

Scaling-Up Resilience in Africa's Great Green Wall (SURAGGWA)

ANNEX 3: Economic & Financial Analysis and Environmental Co-Benefits

Executive Summary

1. This annex presents the economic and financial analysis (EFA) of the proposed GCF-funded Scaling-Up Resilience in Africa's Great Green Wall (SURAGGWA) programme, which will be implemented in Burkina Faso, Chad, Djibouti, Mali, Mauritania, Niger, Nigeria, and Senegal. The EFA assesses the financial viability and economic impact of the programme by comparing the investment costs required for the implementation with the expected benefits derived from key promoted activities. The analysis is conducted from both a financial perspective, evaluating profitability at the participant level, and an economic perspective, aggregating benefits across all stakeholders and estimating the broader socio-economic and environmental gains.

2. The EFA of the proposed programme is based on a Cost-Benefit Analysis (CBA) applied to a range of typical community land and farmland restoration models in each of the eight countries including Reforestation/Afforestation using native tree, shrub and grass species as well as Agroforestry systems integrating native tree species into cropping systems. Additionally, the analysis assesses the enhancement of smallholder Non-Timber Forest Product (NTFP) value chains such as gum arabic, Balanites, moringa, jujube, baobab, etc. by improving production, processing, storage and marketing strategies.

Overall, the results demonstrate that SURAGGWA is a profitable initiative, generating a net present value (NPV) over a 20-year period of USD 154.2 million and an economic internal rate of return (ERR) of 19.2 percent, on a total budget of USD 222.0 million, of which USD150 million would be financed by the Green Climate Fund (GCF). These strong economic returns are achieved even without incorporating environmental benefits. However, considering even the extreme climate vulnerability of rural communities, their limited access to financial services, and the high level of indebtedness across the eight participating countries, the mobilization of grant funding from the GCF is fully justified to ensure the SURAGGWA programme's success and sustainability. The full economic potential of the programme is significantly higher when accounting for greenhouse gas (GHG) mitigation benefits. **Using more conservative prices, at current carbon market rates, the estimated NPV rises to USD 754.5 million, with an EIRR of 57.5 percent over a 20-year period. When higher social prices of carbon are considered, the results improve even further, highlighting the substantial economic and environmental value of the initiative.** These results further emphasize that the public benefits generated by the programme would largely outweigh the private benefits created, reinforcing its role as a transformative investment in climate resilience, ecosystem restoration, and sustainable rural development.

A. Background and rationale of the Programme

3. The SURAGGWA programme is a large-scale, multi-country initiative aimed at addressing land degradation and enhancing climate resilience in the Sahel region. The project is designed to restore degraded lands, improve livelihoods, and strengthen institutional capacities across eight participating countries.

4. The project comprises three key components: **(i) Landscape Restoration for and by Local Communities, (ii) Value Chains for Climate-Resilient Livelihoods, and (iii) Institutional Strengthening and Capacity Building.** Under the first component, SURAGGWA will engage 14,700 community groups (300,000 households) to restore **133,000 hectares** of severely degraded land and **1,140,513 hectares** of moderately degraded land through soil and water conservation techniques, mechanized plowing, and revegetation with native species, ensuring at least 30% participation of women.

Additionally, it will enhance seed supply systems by producing 2,000 tons of high-germination restoration seeds and establishing community-based nurseries. The second component focuses on strengthening **non-timber forest product (NTFP) value chains**, supporting **1,795 cooperatives and SMEs** to engage in sustainable processing and marketing of products such as baobab, Balanites, and gum arabic, while fostering **partnerships with 15 local financial institutions** to facilitate access to credit and investment for rural businesses. The third component enhances institutional capacities by training **GGW agencies in land restoration coordination, results monitoring, and mobilizing climate change finance**, while also integrating restoration activities into **national climate adaptation plans** and strengthening policies on land tenure security. Through these interventions, the project aims to **restore 1.27 million hectares of degraded land, improve livelihoods for 1.5 million direct beneficiaries and sequester 65.1 million tons of CO₂**.

5. Identification of benefits. The Programme activities are expected to generate several benefits streams: (i) large mitigation benefits from increased soil organic matter, as well as from below and above ground biomass generated by the restoration of degraded dryland ecosystems; (ii) major climate change adaptation benefits, through the range of ecosystem services (provisioning, regulating, cultural and supporting) provided by land restoration. Land restoration activities increase soil fertility, preserve soil water holding capacity, reduce run-off, protect land and agricultural production from increasingly intense floods and droughts, increase infiltration of rainwater, regenerate grasses for livestock; and (iii) important sources of income diversification, whether seasonally or in poor agricultural years, from non-timber forest product (NTFP) commodities valorization and promotion.

6. Specifically, Communities and farmers will benefit from increased crop yields, increased revenues, improved resilience to climate variability and change risks through improvement of smallholder NTFP value chains, along with more intangible social benefits such as improved food security and nutrition, human capital strengthening and women's empowerment, by participating in the Programme activities (highly degraded land and moderately degraded farmland restoration with a range of genetically appropriate seeds that provide increased climate resilience). Farmers' organizations/community will also generate additional income through small-scale rural production, processing, storage, and marketing activities/enterprises, along with capacity development and access to finance. Environmental benefits, such as natural resources protection and reduced GHG emissions using sustainable technologies are also expected.

7. The primary driver of these benefit streams is the implementation of activities under Component 1, which focuses on land restoration including access to improved seeds, adoption of advanced techniques and innovations. Component 2 is the secondary driver of these benefit streams, by enhancing resilience and livelihoods of the local agroforestry and livestock farming communities and smallholder NTFP collectors, processors and sellers. However, the national and regional-level activities under Component 3 are envisaged to generate the necessary conditions for the successful implementation of Components 1 and 2, and to result in additional farmers adopting improved practices and technologies both inside and outside the programme area. Total areas targeted for land restoration activities in the eight SURAGGWA countries are provided in the table below.

