



Report on Economic Analysis

In Support of the Funding Proposal submitted to the Green Climate Fund (GCF) by Sri Lanka on “Strengthening Climate Resilience for Subsistence Farmers and Agricultural Plantation Communities Residing in the Vulnerable River Basins, Watershed Areas and Downstream of the Knuckles Mountain Range Catchment of Sri Lanka”

IUCN Sri Lanka Country Office

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1.1. Context

This economic analysis is related to the benefits that will be provided by the proposed project to the smallholder and subsistence farmers by

- improving their resilience related to farm and land management practices; and
- improving underlying ecosystems in the Knuckles/Amban ganga watersheds through participatory climate-smart landscape management while improving water availability to farmer families in the lowland command area at the same time and protecting and improving the public investment in the Moragahakanda multipurpose irrigation scheme.

As such, the GCF investment proposed will address observed increases in temperatures, changes in rainfall frequency and intensity, and extreme events that are causing extended droughts, frequent floods, landslides, and silting of reservoirs, which increase the vulnerabilities of small-scale farmers, plantation operations and the nature ecosystems on which they depend.

1.2. Methodology

1.2.1. Benefit Streams of the Investment

For the economic analysis, based on the 18 project interventions (Please see Annex: Outputs and Activities) identified through stakeholder consultations (Section 7), secondary information (Sections 2 and 4), and climate impacts (Section 3), the contributions of the 18 activities were grouped into five (5) broad benefit areas or benefit streams.

Table 1: Linkages GCF project activities to economic benefits

GCF Project Activity number (Section 7)	Benefit Stream (Economic)
1.1.1. Streamside protection and drainage management along roads	Benefit Stream 1: Reducing the impact of erosion and sediment on major reservoirs benefiting smallholder farmers to obtain the maximum usage of public investments
3.1.3. Development and refinement of an options by context framework for SLM and sustainable intensification	
1.1.2. Rehabilitation and establishment of village tanks, ponds and irrigation networks	Benefit Stream 2: Water management and agriculture support for subsistence and downstream farmers for better productivity and to cope with climate induced economic damages
1.2.1. Increasing cropping intensity of irrigated rice in both upstream and downstream areas	
1.2.3. Restoration and sustainable intensification of plantations	
3.1.1. Develop an integrated land use policy and planning mechanism at sub-basin scale	
3.1.2. Develop the SHARED information system to support land use planning, climate adaptation, market information and monitoring of the performance	

3.2.1. Establishment of nested-scale multi-stakeholder innovation platforms from sub-basin to GN scale	
1.2.2. Sustainable intensification of smallholder production	Benefit Stream 3: Upgrading of the value chain to support subsistence farmers
2.1.1. Domestic value chain mapping and green market assessments for products especially from smallholder and subsistence farmers	
2.1.3. Identification and implementation of value chain upgrading options	
2.2.1. A portfolio of business cases for negotiating performance-based financial transfer mechanisms	
3.2.3. Development of simple to use guidelines, manuals and tools for matching options to context and implementing SLM, sustainable intensification and value	
1.1.3. Restoration of forest mosaic landscapes	Benefit Stream 4: Forest conservation, community forestry and tourism development
2.2.2. A PES intermediary body as a part of the multi-stakeholder platform, and its governance system established	
2.2.3. A monitoring system for PES schemes in the upstream catchment area	
2.1.2. Enterprise and institutional development to exploit green growth opportunities for smallholder farmers in the uplands	Benefit Stream 5: Strengthening community-based organizations
3.2.2. Training in methods and tools for adaptive and participatory co-design of adaptation options	

1.2.2. Assumptions Used in the Economic Analysis

Number of assumptions have been used to arrive at the financial numbers in the economic analysis as explained below. In order to do so, five benefit streams have been identified based on the project design (results chain).

