WFP
World Food Programme

SAVING LIVES
CHANGING LIVES

A Cost-Benefit Analysis of WFP Integrated Resilience Programme

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Index

Introduction

Food systems are critical to livelihoods in West and Central Africa, contributing to 35percent of GDP and supporting two-thirds of West Africa's workforce. Despite this potential, food insecurity and malnutrition are rising in the region, mainly due to land degradation, climate shocks, and resource competition driven by conflicts, which weaken food system resilience and increase dependency on imports. Addressing these structural risks requires a holistic, multi-sectoral approach. **WFP's Integrated Resilience Package (IRP)** aims to address these challenges by combining complementary interventions to strengthen livelihoods and food systems. This package integrates land rehabilitation, climate-adaptive agricultural practices, economic and social support measures, such as market access, financial inclusion, and community capacity-building, school meal support and malnutrition prevention and treatment.

By addressing multiple vulnerabilities simultaneously, the IRP enhances household incomes, food security, and social cohesion, aiming for long-term resilience. The approach emphasizes community-driven solutions tailored to specific vulnerabilities, ensuring sustainable benefits across environmental, social, and economic dimensions.

Quantifying benefits and involving diverse stakeholders helps guide investments that balance competing land uses and maximize impact, fostering sustainable development and resilience in fragile ecosystems.

Methodological Aspects

This note estimates the costs and benefits of WFP's Integrated Resilience Programme, focusing on the investment's efficiency. The analysis is based on a per-household perspective and considers both the costs and a broad spectrum of co-benefits linked to the intervention. A key component of this evaluation is the calculation of the Benefit-Cost Ratio (BCR), which quantifies the overall value or efficiency of the investment by expressing the cost-benefit analysis as a percentage.

The Cost benefit analysis considers the following components: investments in resilience and costs of recurrent humanitarian assistance and losses, in areas of the Sahel facing acute food insecurity and recurrent climate shocks, environmental degradation, and other stressors.

It outlines, what on average an integrated resilience package costs and what, in alternative, an emergency response package costs in a Sahel context. It also outlines several benefits that would ultimately reduce and offset the need of approximately 70-80percent of humanitarian assistance after a 5-years period.

The main assumption is that resilience interventions are undertaken based on trends analysis, in areas with recurrent IPC3/4 and high recurrence of climate shocks for the past 5-10 years. In absence of resilience interventions these areas are recurrently assisted with emergency response, lean season support and treatments of malnutrition.

The analysis is based on the past 6-8 years of resilience interventions supported by WFP and its partners across Niger, Chad, Burkina Faso, Mali, and Mauritania. This period of experience provides valuable insights into the effectiveness of different strategies and outcomes related to building resilience in these regions.

It is a modelized, estimated calculation, that would need specific studies with cost-benefit analysis in multiple scenarios to define precise cost-benefit analysis.

Assumptions

General Assumption: This estimate is based on the needs of an average household, consisting of 7 people, with approximately 300 households per community (totaling 2,100 people). The community is situated in a territorial unit of roughly 1,000 hectares, over half of which is severely degraded. As a result, rehabilitation of about 700 hectares is necessary over a 5-years period.

Detailed assumptions: A table detailing the different assumptions is annexed to the document (see Annex 1).

Assumptions on co-benefits have been reduced to calculate specific risk factors, related to non-materialization or variability in highly volatile contexts (all details in the table). Additionally, an overall discount rate, based on the rates of major development financial institutions for high-risk countries in the region, has been applied to the co-benefits calculation, and it's also detailed in the annex (Table ref. #14). This approach ensures that the calculations are adjusted for time and the associated increase in risk.

1. Costs and Benefits Analysis

The first component of the analysis corresponds to the costs of humanitarian assistance and lean season support, as well as the losses related to the lack of such support and and its consequences. The main elements and components involved are listed and estimated as follows:

- **Costs of Humanitarian Assistance:** These include financial outlays for food aid, emergency healthcare, water sanitation, and shelter, which are necessary to sustain vulnerable populations during crises. The provision of these services often represents a significant portion of overall humanitarian spending.
- **Lean Season Support Costs:** During periods of food scarcity, additional resources are required to ensure that populations affected by the lean season (typically pre-harvest periods) receive adequate nutrition. This support includes food distribution, nutritional supplements, and cash transfers.
- **Losses from Lack of Support:** When humanitarian interventions are inadequete, the resulting economic losses can manifest as higher rates of morbidity and mortality, loss of livelihoods, and long-term disruptions to local economies. These impacts often compound over time, exacerbating food insecurity and further straining resources.Economic and Social Effects: The absence of adequate support can result in significant reductions in agricultural productivity, income loss, and potential displacement, which may lead to broader social and economic destabilization.