Table 1: Land usage under SURAGGWA and coverage area (in ha)

SURAGGWA Countries	Land restoration activities in hectare		
	Reforestation	Agroforestry	Total
	Area in ha		
Burkina-Faso	4,000	36,300	40,300
Chad	4,500	79,500	84,000
Djibouti	2,500	21,000	23,500
Mali	12,440	180,280	192,720
Mauritania	38,083	174,900	212,983
Niger	21,403	244,215	265,618
Nigeria	46,812	322,818	369,630
Senegal	3,500	81,500	85,000
Total	133,238	1,140,513	1,273,751

B. Methodology and Assumption

8. Cost-Benefit Analysis approach. This analysis follows the standard methodology recommended by the World Bank, as outlined in Gittinger (1982) and Belli et al. (2001) and is aligned with the latest guidelines for economic and financial analysis (IFAD internal guidelines on Economic and Financial Analysis of rural development projects, 2019). The financial analysis was conducted to assess the profitability of the proposed programme activities, modelled from the perspective of the target beneficiaries, and compared with the without-project situation over the 20-year lifespan. For reforestation, agroforestry/Agroecology, NTFP promotion, detailed crop and activity budgets have been prepared, covering key tree, shrub and grass species. The analysis computes costs and benefits experienced by the beneficiaries under both scenarios, using market prices (detailed in the accompanying Excel file) and applying a **15 percent discount rate, which reflects the average commercial lending rate and inflation forecasts**¹ in the eight participating countries.

9. Data sources. The programme will promote several priority value chains (FP-Table 6: List of priority NTFPs by country), and land restoration techniques strongly based on local demand and on indigenous species. The analysis supporting this initiative is grounded in an extensive literature review, consultations with FAO technical experts, and insights from the FAO Forestry Division (NFO). Additionally, discussions with stakeholders during country missions have helped shape the financial models that illustrate both current practices and the programme's anticipated support. The analysis is built upon the following key sources of information: (i) Non-timber forest products from restoration to income generation, Sacande, M. & Parfondry, M., 2018 Rome, FAO. 40 pp. License: CC BY-NC-SA 3.0 IGO²; (ii) Analyse de la chaine de valeur des fruits de *Balanites aegyptiaca* (L.) DEL., *Ziziphus mauritiana* Lam., *Sclerocarya birrea* (A. RICH.) HOCHST. et *Bossia senegalensis* (Pers.) Lam. dans le Ferlo (Senegal), (iii) Commodities at a glance, special issue on gum arabic UNCTAD/SUC (2017), (iv) Revue bois et foret des tropiques No 213, 1986, (v) Guidelines on sustainable forest management in drylands of sub-Saharan Africa FAO, 2010, (vi) Etude de la chaine de valeur de la filière balanites dans la commune de Mboula au Sénégal (Janvier 2017), (vii) Past and ongoing experiences of WB³, IFAD⁴ and GCF projects⁵.

10. Climate-Responsive Financial models through the Integration of Climate Risks into Economic Planning. The analysis had to include some strong assumptions about climate risks and their impact on the overall mix of benefits, given the complexity of conducting economic and financial analysis of community-driven and beneficiary-driven activities. Climate variability affects the selection of trees, shrubs, crops, and investment

¹ International Monetary Fund, World Economic Outlook Database, October 2022

² <https://www.fao.org/documents/card/es/c/CA2428EN/>

³ PReCA, PRECEL, WB project in Burkina-Faso, PDIDAS, World Bank Senegal 2022

⁴ RENFORT, IFAD Project in CHAD, INCLUSIF Mali, PRoDAF Niger, AGRIJEUNES Senegal, IFAD, 2023,

⁵ IGREENFIN, Sudan GAMS project.

activities undertaken by community groups and farmers, requiring a financial framework that is both adaptive and resilient to climate uncertainties. Based on the AAD project experiences, a total of 24 climate responsive financial models have been developed, with three (3) models for each country. The first model focuses on the restoration of degraded community land through reforestation, the second model addresses agroforestry on moderately degraded farmland by integrating woody species and fodder crops, improving soil health, and increasing resilience to climate shocks. The third model promotes the resilience of small actors in NTFP value chains by strengthening production, processing, and market access, ensuring economic sustainability despite changing climatic conditions. The WOP scenario⁶ in community land reflects severe land degradation, low vegetation cover with only 100 trees per hectare and declining agricultural yields due to soil depletion, exacerbated by climate change. In contrast, the With Project (WP) scenario introduces climate-smart reforestation, agroforestry practices, and adaptive value chains that result in improved productivity, greater economic resilience, and stronger climate adaptation benefits. By embedding climate risk projections into the financial analysis, the models ensure that investments remain viable under different climate conditions. The tables below provide a detailed presentation of these models.

Table 2: Climate responsive financial models prepared for the EFA.

SURAGGWA Countries	Highly Degraded Community Land Rehabilitation/reforestation models	Moderately degraded farmland Agroforestry/Agroecology models	NTFP and fodder value chains (VC) support⁷
	<i>Average of 1000 trees/ha associated with fodder⁸ (1 ha)</i>	<i>Average of 150-200 trees/ha (10-15% of the area) associated with fodder and annual crops (85-90% of the area)⁹ (1 ha)</i>	<i>Organization of Collectors of NTFP, Training in collection, storage and simple processing techniques, access to Finance, Facilitation of Interaction with Private Sector</i>
Burkina-Faso	Acacia, Balanites, Fodder	Acacia, Balanites, Fodder, Sorghum, Groundnut	Shea nuts processing- 10 ton/year
Chad	Acacia, Balanites, Fodder	Acacia, Balanites, Fodder, Fonio	Flour enriched with Moringa -7 ton/year
Djibouti	Resin species, Balanites, Fodder	Resin species, Balanites, Fodder, Sorghum, Maize	Flour enriched with Moringa-7 ton/year
Mali	Acacia, Balanites, Fodder	Acacia, Balanites, Fodder, Fonio	Shea nuts processing-10 ton/year
Mauritania	Acacia, Balanites, Fodder	Acacia, Balanites, Fodder, Soy, Maize	Balanites oil production-1000 liter/year
Niger	Acacia, Balanites, Fodder	Acacia, Balanites, Fodder, Millet, Groundnut	Balanites oil production—1000 liter/year
Nigeria	Acacia, Balanites, Fodder	Acacia, Balanites, Fodder, Sorghum	NTFP seeds collection and treatment-1200 kg/year
Senegal	Acacia, Balanites, Fodder	Acacia, Balanites, Fodder, Millet	Biologically certified Balanites oil production for export-2000 liter/year