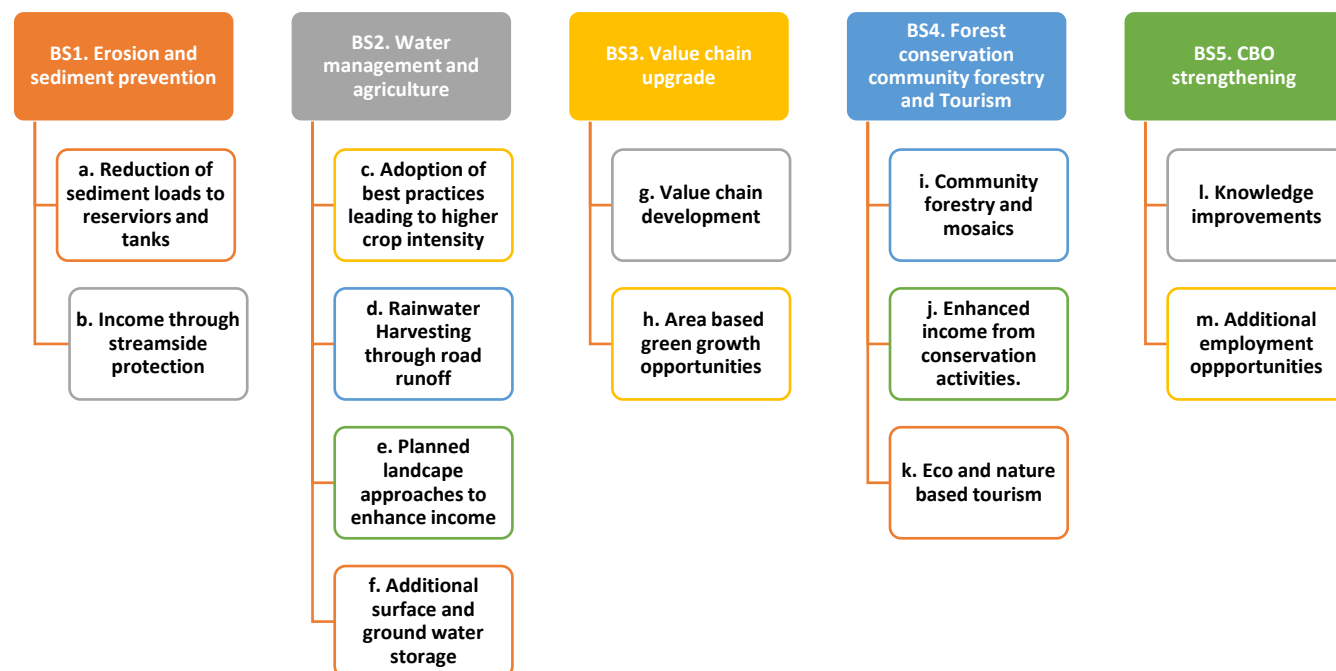


Figure 1: Categorization of multiple economic benefits under five main areas

Based on the above structure, the elaborated descriptions of the benefit streams, assumptions and the process adopted to arrive at costs and benefits are as follows.

Cost Benefit Stream 1. Erosion and Sediment Prevention

- a) Reduction of sediment loads to reservoirs and tanks:** Erosion across the Knuckles upper catchment is reduced by 50%; sedimentation of reservoirs reduced to a negligible level (<0.1 % loss of capacity per annum), directly benefitting the agriculture production capacity of 41,564 ha, i.e. 25% of the upstream area (link to Activities 1.1.1 on Streamside protection and drainage management along roads and 1.1.2 on rehabilitation and establishment of village tanks, ponds and irrigation networks). The Ambangaga development by GoSL/ADB and area tanks (96 village tanks; 18 large tanks; and 32 abandoned tanks) in the upstream area are at a risk of siltation due to climate influence. GCF Investment will assure the continued functionality of the reservoirs (currently annual siltation rate is >2%). GCF investment is expected to reduce the siltation rate to <1%. Agricultural benefits by the additional water holding has been calculated for 41,564 ha. An unrelated benefit of water management is the ability to manage landslides by site specific drainage and infiltration.