Each of these components contributes to understanding the full cost of humanitarian intervention.

A. HUMANITARIAN & LEAN SEASON SUPPORT OVER 5 YEARS PERIOD (IPC3-4 AREAS)

DESCRIPTION	MONTHLY TRANSFERS COSTS USD (ALL INCLUDED)	#MONTHS	TOTAL USD/ HOUSEHOLD
HUMANITARIAN ASSISTANCE			
5 years lean season (3 months food assistance each year)	16/Person	15 months (in 5 years)	1680 USD
2 years major shocks (i.e. drought/flooding/other. 5 months food assistance)	16/Person	10 months (in 2 years)	1120 USD
Nutritional assistance/treatment	50/Benef/Month	3-6 months/year (5 years)	1500 USD
Total cost of humanitarian assistance			4300 USD
LOSSES			
Environmental Costs (fertility replacement equivalent)	150/year/Ha/HHs (average)	yearly	750 USD
Environmental Costs (i.e. pests, biodiversity, etc)	250/year/2Ha/HHs (average)	yearly	1250 USD
Social and income losses (medical expenditures…)	250/HH/year (average)	yearly	1250 USD
School drop-out, human capital losses and conflict-related damage (includes catchment in NSAG and early marriages effects)	100/HH/year (min average)	yearly	500 USD
Total cost of losses			3750 USD
TOTAL HUMANITARIAN/EMERGENCY ASSISTANCE + LOSSES (5 YEARS)			**8050 USD**

A. Cost of emergency food assistance in areas facing high recurrence of food insecurity and climate shocks and other stressors

An average family of 7 people, located in a highly food insecure area in the Sahel (e.g. Niger, Chad, etc.) such as IPC 3-4 needs every year food assistance.

Considering that resilience interventions are selected in communities facing recurrent IPC3-4 for the past 5 years – it is assumed that with no other interventions, beneficiaries would require 3 months emergency lean season support every year, at approximately 16 USD/month, over 5 years.

Lean Season support is calculated as a 3 months support per year, during five years, considering a monthly support equivalent to 16 USD per person, totaling 1,680 USD.

Humanitarian Assistance during 2 years of major shocks: 5 months assistance, during 2 years, considering a monthly support of 16 USD per person. 1,120 USD. As the recurrence of climate extremes in such areas is also based on high recurrence of at least 2 major climate shocks every 5 years, it is likely that the humanitarian needs would, for that year, be of at least 5 additional months for 2 years.

Adding the costs that at least 10-15 percent malnutrition rates found in such contexts imply in terms of costs of treatment and health related issues, the costs of nutritional assistance will add additional 1500 USD/HH/ for the duration of 5 years.

Overall, 4300 USD per household for humanitarian assistance and lean season support are the estimated costs over 5 years.

B. Associated Losses

Associated losses refer to the negative outcomes resulting from a lack of intervention. These losses impact people and ecosystems, spanning environmental, socio-economic, human dimensions.

Environmental costs: Land degradation/ fertility loss equivalent – considering that on average a household has less than 2 hectares of which 50 percent is severely degraded and the remaining 50 percent moderately degraded the costs of land degradation range from 100 to 150 USD/ha/ year in fertility replacement equivalents (Table Ref. #1 and #2), meaning 750 USD over the period

Other environmental services and longer term offsite negative effects such as incidence of pests, flooding, and biodiversity losses make an overall estimate of environmental losses over

250 USD/HH/year x 5 years = 1250 USD for the 5 years period[1] (Table Ref. #3).

Social, income and human capital losses: Based on the Household Economic Analysis (HEA) in most Sahel contexts around 30 percent HH is classified extreme poor and around 40 percent poor – with higher proportions in IPC 4 areas. This entails a growing number of landowners with poor quality or no land, owning fewer or no livestock, with high levels of debt, often with low remittances and relying on daily negative coping strategies (e.g. sale of firewood, low wage works, etc.), and with high levels of malnutrition and no means to cover health costs. Over time costs of malnutrition and lack of viable alternatives erode meagre