11. Impact and Effects of Climate Change on Financial Viability. The financial analysis explicitly accounts for the impact of climate change, recognizing the increasing risks faced by rural livelihoods in the Great Green Wall Area (GGWA), particularly in the Sahelian countries. Climate change is intensifying extreme weather events such as droughts, floods, and erratic rainfall, which significantly affect agricultural productivity, ecosystem services, and the financial sustainability of land restoration efforts. Without climate-adaptive interventions, agricultural systems will continue to suffer from declining

⁶ Detailed for each model in the annex 3- Excel sheet.

⁸ Action Against Desertification implementation (2015-2020)

⁹ Action Against Desertification implementation (2015-2020)

yields, soil degradation, and reduced water availability, increasing economic vulnerability across communities.

12. The high frequency of crises in the Sahel, in particular the recurrence at increasingly short intervals has direct consequences for agricultural productivity. Prolonged droughts reduce soil moisture retention and limit the regeneration capacity of degraded land, extending the time required for rural households to replenish their agricultural production system and production assets. As mentioned in the feasibility study (Annex 2. Chapter II) **Most historical and projected precipitation trends** in the states participating in the SURAGGWA program **either show insignificant variation or conflicting patterns**, making it difficult to predict future rainfall with a high degree of certainty. The yield projections in this analysis consider different levels of agricultural output, fluctuating between extreme weather events ranging from total crop failure, in extreme years, 60-80 percent of average output in moderate years and full productivity in favorable years. The estimated frequency projections for 2021 are 3/10 for extreme events years, 6/10 for moderate years and 1/10 for good years.

13. **Main yields and production.** The without project (WOP) and with project (WP) yields, and outputs parameters are presented in the attached annex table. For trees and shrubs (Acacia, Balanites) and fodder, yield estimates based on the 2018 FAO study on non-timber forest products from restoration to income generation (conducted under the AAD framework), along with data from land restoration projects such as GAMS in Sudan and stakeholders' insights during the field missions. These sources helped establish an average yield benchmark for each country. In the WOP scenario, gum yield is estimated at 0.25 kg/tree, whereas in the WP scenario, yields increase to 0.55 kg/tree due to project interventions. Similarly, Balanites fruit production is projected at 30-40 kg per tree per year, while fodder yields reach 1.2 tons per hectare per year in the GW area.

14. . For crops, yield variations are country -specify and detailed in the table below. The analysis assumed gradual adoption of improvements over 3 to 8 years, with financial models developed over a -20-year period for land restoration activities and 10-15 years for agro-processing, marketing and storage initiatives.

Table 3: Annual crop basic yields under agroforestry¹⁰.

Crops under agroforestry	Unit	Burkina-Faso		Chad		Djibouti		Mali		Mauritania		Niger		Nigeria		Senegal	
		WOP	WP	WOP	WP	WOP	WP	WOP	WP	WOP	WP	WOP	WP	WOP	WP	WOP	WP
Sorghum	Kg/ha	900	1170			900	1170							1300	1671		
Groundnut	Kg/ha	980	1274									980	1225				
Fonio	Kg/ha			500	643			600	771								
Soy	Kg/ha									1200	1380						
Maize	Kg/ha					1700	2210			1500	1725						
Millet	Kg/ha											450	585			600	771

15. The estimated total number of trees seeded or planted over ten years is almost 320 million across all eight states over a total of 1,273,751, hectares. The figure assumes a 70 percent survival rate in the first two years, with a 30 percent replacement value in the second year, after initial seeding or planting. The expected number of trees remaining in the ground is just above 300 million.

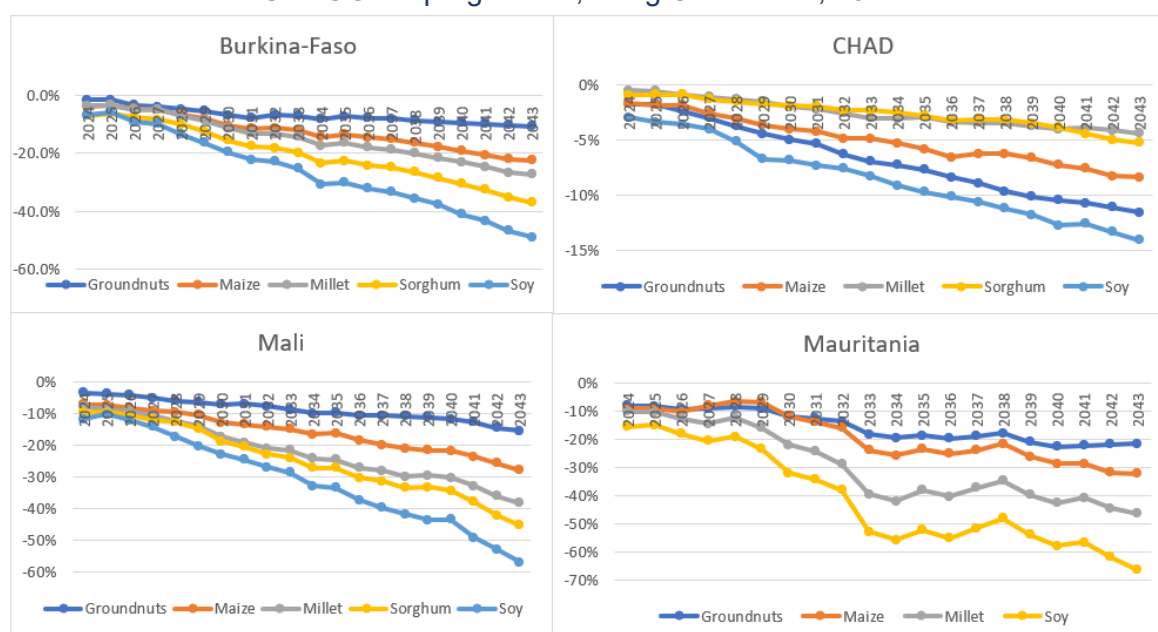
¹⁰ Average of 30% of in the yield improvement