It is estimated USD 50,000 could be saved from the Government's annual budget on tank de-siltation. It is assumed that 8 minor tanks of approximately out of 150 tanks require annual tank rehabilitation (approximately LKR Mn 1-2 per small tank) to cope with the existing siltation issue. The Government budgets on frequent de-siltation could be diverted in consultation with the proposed project for PES sustainability and direct support to subsistence farmers to expedite the economic development.

- b) Additional income through streamside protection:** Streamside protection will allow the communities to grow plants that have an economic value and protect the stream sides while obtaining an income from the harvest and related products. For example, areca nut, bamboo and certain types of timber can be planted in selected stretches of the over 2,000 km of stream network in the upstream area. This benefit is linked to Activity 1.1.1.

The total estimated benefits for the community nursery holders will be USD 100,000 per year.

Cost Benefit Stream 2. Water Management and Agriculture

- c) Adoption of best practices leading to higher crop intensity (from current 1.2 to over 1.7) in both upstream and downstream:** Approximately 61,000 farmers in the project area will be benefited from water management and climate-adapted agricultural practices (including estate workers) where the average cropping intensity for irrigated rice is expected to be >1.75. This benefit is linked to Activities 1.2.1 and 1.2.2. The smallholder farmers in those areas will increase the production from own consumption to market oriented.

On average a farmer has a land the size of 0.2-0.5 ha and the current monthly income/benefit from this land is calculated as LKR 6,000. After the project implementation, the income is expected to reach around LKR 15,000 per month where the project will support to increase the marginal benefit by LKR 9,000 at least for 3300 farmer families. The total economic benefits per annum will be USD Mn 2.23

- d) Rainwater harvesting through roadside drainage management:** Proper road maintenance and harvesting of rainwater in over 159 km of road length in the upstream area, in addition to the sediment control benefit identified in Benefit Stream 1, will enhance the groundwater recharge by reducing the runoff by at least 30%, leading to an increase in the area water budget. This benefit is linked to Activity 1.1.2.

It is estimated approximately 1.2 Mn water units (water units according to the National Water Supply and Drainage Board) could be collected per year through roadside drainage management. It is valued as USD 190,000.

- e) Planned landscape and land use approaches to enhance area income:** The landscape level planning covering 4,100 ha of tea; 2,710 ha of coconut; 2,250 ha of rubber; 2,090 ha of timber; 1,076 ha of pepper; and 102 ha of cinnamon at present in plantation areas can be optimized (intercropping and other changes) to generate better net benefits. This benefit involves Activity 1.2.3.

The main economic crops and other field crops significantly contribute to a healthy economy in a country. There are fluctuations in the global prices for these plantations and the proposed project will work with communities and plantation companies to eliminate the drawbacks of the production and the quality due to climate change impacts. The project will also help to better plan the land use and decide the extent of cultivations and identify suitable crops to intercrop with the economic crops, especially when cultivating the abandon and degraded lands. Overall these steps will benefit estate workers to enhance their living standards and the profit margins of the plantation companies. It is estimated that benefits worth of USD Mn 1.4 will be created for the sector.

- f) Additional surface and ground water storage through tank rehabilitation:** Community led partial de-siltation and rehabilitation of the 32 abandoned village tanks and 121 functional ponds and tanks within the upper catchment area will improve the living conditions of the families, especially women. At least 5,000 families are to be benefited.

Water for Irrigation and domestic purposes during dry spells is an issue for both upstream and downstream areas of the proposed project area. This issue has strong linkages with gender issues created as a result of climate change. Women are more vulnerable due to the lack of water to fulfil domestic needs. The calculation considered the number of hours spent by women to find water, by traveling long distances.