1 This assumes a static estimate which is reality would be incremental as per the status of degradation and environmental services deteriorates further

coping capacities, further deplete natural resources and push people migrate, drop out of school at earlier grades and/or not complete school cycles, early marriages, and deeper indebtedness. The costs of inaction in tackling underlying problems except for a few months lean season transfer is the function of how long communities are left without any development assistance – raising exponentially the costs of malnutrition. A conservative figure would be a capital loss of at least 250 USD/year (medical expenses, debt, reduced means of production, increased negative coping strategies) + 100 USD/Year (drop-out and related catchment in Armed Groups and early marriage) **(Table ref. #4)**, resulting in a minimum 500 USD losses over 5 years.

Overall, 3750 USD are the estimated costs related to losses.

Overall, 8050 USD are the estimated costs per household over 5 years, as a sum of Humanitarian Assistance Costs and Losses.

C. Costs of resilience package and estimated benefits

Investment of the integrated resilience package: The average investment required for the integrated resilience programme is of around 100 USD/Person/Year (all WFP costs included) or 700USD/HH/year (with an average of 7 people/HH). For a duration of 5 years – i.e. 3500 USD/Household for 5 years.

The investment includes a full package of livelihood assets building such as land rehabilitation, soil conservation and water harvesting, improved storage to reduce post-harvest losses, home-grown school meals, and nutrition support for mothers and children, and capacity strengthening (Table ref. # 5).

C. IRP INVESTMENT ASSOCIATED COSTS (OVERALL AND COMPONENTS) OVER 5 YEARS PERIOD (IPC3-4 AREAS)

DESCRIPTION	MONTHLY COSTS/HH	ANNUAL COST/HH.	TOTAL COST/HH (5 YRS)	TOTAL USD/HH* (7 BENEF/HH) (5YEARS)
OVERALL INVESTMENT IRP				
FFA (18days*6months*5 years)	41.67	250	1250	1250
SAMs (200xyear/HH)	200	200	1000	1000
NUT (50xyear)	50	50	50	250
SF (2 children/HH*8months)	18	144	144	144
CS-Training	1.67	20	100	100
CS-Asset	9.26	111.2	111.2	556
OVERALL INVESTMENT IRP			700	3500 USD

D. Estimated benefits from the integrated resilience package

The following is a linear and non-progressive set of listed benefits per/year for 5 years average developed for overall awareness purposes.

The overall estimated benefits are projected at 8,050 USD over a 5-years period.

This figure encompasses the various positive outcomes expected from the resilience interventions, including improvements in livelihoods, food security, and ecosystem restoration.

D. IRP INVESTMENT ASSOCIATED COSTS (OVERALL AND COMPONENTS) OVER 5 YEARS PERIOD (IPC3-4 AREAS)

DESCRIPTION	NUMBER OF YEARS	ANNUAL BENEFIT	TOTAL BENEFIT (5 YEARS)
Increased yields from rehabilitated land	**3 (from 3rd onward)**	**450**	**1,350**
Access to pasture and livestock feed	**3 (from 3rd onward)**	**100**	**300**
CO2 sequestration	**4 (from 2nd onward)**	**75**	**300**
Human Capital/Education	**5**	**720**	**3,600**
Access to vegetable gardening	**3 (from 3rd onward)**	**200**	**600**
Reduction of hardships	**3 (from 3rd onward)**	**334**	**1,000**
Post-harvest losses prevention	**3 (from 3rd onward)**	**167**	**500**
Reduction of debt burden	**3 (from 3rd onward)**	**300**	**900**
TOTAL CO-BENEFITS			**8,550**

Increased yields from rehabilitated land: On average one additional hectare of degraded lands is restored per household and existing cultivated 2 hectare is improved through better land management techniques per household, thus 2 ha by the end of the programme cycle. This is minimum 1MT of produce available per year generating approximately 450 USD per year over a 3-years period. The total direct benefits for each household are estimated at 1,350 USD over the 3 years, assuming the household reaches full production capacity by the third year (Table ref. #6).