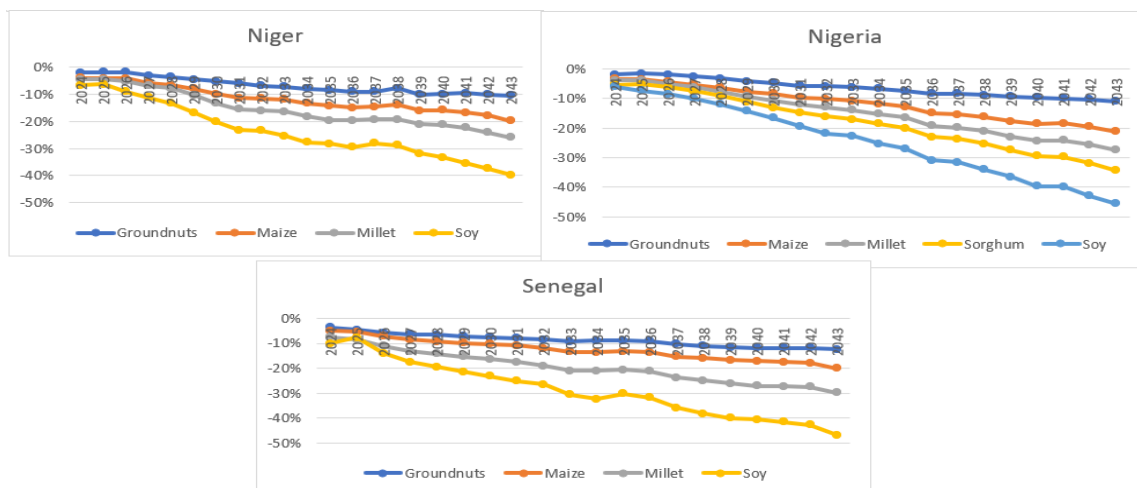
Table 4: Number of trees planted or seeded under SURAGGWA.

SURAGGWA Countries	Land restoration activities in hectare					
	Reforestation		Agroforestry		Total	
	Area in ha	nb of tree	Area in ha	nb of tree	Area restored	nb of tree
Burkina-Faso	4,000	3,600,000	36,300	6,352,500	40,300	9,952,500
Chad	4,500	4,050,000	79,500	13,912,500	84,000	17,962,500
Djibouti	2,500	2,250,000	21,000	3,675,000	23,500	5,925,000
Mali	12,440	11,196,000	180,280	31,549,000	192,720	42,745,000
Mauritania	38,083	34,275,046	174,900	30,607,500	212,983	64,882,546
Niger	21,403	19,262,700	244,215	42,737,625	265,618	62,000,325
Nigeria	46,812	42,130,398	322,818	56,493,228	369,630	98,623,627
Senegal	3,500	3,150,000	81,500	14,262,500	85,000	17,412,500
Total	133,238	119,914,145	1,140,513	199,589,853	1,273,751	319,503,998

16. The IFAD Climate Adaptation in Rural Development (CARD) Assessment Tool. CARD is intended to enhance the quantitative integration of climate-related risks in agricultural and rural development investments and strategies, particularly in economic and financial analyses (EFA). By incorporating climate variability projections. CARD strengthens the resilience of investment planning by ensuring that financial and economic models account for potential climate shocks. In this analysis, CARD was applied to forecast yields variations for the six key field crops under anticipated climate change conditions. The assessment utilized a median climate scenario, incorporating projected temperature and precipitation changes, spanning from 2024 until 2043. This approach allows for a more accurate estimation of climate-induced agricultural shifts, ensuring that adaptation strategies are effectively aligned with expected environmental conditions and long-term rural development goals.

Chart 1: Climate affected crop yield forecast in the countries participating in the SURAGGWA programme, using CARD Tool, 2021





Note: Includes with and without programme impact scenarios

C. Financial Results and impact on household Income

17. The Profitability results, as summarized in the table below, demonstrate that all models promoted under SURAGGWA yield positive Net Present Values (NPV) and Financial Internal Rates of Return (IRR) making them financially viable and sustainable. The IRR across the different models ranges from 17.3% to 29.6% while NPV varies from USD 23 to USD 3,877. All models promoted are classified as profitable with anticipated increases in returns to family labor. The IRR of land restoration activities promoted across the eight participating countries are between 18.8%-26.3% for reforestation and 18.9%-29.6% for agroforestry. The development of NTFP value chains, which includes activities promoted by SMEs working in commercial or productive partnership with smallholders, also exhibits strong financial performance. The models for shea butter, Moringa- enriched flour processing, Balanites oil production and NTFP seed treatment demonstrate IRRs between 17.3%- 29.4% over an investment period of 10 to 20 years.