Considering most vulnerable areas for drought and water availability, the tank rehabilitation will directly have an economic impact worth minimum USD 187,500 where the women can be involved in productive economic activities during the time they spent before to find water.

Benefit Stream 3. Value Chain Upgrade

- g) Value chain development:** GCF investments will generate an additional income to an estimated 5,000 families by way of value chain upgrading options in the upstream area (certification, quality assurance, processing and innovative marketing). Family income is expected to increase allowing the resilience to improve. New level of production and branding of products, named "Jurisdictional Area Approach" will be tested. New markets will be opened in the global market to "area brand" products linked to agriculture, tourism and services.

Through the project involvement on value chain development, the marginal income per family will be approximately LKR 3,500 per month. In total, USD Mn 1.25 could be calculated as the economic benefit created from this benefit stream.

- h) Area based green growth opportunities:** New approaches, technologies and low-carbon growth opportunities (also in line with Jurisdictional Area Approaches) can be utilized to enhance the value of products and services in the Knuckles area. Benefits due to price markup's with branded products specific to the area will bring more resources into the hands of the people. This benefit is linked to Activity 2.1.2.

The chain of issues related to upstream agriculture production by subsistence farmers is climate change and productivity → low quality and less production → disadvantages in global competition → low demand → low income for subsistence farmers. This chain will be changed with the support of the project, as climate resilient high-quality production → crop intensification → competitive advantages i.e. standards, green approaches, etc. → high global demand → high income for subsistence farmers. It is estimated approximately USD 800,000 worth of marginal economic benefits will be created.

Benefit Stream 4. Forest Conservation, Community Forestry and Tourism

- i) Community forestry and mosaics including economically viable environmental conservation activities in nearly 126,000 ha (41,900 ha dense forest, 21,900 ha open forest and 62,200 scrub (degraded grassland):** In the upstream area this will lead to opportunities to grow/market super foods, spices, medicinal plants and other niche products. These products and sustainable harvesting opportunities could contribute to the transformational climate resilience, significantly, and provide opportunities to develop public, private, people initiatives. The additional ecosystem services due to this greening will also be significant, but not counted in the computation. This benefit is connected to Activity 1.1.2.

Sri Lanka is importing herbals for domestic needs mainly from India and other Asian countries. The project area has an extended forest cover that can be protected and conserved involving communities, especially subsistence farmers. One of the issues for subsistence farmers is the land inadequacy. Therefore, the proposed project will facilitate the releasing of lands to communities under close monitoring of Community based Forestry Organizations and the Forest Department. Non-Timber Forest Resources such as fruits, tree parts only for herbal production could be extracted in systematic ways. These products could be coupled with the opportunities created by tourism and value chain development for agriculture production. It is estimated USD 800,000 of economic benefits will be created for the country per annum.

- j) Enhanced income for communities from conservation activities:** GCF related investments will transform employment opportunities to a higher level so that communities will appreciate and engage also minimizing the outward migrations. Currently climate change impacts and other hardships on subsistence farmers who engage in agriculture are being influenced by the benefits of migration due to

the risks associated with farming. To make a paradigm shift of this perception, high attractive opportunity schemes will be introduced through labour-oriented adaptation activities. It is estimated that a large number of people could be attracted for adaptation and conservation related interventions if they are motivated by a reasonable daily wage.

It is observed that making conservation an economically viable livelihood is of great importance. The daily rate for communities who support conservation activities will be approximately USD 20 per day, which is a very competitive rate in Sri Lanka to attract more youth, especially even well-educated people as a part-time engagement. It is calculated that an additional USD 200,000 will go to the hands who seek good employment in the area.

- k) Eco and nature-based tourism:** This will generate economic advantages for communities through high-value tourism based on nature, culture and heritage in the area plus seasonal changes of waterfalls and other nature related features. New trends in research and medicinal tourism can be explored as well. The private sector (tour operators and companies) is a key along with promotional systems via multiple media.