Access to pasture and livestock feed generated from protected communal/ groups' lands: in most communities in the Sahel each family will have access to approximately 0,5 MT of fodder or hay from rehabilitated pastures – equivalent to some min 100 USD/year x 3 years = 300 USD HH/3 years period (direct benefit) during the five years period and beyond (Table ref. #7).

Carbon sequestration: Each ha of rehabilitated land would generate 3 tons of CO2 sequestration/Ha/year acting as a carbon sink – generating some additional 75 USD/year (on average) in environmental/ climate services – This is approximately 225 USD per household for 3 years during the implementation period and beyon (Table ref. #8).

School attendance: Two school age children per household attend school and receive a hot meal from locally produced foods. School meals can be reflected in a gain in terms of potential of human capital, and future work force and social cohesion, that can be estimated at 250 USD/year, for 25 percent of the targeted population (people in primary school age, that we can assume represent 2 children per HHs) - (Table ref. #9).

Incomes/revenues: Increased income from access to vegetable gardening (approx. 200 USD per household and per year), compost making and sale(approx. 600 USD per household in 3 years—direct benefit) during the implementation period (Table ref. #10).

Reduction of hardships – reduction of the time attributed to daily chores, saving approximately 60 working days/year – equivalent to 1000 USDper household in 3 years (direct benefit) (Table ref. #11).

Savings: Approximately 20 percent of food produce saved based on post-harvest losses prevention – equivalent to 200 kg/year – This generates 1MT in 5 years saved for consumption or sale – approx. 500 USD per household in 3 years (direct benefit) during the implementation period – that includes grains and fresh foods (Table ref. #12).

Other benefits: Reduction of debt burden, reduced acute moderate and severe malnutrition, health benefits, increased solidarity, jobs creation, floods protection, recharge of water table, and other tangible and intangible benefits would probably double this figure and important to consider but need more accurate estimates and studies. Approximately 900 USD/HH in 3 years (Table ref. #13).

2. Benefit-Cost Ratio (BCR)

The Benefit-Cost Ratio (BCR) is a financial metric that assesses the efficiency of an investment or intervention by comparing its total benefits to its total costs. A BCR greater than 1 indicates that the benefits outweigh the costs. For example, a BCR of 2 means that for every dollar invested, two dollars in benefits are generated.

The BCR calculated for 5- and 10-year periods helps evaluate the medium-term incremental benefits and effectiveness of WFP Integrated Resilience program. For the Integrated Resilience Programme (IRP), the BCR after 5 years is almost 3, indicating that the investment triples after 5 years. After 10 years, the BCR rises to approximately 4.5, meaning that for every dollar invested, 4.5 USD in benefits are generated. The following calculations provide further details.

A. Estimated BCR after 5 Years

We calculate the BCR of resilience investments after 5 years based on the formula:

$$BCR = \frac{\left(\text{Estimated Discounted Benefits of Resilience Investment} + \text{Saved Costs Humanitarian Assistance and losses} - \text{Resilience Investment Costs}\right) \times 100}{\text{Resilience Investment Costs}}$$

STEP-BY-STEP CALCULATION

1. Costs of Humanitarian Assistance

- Total Humanitarian Assistance (A) plus Associated Losses (B) over 5 years:

E = A + B = 4,300 + 3,750 = 8,050 USD

- Saved Costs of Humanitarian Assistance over 5 years:

E'= E x 75% = 8,050 x 75% = 6,038 USD

We assume that resilience interventions reduce the need for humanitarian assistance by 70-80 percent (Table ref. #15); so we take the average (75 percent) reduction on the Saved Costs corresponding to Humanitarian Assistance plus associated losses.

2. Resilience Investment Costs

- Cost of Resilience Investment (C):

Integrated Resilience Package: 3,500 USD

3. Estimated Benefits from Resilience Investment

- Total Estimated Benefits over 5 years (D):

8,550 USD

- Total Estimated benefit applying high-risk discount rate (3.9 percent rate) over 5 years (D'):

7798 USD

4. Calculation of Benefit-Cost Ratio (BCR)

BCR = [(D'+E'-C) / C] x 100

BCR = (7,798 + 6,038 − 3,500) / 3,500 × 100 = 295 %

CONCLUSION

The BCR of resilience investments, considering the saved costs of humanitarian assistance and the benefits of the resilience investment, is over 295 percent: that means that benefits almost triple the investments after 5 years. This indicates that for every dollar invested in resilience, there is a return of approximately 3 USD in benefits and savings.