18. The financial analysis from the private perspective of smallholder beneficiaries further underscores the high economic potential of land restoration activities. On average, rural households participating in the programme generate a return of 1.52 USD for each USD invested, with financial outcomes ranging from 1.1 USD to 3.19 USD. These results highlight the financial incentives for smallholders, reinforcing the economic viability of investing in land restoration, climate-resilient agroforestry, and NTFP development.

Table 5: Burkina-Faso Financial Profitability indicators per model

Financial indicator	Models promoted (Reference to table 2)		
	Reforestation	Agroforestry	NTFP SME support
Opportunity cost of the capital	15%	15%	15%
NPV (USD)	190	44	2,460
FIRR	19.9%	27.4%	29.4%
Ratio B/C	1.09	1.70	1.05
NVPVc (USD)	2,570	1,225	15,904
NPVb (USD)	2,797	2,084	15,214
breakeven benefits	-8%	-41%	-4%
breakeven costs	9%	70%	5%

Table 6: Chad Financial Profitability indicators per model

Financial indicator	Models promoted (Reference to table 2)		
	Reforestation	Agroforestry	NTPF SME support
Opportunity cost of the capital	15%	15%	15%
NPV (USD)	208	213	3,760
FIRR	21.7%	#NOMBRE!	23.9%
Ratio B/C	1.09	1.27	1.73
NVPVc (USD)	2,716	2,112	65,173
NPVb (USD)	2,950	2,691	37,630
breakeven benefits	-8%	-22%	-42%
breakeven costs	9%	27%	73%

Table 7: Djibouti-financial profitability indicators per model

Financial indicator	Models promoted (Reference to table 2)		
	Reforestation	Agroforestry	NTPF SME support
Opportunity cost of the capital	15%	15%	15%
NPV (USD)	294	50	3,877
FIRR	18.8%	29.6%	24.2%
Ratio B/C	1.13	1.58	1.73
NVPVc (USD)	3,928	1,562	65,257
NPVb (USD)	4,424	2,461	37,679
breakeven benefits	-11%	-37%	-42%
breakeven costs	13%	58%	73%

Table 8: Mali-financial profitability indicators per model

Financial indicator	Models promoted (Reference to table 2)		
	Reforestation	Agroforestry	NTPF SME support
Opportunity cost of the capital	15%	15%	15%
NPV (USD)	213	204	1,895
FIRR	20.7%	#NOMBRE!	26.6%
Ratio B/C	1.09	1.59	1.19
NVPVc (USD)	2,469	1,959	19,715
NPVb (USD)	2,695	3,105	16,523
breakeven benefits	-8%	-37%	-16%
breakeven costs	9%	59%	19%

Table 9: Mauritania-financial profitability indicators per model

Financial indicator	Models promoted (Reference to table 2)		
	Reforestation	Agroforestry	NTPF SME support
Opportunity cost of the capital	15%	15%	15%
NPV (USD)	188	204	2,236
FIRR	18.9%	#NOMBRE!	28.0%
Ratio B/C	1.07	1.75	1.17
NVPVc (USD)	3,073	1,428	21,205
NPVb (USD)	3,297	2,502	18,176
breakeven benefits	-7%	-43%	-14%
breakeven costs	7%	75%	17%

Table 9: Niger-financial profitability indicators per model

Financial indicator	Models promoted (Reference to table 2)		
	Reforestation	Agroforestry	NTPF SME support
Opportunity cost of the capital	15%	15%	15%
NPV (USD)	408	23	2,124
FIRR	26.2%	18.9%	27.6%
Ratio B/C	1.16	1.88	1.15
NVPVc (USD)	2,635	1,316	21,754
NPVb (USD)	3,066	2,468	18,857
breakeven benefits	-14%	-47%	-13%
breakeven costs	16%	88%	15%

Table 10: Nigeria-financial profitability indicators per model

Financial indicator	Models promoted (Reference to table 2)		
	Reforestation	Agroforestry	NTPF SME support
Opportunity cost of the capital	15%	15%	15%
NPV (USD)	505	301	2,427
FIRR	26.3%	#NOMBRE!	17.4%
Ratio B/C	1.18	1.84	1.11
NVPVc (USD)	3,796	1,888	82,141
NPVb (USD)	4,477	3,475	74,238
breakeven benefits	-15%	-46%	-10%
breakeven costs	18%	84%	11%

Table 11: Senegal -financial profitability indicators per model

Financial indicator	Models promoted (Reference to table 2)		
	Reforestation	Agroforestry	NTPF SME support
Opportunity cost of the capital	15%	15%	15%
NPV (USD)	279	343	2,175
FIRR	21.9%	#NOMBRE!	17.3%
Ratio B/C	1.11	1.18	1.09
NVPVc (USD)	2,792	2,044	68,900
NPVb (USD)	3,097	2,411	63,298
breakeven benefits	-10%	-15%	-8%
breakeven costs	11%	18%	9%

19. Impacts on household incomes. All the models assessed as part of this analysis appear viable, generating additional income and attractive returns on the investment for households participating in the programme. The adoption of sustainable land management practices integrating the cultivation of fodder and other fast-returning crops, would allow for a substantial increase in household income (up to 65%) over the first 5 years of the investment, depending on the level of adoption. The average income per HH is projected to be increased from 55 USD/year to 421 USD/year.

20. This increase in income has direct implications for poverty reduction, especially considering the high poverty rates in the Sahel region. For instance, in Chad, approximately 44.8 % of the population lives below the poverty line, and in Niger, about 45.7% of the population. While the projected income growth may not fully lift all beneficiary households above the national poverty thresholds, it represents a significant step toward improving livelihoods and reducing poverty levels in these communities.