The communities and authorities could get the involvement of tourists in conservation activities and promote conservation, climate change adaptation, climate resilient community products—especially herbals, fruits, dried fruits and Knuckles branded products—among the tourists. It is estimated that USD 500,000 will be additionally generated to the economy through these new diversifications of tourism products.

Benefit Stream 5. CBO Strengthening

- l) Knowledge improvements related gains:** Nearly 300,000 households will receive integrated rural advisory capacity responsive to develop their knowledge base, real-time weather and market information. Timely information to farmers on climate, weather and commodity products will help farmers to plan against droughts, crop damages and income reductions due to excessive rain and market irregularities. This benefit is related to Activity 3.2.2 and involve the assumptions that the Government will not require to pay compensation for disaster affected families on crop damages due to drought or intensified rains.

The benefits created from learning and obtaining knowledge are hard to quantify in financial values. However, it can be calculated from the side of compensation on disasters. For the past decade, the GoSL has paid billions of rupees as compensation for the disaster victims in Sri Lanka, especially the farmers who lose their cultivation due to droughts. Monthly compensation per family is LKR 10,000. It is estimated that the project will have an impact on at least more frequent disaster victims who will be benefited, and actions can be taken to manage their crop and cultivation according to climate forecasts. USD 700,000 per annum could be saved at least for 11,200 frequently affected farmers in project area if they adapt themselves by managing the crop. The saved money could be pumped back to the economy as investments.

- m) Additional employment opportunities to communities in service delivery:** Services on environmental monitoring, information collection and reporting, internet services, telemarketing, tour guiding, and many opportunities will emerge needing communities to improve their technical and communication skills. These services will change the area service delivery quality and quantity, significantly.

In parallel to the above-mentioned economic development, the supporting services are also increased. For example, local tour guides associations, internet cafes, coffee shops, fruit drying centres, recruitment agencies etc. will be established. It is estimated that at least USD 100,000 worth of marginal service development in the area could be expected.

1.3. Economic Viability of the Project

1.3.1. Investment / Inputs

The investments/inputs to reach each benefit is summarized below based on the inputs through relevant activities contributing to each benefit stream.

Table 2: Cost streams related to proposed interventions

Year	Cost Stream 1: Erosion and sediment prevention (USD Mn)		Cost Stream 2: Water management and agriculture support for subsistence and downstream farmers (USD Mn)		Cost Stream 3: Value chain upgrade to support subsistence farmers (USD Mn)		Cost Stream 4: Forest conservation and community forestry and Tourism Development (USD Mn)		Cost Stream 5: Strengthening Community Based Organizations (USD Mn)	
	GCF	GoSL	GCF	GoSL	GCF	GoSL	GCF	GoSL	GCF	CBO
1	0.81	0.5	2.81	0.05	2.06	1.67	0.48	1.03	0.48	
2	0.81	0.5	2.81	0.05	2.06	1.67	0.48	1.03	0.48	
3	0.81	0.5	2.81	0.05	2.06	1.67	0.48	1.03	0.48	
4	0.81	0.5	2.81	0.05	2.06	1.67	0.48	1.03	0.48	
5	0.81	0.5	2.81	0.05	2.06	1.67	0.48	1.03	0.48	
6	0.81	0.5	2.81	0.05	2.06	1.67	0.48	1.03	0.48	
7		0.5		0.05		1.67		1.03		0.25
8		0.5		0.05		1.67		1.03		0.25
9		0.5		0.05		1.67		1.03		0.25
10		0.5		0.05		1.67		1.03		0.25
11		0.5		0.05		1.67		1.03		0.25
12		0.5		0.05		1.67		1.03		0.25
13		0.5		0.05		1.67		1.03		0.25
14		0.5		0.05		1.67		1.03		0.25
15		0.5		0.05		1.67		1.03		0.25
16		0.5		0.05		1.67		1.03		0.25
17		0.5		0.05		1.67		1.03		0.25
18		0.5		0.05		1.67		1.03		0.25
19		0.5		0.05		1.67		1.03		0.25
20		0.5		0.05		1.67		1.03		0.25