B. Estimated BCR after 10 Years

To calculate the BCR of resilience investments over 10 years, we need to extend the previous 5-year analysis with the given assumptions:

1. **Humanitarian assistance costs remain unchanged from year 6 to 10.**
2. **The cost of resilience investments is reduced to 50 percent of the annual average from years 6 to 10, based on a progression strategy.**
3. **Benefits of resilience investments continue from year 6 to 10 as in year 5.**
4. **The return from human capital (drop-out reduction) remains unchanged as in the 5-year calculation (because of turn-over of children in school age).**

1. Humanitarian Assistance Costs Over 10 Years

The annual humanitarian assistance cost per household remains unchanged from years 6 to 10 compared to the first five years. Despite this may be an underestimation, as the absence of longer-term investments continues to erode livelihoods and coping capacities, while the severity of climate and other stressors increases in increasingly fragile contexts, we keep the same investment cost per year than in the first 5 years.

Therefore, the total cost of Humanitarian Assistance and Losses over 10 years would be:

- Total Humanitarian Assistance (A) and Losses (B) over 10 years:

E = (A+B first 5 years) + (A+B additional 5 years)[2] = 8,050 USD + 8,050 USD = 16,100 USD

1. Resilience Investment Costs Over 10 Years

The costs of resilience investments decrease significantly from year 5 onward, averaging 50 percent of the initial five-year costs. This reduction accounts for the likelihood of 1–2 major shocks over the following five years, during which anticipatory actions may be needed to intervene early and protect resilience gains. Furthermore, in the second five-year period, emphasis will be placed on strengthening local capacities for improved management of natural resources, assets, and governance systems, along with targeted measures to enhance value chain development and youth employment opportunities. Therefore, the total Resilience Investment Cost over 10 years would be:

- Cost for the first 5 years:

Total Cost (5 years) = 3,500 USD

- Cost for the next 5 years (50 percent reduction):

Total Cost = 1,750 USD

2 From year 6 to 10, we keep the same investment cost per year than in the first 5 years.

- Saved Costs of Humanitarian Assistance over 10 Years

  Assuming a 75 percent reduction in humanitarian assistance due to resilience investments, the Saved Costs of humanitarian assistance (E') over 10 years would be:

  E'= E x 75 % = 16,100 x 75 % = 12,075 USD

- Total Cost of Resilience Investment over 10 years:

  C = 3,500 + 1,750 = 5,250 USD

3. Estimated benefits from Resilience Investments over 10 Year

The benefits from resilience investments continue from year 6 to year 10, with a gradual reduction due to the applied discount rate related to long-term investment in high-risk contexts.

Therefore, the total Benefits from Resilience Investment over 10 years would be:

- Benefits for the first 5 years:

  8,550 USD

- Benefits for the next 5 years (same as year 5):

  11,727 USD

- Total Estimated Benefits over 10 years:

  D = 20,278 USD

- Total Estimated benefits applying high-risk discount rate (3.9 percent rate) over 10 years:

  D' = 16,910 USD

4. Calculation of BCR Over 10 Years

Using the BCR formula:

BCR = [(D'+E'-C) / C] x 100

BCR = (16,910 + 12,075 − 5250) / 5250 × 100 = 452 %

CONCLUSION

The BCR of resilience investments over 10 years, considering the saved costs of humanitarian assistance and the benefits of resilience investments, is 452 percent - that means that benefits are over 4.5 times the investments in 10 years. This indicates that for every dollar invested in resilience over 10 years, there is a return of over 4.5 USD in benefits and savings.

This also suggests that the benefits from Resilience Investment increase in time, even taking into consideration discount specific measures and high-risk discount rates.