Table 10: Average income per HH and increase in Income

SURAGGWA Countries		Burkina Faso	Chad	Djibouti	Mali	Mauritania	Niger	Nigeria	Senegal
Household average size		7	5.49	5.89	7.89	5.62	7.45	6.84	11.6
Reforestation	Additional income per (HH)	168	78	111	86	96	55	138	130
	% of increase in income	40%	34%	65%	35%	37%	41%	17%	30%
Agroforesterie (4ha/HH)	Additional income per (HH)	404	209	108	229	247	113	358	421
	% of increase in income	63%	51%	16%	31%	37%	12%	31%	38%
NTPF actors support-4-10 HH members involved	Additional income per (HH)	255	418	424	221	244	233	345	321
	% of increase in income	23%	40%	25%	17%	21%	14%	17%	16%

21. Financial sustainability analysis. Loan repayment analysis was assessed for the component 2 models (NTPF) and it shows that for all eight countries, the producers have the capacity to keep their activity running with positive cumulative cash flow starting the first year, alleviating cash flow pressure during the starting years of the activity. For all countries, the NTPF activities show higher NPVs than before financing situation, thanks to higher positive cash flows all years, especially in the early period.

D. Economic Results and Climate Change Mitigation Benefits

22. **The benefits of the Programme have been aggregated using the economic results of the identified benefit streams and the Programme costs.** The economic analysis followed a similar approach but using economic prices and aggregating the results at the level of the program and from the society's viewpoint for each of the 8 countries. The economic analysis uses the incremental benefits, adoption rates and expected total number of beneficiaries (aligned to the results framework in Annex 23), adding to that the environmental co-benefits arising from reduced GHG emissions and subtracting the total project economic costs to determine the overall economic viability of the project. The discount rates used are 10 percent for the social discount rate, used by the GCF for related investments. The analysis assumes an initial adoption rate of 100 percent of the target numbers, followed by drop-out rates of around 20-40 percent, thereby arriving at an adoption rate of around 60-80 percent¹¹.

23. . For each participating country and at regional level, the total economic costs of the interventions have been estimated using disbursement plan by country and at regional level, by removing transfer costs, and including all costs (total cost of the programme estimated at USD 222 million including USD 150 million of GCF grant), the costs incurred by the beneficiaries already integrated into the models, Government contributions and other co-financing totalling about USD 72 million USD. The specific conversion factors for exchangeable and non-exchangeable goods (inputs and outputs) were also applied to convert the financial price into economic price.

24. **Overall, the Ex-Ante economic results at regional level show satisfactory and positive NPVs** at regional level with some disparity between countries (as summarized in Appendix A). On the whole, the SURAGGWA interventions are economically justified, generating a net present value (NPV, at 10% discount rate¹²) of the additional benefits of US\$ 154.2 million and an economic rate of return (EIRR) of 19.2% over a 20-year period, not accounting for environmental externalities. The vulnerability to climate change of the rural communities involved, in combination with their extremely limited access to financial services and the high level of indebtedness of the eight SURAGGWA countries, however, fully justify the mobilization of grant funding from the GCF.

Table 11. Economic Result of the programme

Indicateurs @20ans , Total cost @220 Millions USD	Whithout Env, Benefits
NPV BNA (million USD, @10%)	154.2
ERR	19.2%
NPVb (million USD @10%)	315
NPVc (million USD, @10%)	160
B/C ratio	1.96
Discount rate	10.0%
Switching values - Bénéfices	-0.49
Switching values - Coûts	0.96

¹¹ The adoption rate of 60-80 percent is considered conservative, given that a higher adoption rate of 75-85 percent was experienced under several similar project in the GGW countries with WB, IFAD project.

¹² The discount rates used are 10 percent for the social discount rate, used by the GCF for related investments .

Table 12. Economic Result per SURAGGWA country.

Economic results		Burkina Faso	Chad	Djibouti	Mali	Mauritania	Niger	Nigeria	Senegal	Regional
Budget	USD million	12.0	15.4	10.4	21.6	36.8	32.5	52.6	25.7	222
Targeted area	Hectares	40,300	84,000	23,500	192,720	212,983	265,618	369,630	85,000	1,273,751
NPV @ 10%, 20-years	USD million	7.3	4.6	5.3	18.5	31.9	33.4	37.3	15.9	154.2
ERR	(%)	15.8%	18.1%	15.6%	19.3%	18.0%	18.6%	24.4%	19.9%	19.2%
Including 15million USD Regional coordination costs.										

25. Environmental externalities. The environmental externalities of the SURAGGWA were estimated using the EX-ACT tool developed by FAO to provide estimations of the impact of AFOLU (Agriculture, Forestry and Other Land Use) projects and policies on the carbon balance. The carbon balance using the EXACT-Tool is defined as the net balance across all GHGs expressed in CO₂ equivalents (CO₂e) that will be emitted or sequestered due to project implementation (WP), as compared to a business-as-usual scenario (WOP). EX-ACT is a land-based accounting system, estimating CO₂e stock changes (i.e. emissions or sinks of CO₂) expressed in equivalent tons of CO₂ per hectare and year. The tool was designed using mostly data from the Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories (NGGI-IPCC, 2006), which furnishes EX-ACT with recognized default values for emission factors and carbon values in soils and biomass (the so-called “Tier 1 level” of precision). As presented in CO₂ impact potential Annex 22, the direct CO₂ impact of SURAGGWA’s restoration activities for the accounting duration of 20 years (i.e. 10 years implementation + 10 years capitalization period) is estimated at **-65.1 million tons CO₂-eq** over a total land area of 1,273,751, hectares, corresponding to - 2.6 tCO₂-eq per hectare and per year.

