348%

Table 24. Restoration left aside degraded land

	30 years	**20 years**	**10 years**
NPV	$1,713,463.16	$321,809.98	($832,900.58)
FIRR	14.920%	10.223%	#NUM!
B/C	$2.10	$1.25	($0.11)

Payback period	16.78	16.78	16.78
FNPV/Beneficiary	3427	644	-1666
Switching value - benefit	-52%	-20%	-993%
Switching value - cost	110%	25%	-111%

Table 25. Short Rotation Plantations

	20 years	20 years	10 years
NPV	$1,046,046.54	$539,175.48	($470,530.10)
FIRR	15.397%	13.448%	-9.40%
B/C	$1.38	$1.23	$0.70
Payback period	11.56	11.56	11.56
FNPV/Beneficiary	1308	674	-588
Switching value - benefit	-27%	-19%	44%
Switching value - cost	38%	23%	-30%

Table 26. Sustainable Forest Management

	30 years	20 years	10 years
NPV	($2,395,564.61)	($69,915,251.52)	($98,984,130.86)
FIRR	7.269%	-0.068%	#NUM!
B/C	$0.79	($7.16)	($20.37)
Payback period	20.03	20.03	20.03
FNPV/Beneficiary	-98	-2868	-4061
Switching value - benefit	27%	-114%	-105%
Switching value - cost	-21%	-816%	-2137%

Table 27. Forest Protection (SFM) - Non timber activity

	30 years	20 years	10 years
NPV	$8,762,494.76	$794,836.82	($1,019,325.54)
FIRR	23.569%	12.709%	122.82%
B/C	$1.44	$1.06	$0.73
Payback period	17.31	17.31	17.31
FNPV/Beneficiary	35050	3179	-4077
Switching value - benefit	-31%	-6%	38%
Switching value - cost	44%	6%	-27%

Table 27. Forest Conservation (HFV) - Tourism activity

	30 years	15 years	10 years
NPV	$258,158.32	($12,314.35)	($138,966.79)
FIRR	14.387%	6.525%	#NUM!
B/C	$1.27	$0.98	$0.55
Payback period	17.19	17.19	17.19

FNPV/Beneficiary	12908	-616	-6948
Switching value - benefit	-21%	2%	83%
Switching value - cost	27%	-2%	-45%

V. Conclusions

13. Based on the findings of the ex-ante cost-benefit analysis, the overall project investment is expected to yield a positive economic return. The estimated Internal Rate of Return exceeds the social discount rate considered in this analysis, indicating that the project is economically viable over a 30-year evaluation period.

14. Additionally, most activities funded under the project are projected to generate positive financial outcomes, primarily in the medium and long term. In economic terms, most activities are expected to yield positive returns over a 30-year evaluation period. This underscores the nature of investments that require time to generate results, particularly the investments in the different forestry models analyzed.

VI. References

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VII. Annex.

EFA Excel calculation model