These results are in line with The Global Commission on Adaptation: "An investment of USD 1.8 trillion in resilience and adaptation, focused on five priority areas from 2020 to 2030, could generate USD 7.1 trillion in total net benefits. Also, for every USD 1 spent in building resilience there could be up to USD 3 in benefits from reduced need for humanitarian aid and avoided losses" (Investing in resilience: Innovative finance for drought preparedness | PreventionWeb)

Annex 1

#	ASSUMPTIONS	EXTERNAL SOURCE	NOTE ON CALCULATION/SOURCE DATA USE	INTERNAL SOURCES
1	Considering that on average a household has less than 2 hectares, of which 50% is severely degraded and the remaining 50% moderately degraded.	FAO data-source	FAO data-source, Niger Average for SAMs, reduced to 2Ha considering vulnerable WFP targeted HHs.	CBPP, Programme Monitoring Data-base
2	The costs of land degradation range from 100 to 150 USD/ha/year/ household in fertility replacement equivalents.	UNEP-WOCAT	The costs of land degradation, specifically in terms of fertility replacement, are estimated to range between 100 to 150 USD per hectare per year. This figure is derived from analyses focused on the economic impacts of soil degradation and its mitigation through Sustainable Land Management (SLM) practices, as noted by studies under the WOCAT initiative. These assessments emphasize the importance of quantifying such costs to better inform land management and restoration strategies.	
3	Other environmental services and longer term offsite negative effects such as incidence of pests, flooding, and biodiversity losses makes an overall estimate of environmental losses over 250 USD/HH/year or approx. 1250 USD for the 5 years period.	U.S. Geological Survey (USGS) and the European Central Bank's analysis of nature-related financial risks.	These figures reflect broader impacts on ecosystem services, including offsite negative effects and challenges such as increased pest incidences and reduced biodiversity. These estimates assess the economic burden on rural and vulnerable communities, especially in regions like Sub-Saharan Africa and parts of the Sahel, where agricultural livelihoods are closely tied to land and ecosystem health.	
4	Social and income losses: Based on the Household Economic Analysis (HEA) in most Sahel contexts around 30% HH is classified extreme poor and around 40% poor – with higher proportions in IPC 4 areas… A conservative figure would be a capital loss of at least 250USD/year (> medical expenses, debt, reduced means of production, increased negative coping strategies) ie. approximately 1250 USD/household for 5 years. In addition this can be associated with an additional dropout, human capital loss costs (actualized cost of qualified work force) estimated for 500 USD/ household over the same period.	1. An Atlas of Household Economy Analysis Information Across the Sahel 2. Using the Household Economy Approach to inform social protection programming in the Sahel 3. Cost of Malnutrition	The statistics regarding poverty in the Sahel, specifically that 30% of households are classified as extremely poor and 40% as poor in areas affected by IPC 4 levels of food insecurity, are corroborated by multiple sources, particularly those using the Household Economy Analysis (HEA) framework. These figures are based on vulnerabilities exacerbated by poor land ownership, limited livestock, high debt levels, and reliance on negative coping strategies like selling firewood and engaging in low-wage labor. The HEA studies, such as those from Save the Children, highlight how these households face compounded issues, including malnutrition and poor access to healthcare. These economic pressures can lead to capital losses exceeding conservative estimates of $250 per household annually, due to additional financial burdens from medical expenses and loss of productive assets. A significant portion of these financial losses is attributed to malnutrition, with reports like those from UNDP estimating human capital loss at $500 per household per year due to malnutrition alone(Global Panel). The estimated impact on the global economy could be as high as US$3.5 trillion per year, or US$500 per individual. These enormous costs result from economic growth foregone and lost investments in human capital associated with preventable child deaths, as well as premature adult mortality linked to diet-related non-communicable diseases. This study highlights that adult earnings are reduced by 2.4% for every 1% loss in potential attained height.	
5	The amount needed is of around 100 USD/Person/Year (all WFP costs included) or 700USD/HH/year (with an average of 7 people/HH). For a duration of 5 years – i.e. 3500 USD/Household for 5 years.	WFP planning, IRP budgeting	Average cost per person/year in integrated resilience, span from 70 to 130 USD, according to last estimation, country, context. 100USD is an average.	WFP planning,IRP budgeting and financial reports