26. The total additional carbon sequestration from SURAGGWA’s investment in tree cover restoration is estimated at 5.76MtCO₂ for a total accounting period of 20 years. Promoting agroforestry with carefully chosen indigenous species on annual cropland is projected to establish carbon sinks, potentially sequestering an estimated 60,2 MtCO₂ over a 20-year period. Methane emissions associated with increased livestock productivity, as evaluated in the grassland and livestock module of EX-ACT, could amount to 892,461 tCO₂-eq over the same period. The net environmental benefit of 65.1 Mt CO₂eq over 20 years calculated in Annex 22 has been included in the economic valuation and in line with the World Bank guidelines¹³. The GHG emissions results have been valued using the social price of carbon, using the gradually increasing estimates at both low and high ranges (respectively an average of 70 USD and 140 USD/ tCO₂-eq) and current market price estimate at 31 USD/tCO₂-eq¹⁴.

27. The full economic potential of the programme, when the projected GHG mitigation is valued appropriately, is much higher. **Using more conservative prices, at current market price (31 USD per tCO₂-eq), SURAGGWA would generate a net present value (NPV) of US\$ 754.5 million and an economic internal rate of return (ERR) of 57.5 percent over 20 years period.** These results further emphasize the fact that the public benefits that would be generated by the programme largely outweigh the private benefits created. The results per country are also presented in the Appendix A.

¹³ Based on the World Bank 2024 *Guidance note on shadow price of carbon in economic analysis*).

¹⁴ <https://markets.businessinsider.com/commodities/co2-european-emission-allowances>

Table 13. Climate Change Mitigation Benefits of Carbon Sequestration

Indicateurs @20ans , Total cost @220 Millions USD	Without Env. Benefits	With ENV. Benefits @current market price	With ENV. Benefits @low estimate range	With ENV. Benefits @high estimate range
NPV BNA (million USD, @10%)	154.2	755	1,588	3,026
ERR	19.2%	57.5%	98.1%	159.1%
NPVb (million USD @10%)	315	915	1,748	3,186
NPVc (million USD, @10%)	160	160	160	160
B/C ratio	1.96	5.70	10.90	19.86
Discount rate	10.0%	10.0%	10.0%	10.0%
Switching values - Bénéfices	-0.49	-0.82	-0.91	-0.95
Switching values - Coûts	0.96	4.70	9.90	18.86

E. Sensitivity Analysis and sustainability.

28. In addition to the occurrence of good, moderate, and extreme climate shocks years reflected in the models by assuming a yield of 0-60-80-100 percent for trees and the integration of the effect of climatic shocks on projected field crops using the CARD tool for the baseline and with project scenarios, a sensitivity test was developed using different risk-occurrence scenarios. These included: (i) increase in costs due to extreme climate events (droughts, floods) leading to higher prices for agricultural inputs (fertilizers, seeds),(ii) reduction in benefits due to variability in yields and prices caused by climate change (reduced harvests due to heatwaves, irregular rainfall affecting product quality, and slower adoption of resilient practices); (iii) delay in benefits due to unpredictability of weather conditions and lack of financial incentives for farmers, (iv) extreme climate shocks every 2- and 3-years affecting supply and demand (droughts, storms, shifting growing seasons, impact on supply chains, and fluctuations in agricultural prices. NPV remains positive, indicating that the is still considered to be profitable under the different risk occurrence scenarios tested. Detailed assumptions and calculations are attached to the Annex 3. Table 14 below presents the main results of the sensitivity test.

Table 14. Sensitivity analysis including climate risk.

ANALYSE DE SENSIBILITE		Climate Risks	ERR	VAN (@10%, 20 years, Million (USD))
Base Scenario			19.2%	154.2
Coûts +	10%	Rising costs due to extreme climate events (droughts, floods) leading to higher prices for agricultural inputs (fertilizers, seeds...)	18.0%	138.2
	20%		16.8%	122.2
	30%		15.7%	106.1
Benefits -	10%	Variability in yields and prices due to climate change (reduced harvests due to heatwaves, irregular rainfall affecting product quality, slower adoption of resilient practices).	17.8%	122.8
	20%		16.2%	91.3
	30%		13.1%	43.8
Delay 1 year in benefits		Adoption rate/delay -unpredictability of weather conditions and lack of financial incentives for farmers.	16.8%	115.5
Delay 2 year in benefits			14.7%	78.7
Delay 3 year in benefits			12.6%	42.4
Extreme climate shoks every 2 years -		Climate-related external shocks affecting supply and demand (droughts, storms, shifting growing seasons, impact on supply chains, and fluctuations in agricultural prices	13.3%	51.9
Extreme climate shocks every 3 years -			16.8%	122.6

29. The exit strategy and sustainability of SURAGGWA rely on community ownership, private sector engagement, and institutional capacity building. The programme fosters long-term economic incentives through strengthened NTFP value chains, linking producers to markets and financial institutions. Access to finance is facilitated through partnerships with commercial banks and digital financial solutions, ensuring continued investment beyond the project. At the institutional level, the programme enhances GGW agencies' capacity for coordination, monitoring, and policy integration, enabling them to sustain restoration efforts and mobilize future funding.

Appendix A

SURAGGWA countries- Economic result including environmental benefits.

Burkina-Faso- Economic result including environmental benefits (Total budget of USD 12.0 million)

Indicateurs @20ans	Whithout Env, Benefits	With ENV. Benefits @current market price	With ENV. Benefits @low estimate range	With ENV. Benefits @high estimate range
NPV BNA (USD, @10%)	7,327,529	26,946,990	52,653,789	98,117,221
ERR	15.8%	32.3%	51.2%	83.1%
NPVb (USD @10%)	16,680,386	36,299,847	62,006,646	107,470,078
NPVc (USD, @10%)	9,352,857	9,352,857	9,352,857	9,352,857
B/C ratio	1.78	3.88	6.63	11.49
Discount rate	10.0%	10.0%	10.0%	10.0%
Switching values - Bénéfices	-0.44	-0.74	-0.85	-0.91
Switching values - Coûts	0.78	2.88	5.63	10.49

Chad- Economic result including environmental benefits (Total budget of USD 15.4 million)