1.3.2. Benefits in Financial Values

Table 3: Expected benefits generated within 20 years

Yr.	Benefit Stream 1: Erosion and sediment prevention (USD Mn)	Benefit Stream 2: Water management and agriculture support for subsistence and downstream farmers (USD Mn)	Benefit Stream 3: Value chain upgrade to support subsistence farmers (USD Mn)	Benefit Stream 4: Forest conservation and community forestry and Tourism Development (USD Mn)	Benefit Stream 5: Strengthening Community Based Organizations (USD Mn)
1					
2					
3	0.15	4.0	2.0	1.5	0.8
4	0.15	4.0	2.0	1.5	0.8
5	0.15	4.0	2.0	1.5	0.8
6	0.15	4.0	2.0	1.5	0.8
7	0.15	4.0	2.0	1.5	0.8
8	0.15	4.0	2.0	1.5	0.8
9	0.15	4.0	2.0	1.5	0.8
10	0.15	4.0	2.0	1.5	0.8
11	0.15	4.0	2.0	1.5	0.8
12	0.15	4.0	2.0	1.5	0.8
13	0.15	4.0	2.0	1.5	0.8
14	0.15	4.0	2.0	1.5	0.8
15	0.15	4.0	2.0	1.5	0.8
16	0.15	4.0	2.0	1.5	0.8
17	0.15	4.0	2.0	1.5	0.8
18	0.15	4.0	2.0	1.5	0.8
19	0.15	4.0	2.0	1.5	0.8
20	0.15	4.0	2.0	1.5	0.8

1.3.3. Sensitivity for Cost and Benefit Changes

Table 4: Financial ratios calculated based on economic benefits analysis

I	Discount rate of 6%		Discount rate of 10%		IRR
	NPV (USD Mn)	BC	NPV (USD Mn)	BC	
Base case	41	2.01	21	1.59	21%
Cost by 10%	37	1.83	5	1.10	18%
Benefits by 10%	33	1.81	16	1.43	18%
Cross sensitivity	29	1.65	21	1.59	15%

1.4. Sensitivity Analysis and NPV

Discounting rates: to obtain an idea of the actual or the net contribution to the economy of Sri Lanka by the proposed GCF investments, the economic analysis uses discounting rates 6% and 10%. The rationale behind the identification of these discounting rates is that the general inflation in Sri Lanka fluctuate within the range of those two values. i.e. in 2017 according to the Colombo Price Index prepared by the Central Bank of Sri Lanka, the annual inflation was 7%. However, it is possible to keep the inflation rate at a healthy level to the economy, therefore, the Government's fiscal policies will be aimed to keep the figure in single digits as per the standards of developed countries or rapidly developing countries.

The analysis delivered that the Internal Rate of Return (IRR) for the base case at 21%. The possibilities of cost increases for the input/project activities and deviations from the assumptions used in the computation of IRR may occur due to increases in Government taxes on goods and services, difference between actual and estimated values, seasonal impacts (weather and emergencies) and market supply and demand context etc.

To test the sensitivity, a perturbation of under 10% increase of base case value was introduced and yet the project generated an IRR of 18%. On the other hand, to test the sensitivity of potential changes on the benefit side, primarily due to potential weak support from partners than expected, changes in external environment such as disasters, access barriers, lack of community participation etc. a 10% reduction of benefits was introduced. The project still generated an IRR of 18%.

At the worst-case scenario, where the cost increase and benefit reduction could be experienced simultaneously at a level of 10% on each side of the cost benefit computation, the project was able to deliver an IRR of 15%.

The estimated costs are for six years and the benefits calculated are for 20 years. The Net Present Value of Benefits are higher than the NPV of costs. Therefore, it is observed that the proposed project has a very healthy economic analysis result and the investment risk is very minimal.