#	ASSUMPTIONS	EXTERNAL SOURCE	NOTE ON CALCULATION/SOURCE DATA USE	INTERNAL SOURCES
6	Increased yields from rehabilitated land: On average 1 additional hectare of degraded lands is restored per household and existing cultivated 2 hectares is improved through better land management techniques. An estimation of 2 ha by the end of the programme cycle would enable to produce min 1 MT of agricultural products available/year which generate approx. 450 USD/ year/household starting from the 3rd year following the beginning of the intervention. At the end of the 5 years, this amount will be approx. 1350 USD/ household of direct benefit within the implementation period. The benefits are	. Integrated Resilience in the Sahel . Smallholders dataportrait . Farmer managed natural regeneration (FMNR)	ON PRODUCTIVITY OF RESTORED LAND: Supporting the figure of 1 metric ton (MT) production from 2 hectares of rehabilitated land per household, several studies and data sources emphasize that improved land management techniques on degraded lands can lead to substantial yield increases, particularly in the Sahel and other arid regions. FAO Data on Dryland Restoration: FAO studies on dryland rehabilitation, particularly through practices like farmer-managed natural regeneration (FMNR), agroforestry, and soil and water conservation techniques, show that 1 to 1.5 MT of cereals per hectare can be achieved under improved conditions in the Sahel region. This is similar to the estimates of 1 MT on 2 hectares when considering that one hectare may already be cultivated at a lower productivity level and the second hectare is rehabilitated and in light of a progressive strategy (World Resources Institute). World Agroforestry Centre (ICRAF) and IFPRI have documented yield increases resulting from interventions like soil fertility management and tree planting. In Niger, for instance, agroforestry practices have led to maize and millet yield increases of up to 300% on rehabilitated lands, from baseline productivity of 0.5 MT/ha to around 1.5 MT/ha . This aligns with projections of households producing approximately 1 MT of agricultural products on rehabilitated land by the end of a program cycle. Great Green Wall Initiative: The World Bank and African Union reports have also documented yield increases from land restoration initiatives under the Great Green Wall. In some cases, yields can more than double with the application of proper soil and water management techniques, which supports the 1 MT projection on rehabilitated land. ON ASSOCIATED ECONOMIC BENEFITS: research on Africa's Great Green Wall suggests that investments in land restoration can yield $1.1 to $4.4 for every dollar spent, with benefits being fully realized within 10 years.	Internal monitoring system database, and evidences support these data (1MT per Ha once land restored), WFP -ACR reports, evidences from the field (WFP.org).
7	Access to pasture and livestock feed generated from protected communal/ groups' lands. in most communities in the Sahel each family will have access to approximately 0,5 MT of fodder or hay from rehabilitated pastures. This would enable to generate a minimum of 100 USD/year starting from the 3rd year, thus approx. 300 USD/ household within the implementation period. This direct benefit is assumed to continue for several years.		The assumption about access to pasture and livestock feed generated from rehabilitated communal or group lands in the Sahel, along with the economic benefits derived from it, is based on several monitoring and evidence example from WFP monitoring and reports: 1. Fodder Yields from Rehabilitated Pastures WFP's Initiatives highlight improved access to communal grazing land through the restoration of degraded pastures, reporting that yields of 0.5 MT per household o fodder are achievable after the initial recovery period. 2. Economic Value of Fodder WFP's interventions in the Sahel highlight that access to rehabilitated lands allows for enhanced fodder production, reducing the need for families to purchase feed and increasing the saleable surplus. TWFP's Market Monitoring or livelihoods assessments shows how families can generate up to $100 annually by selling excess fodder and compost after three years of project implementation.	Sources: COs regular monitoring, ACR, i.e. Burkina Faso, Niger, Mali, ACR 2023. • https://www.wfp.org/operations/annual-country-report?operation_id=BF02&year=2023#/25818/25822 • https://www.wfp.org/publications/annual-country-reports-mali; WFP market assesments
8	CO2 sequestration: every ha of rehabilitated land would generate 3 tons of CO2 sequestration/ha/year acting as a carbon sink. This would generate some additional 75 USD/year (on average) in environmental/climate services, starting from the 3rd year, thus approximately 225 USD/household during the implementation period. The benefit is assumed to continue beyond.	Agrymeth Study	CO2 sequestration metrcis: # of MT reduced by 50% , from 6 to 3 MT/year , to adjust to potential variation in the region.	