Indicateurs @20ans	Whithout Env, Benefits	With ENV. Benefits @current market price	With ENV. Benefits @low estimate range	With ENV. Benefits @high estimate range
NPV BNA (USD, @10%)	4,631,517	40,402,798	89,470,905	174,567,045
ERR	18.1%	62.8%	99.0%	151.3%
NPVb (USD @10%)	15,562,975	51,334,257	100,402,363	185,498,503
NPVc (USD, @10%)	10,931,458	10,931,458	10,931,458	10,931,458
B/C ratio	1.42	4.70	9.18	16.97
Discount rate	10.0%	10.0%	10.0%	10.0%
Switching values - Bénéfices	-0.30	-0.79	-0.89	-0.94
Switching values - Coûts	0.42	3.70	8.18	15.97

Djibouti- Economic result including environmental benefits (Total budget of USD 10.4 million)

Indicateurs @20ans	Whithout Env, Benefits	With ENV. Benefits @current market price	With ENV. Benefits @low estimate range	With ENV. Benefits @high estimate range
NPV BNA (USD, @10%)	5,329,804	17,598,128	33,015,377	60,784,735
ERR	15.6%	29.6%	45.7%	74.4%
NPVb (USD @10%)	11,445,732	23,714,056	39,131,305	66,900,663
NPVc (USD, @10%)	6,115,928	6,115,928	6,115,928	6,115,928
B/C ratio	1.87	3.88	6.40	10.94
Discount rate	10.0%	10.0%	10.0%	10.0%
Switching values - Bénéfices	-0.47	-0.74	-0.84	-0.91
Switching values - Coûts	0.87	2.88	5.40	9.94

Mali- Economic result including environmental benefits (Total budget of USD 21.6 million)

Indicateurs @20ans	Whithout Env, Benefits	With ENV. Benefits @current market price	With ENV. Benefits @low estimate range	With ENV. Benefits @high estimate range
NPV BNA (USD, @10%)	18,480,792	114,043,310	244,538,011	471,279,352
ERR	19.3%	64.9%	111.3%	181.3%
NPVb (USD @10%)	40,316,052	135,878,570	266,373,271	493,114,612
NPVc (USD, @10%)	21,835,260	21,835,260	21,835,260	21,835,260
B/C ratio	1.85	6.22	12.20	22.58
Discount rate	10.0%	10.0%	10.0%	10.0%
Switching values - Bénéfices	-0.46	-0.84	-0.92	-0.96
Switching values - Coûts	0.85	5.22	11.20	21.58

Mauritania- Economic result including environmental benefits (Total budget of USD 36.7 million)

Indicateurs @20ans	Whithout Env, Benefits	With ENV. Benefits @current market price	With ENV. Benefits @low estimate range	With ENV. Benefits @high estimate range
NPV BNA (USD, @10%)	31,949,943	124,803,518	253,380,951	475,482,079
ERR	18.0%	47.3%	85.4%	143.6%
NPVb (USD @10%)	56,624,439	149,478,014	278,055,446	500,156,575
NPVc (USD, @10%)	24,674,496	24,674,496	24,674,496	24,674,496
B/C ratio	2.29	6.06	11.27	20.27
Discount rate	10.0%	10.0%	10.0%	10.0%
Switching values - Bénéfices	-0.56	-0.83	-0.91	-0.95
Switching values - Coûts	1.29	5.06	10.27	19.27

Niger - Economic result including environmental benefits (Total budget of USD 32.5 million)

Indicateurs @20ans	Without Env, Benefits	With ENV. Benefits @current market price	With ENV. Benefits @low estimate range	With ENV. Benefits @high estimate range
NPV BNA (USD, @10%)	33,409,613	160,519,391	337,038,927	641,587,121
ERR	18.6%	61.4%	113.7%	191.2%
NPVb (USD @10%)	55,785,261	182,895,040	359,414,576	663,962,770
NPVc (USD, @10%)	22,375,649	22,375,649	22,375,649	22,375,649
B/C ratio	2.49	8.17	16.06	29.67
Discount rate	10.0%	10.0%	10.0%	10.0%
Switching values - Bénéfices	-0.60	-0.88	-0.94	-0.97
Switching values - Coûts	1.49	7.17	15.06	28.67

Nigeria - Economic result including environmental benefits (Total budget of USD 52.6 million)

Indicateurs @20ans	Without Env, Benefits	With ENV. Benefits @current market price	With ENV. Benefits @low estimate range	With ENV. Benefits @high estimate range
NPV BNA (USD, @10%)	37,252,314	213,469,203	463,886,241	891,811,300
ERR	24.4%	81.2%	130.4%	201.1%
NPVb (USD @10%)	82,284,204	258,501,093	508,918,132	936,843,190
NPVc (USD, @10%)	45,031,890	45,031,890	45,031,890	45,031,890
B/C ratio	1.83	5.74	11.30	20.80
Discount rate	10.0%	10.0%	10.0%	10.0%
Switching values - Bénéfices	-0.45	-0.83	-0.91	-0.95
Switching values - Coûts	0.83	4.74	10.30	19.80

Senegal- Economic result including environmental benefits (Total budget of USD 25.7 million)

Indicateurs @20ans	Without Env, Benefits	With ENV. Benefits @current market price	With ENV. Benefits @low estimate range	With ENV. Benefits @high estimate range
NPV BNA (USD, @10%)	15,863,023	56,767,332	113,774,306	211,981,900
ERR	19.9%	41.5%	65.6%	106.6%
NPVb (USD @10%)	36,002,152	76,906,461	133,913,435	232,121,029
NPVc (USD, @10%)	20,139,129	20,139,129	20,139,129	20,139,129
B/C ratio	1.79	3.82	6.65	11.53
Discount rate	10.0%	10.0%	10.0%	10.0%
Switching values - Bénéfices	-0.44	-0.74	-0.85	-0.91
Switching values - Coûts	0.79	2.82	5.65	10.53