#	ASSUMPTIONS	EXTERNAL SOURCE	NOTE ON CALCULATION/SOURCE DATA USE	INTERNAL SOURCES
9	Human capital, and future work force: School meals can be reflected in a gain in term of potential of human capital, and future work force and social cohesion, that can be estimated at 250 USD/year, for 25% of the targeted population (people in primary school age, that we can assume represent 2 children per household thus a total of 3600 USD/ household within the implementation period and beyond.	% demographics	The World Bank reports that in many Sahelian countries, about 20-30% of the total population falls into the school-age demographic. For instance, in Niger, approximately 40% of the population is under 15 years old, indicating a substantial number of children are in or around the primary school age. Increased Wages: Education correlates positively with higher wages. A report from the World Bank indicates that each additional year of schooling can lead to an average income increase of about 10% in developing countries per year, per people. We assume 2 primary school-age children / HH, and actualize the value with a discount rate. Assumptions: We calculate the actual value of an incremental $200 USD additional value generation per year, starting from the 12th year and continuing for 30 years, per children (2 per HHs): for that we'll discount each of these future values back to the present value. This process involves selecting a discount rate and applying it to the cash flows. Formula: Let's assume a discount rate (r). The present value (PV) of a series of future cash flows can be calculated using the formula for the present value of an annuity: PV=∑t=nm(1+r)tC. Where: • C, C is the annual cash flow ($200 USD in this case). • T, t is the year (ranging from 12 to 41 since the cash flow starts in year 12 and continues for 30 years). • R, r is the discount rate. • N, n is the starting year (12). • M, m is the ending year (41). Variables: • Annual cash flow ($200 USD). • Starting year (12). • Ending year (41, since it's 30 years from the start of year 12). • Discount rate (5% or 0.05). • Compute the present value of each cash flow from year 12 to year 41. Calculation: The present value of the incremental $200 USD value generation per year, starting from the 12th year and continuing for 30 years at a discount rate of 5%, is approximately $1,797.59 USD (per children) ~ 1800 USD per children = 3600 per HHs.	
10	Increased income from access to vegetable gardening: approx. 200 USD income/ household/year) and compost making/sale generates approx. 600 USD/ household in 3 years (direct benefit) during the implementation period.		Overall, Min 600 USD/HH over 3 years, accumulated, encompassing vegetables and compost production, and associated yeald and savings. The total 1.200 USd over 3 years is halved to consider geographival variation Vegetables : On average, households involved in resilience interventions such as "Food Assistance for Assets" (FFA) activities and agricultural support may produce several hundred kilograms of vegetables annually. These production levels, supported by rehabilitated land, water harvesting techniques, and training, help increase household income and contribute to better nutrition. In terms of value, depending on the type of vegetable and local market prices, it is estimated that households can generate a seasonal income of approximately USD 70-150 Compost: 1. Compost Yields WFP's Initiatives highlight improved capacity of local compost production, reporting that yields of 0.5 MT per household o fodder are achievable after the initial recovery period. 2. Economic Value of Compost WFP's interventions in the Sahel highlight that access to rehabilitated lands allows for enhanced demand of compost and ability to produce it, reducing the need for families to purchase imported compost and increasing the saleable surplus. According to Market prices Monitoring and livelihoods assessments, families can generate up to $300 annually by selling excess compost (and saving from buying imported compost) after three years of project implementation. Summary: 70-150 + 300 $ benefit generated annually, means from 1100 to 1350 $ generated in 3 years, which we reduce to 600 $ (-45%) to calculate variation and risk of non materialisation	Sources: PDM 2020-23 Niger; COs regular monitoring, ACR, i.e. Burkina Faso, Niger, Mali, ACR 2023. . https://www.wfp.org/operations/annual-country-report?operation_id=BF02&year=2023#/25818/25822; . https://www.wfp.org/publications/annual-country-reports-mali; WFP market assesments;

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11	Reduction of hardships – reduction of daily chores saving approximately 60 working days/year – equivalent to at least 150 USD/household/ year thus approximately 450 USD/ household in 3 years (direct benefit) during the implementation period. (SHOULD be USD 1000 in 3 years).		Evidence fro field mission reports have shown a reduction in water-fetching times by up to 3–4 hours per day following water infrastructure improvements. that means more then 60 working days a year, equivalent to 500 USD a year considering an average income of 3000/year (FAO). 1,500 USD in 3 years Moreover, chore reduction is connected to fuelwood collection: in sites where Resilience programs promote agroforestry and sustainable land management, or Energy alternatives, local access to fuelwood or alternative solutions have an impact on the reduction of the time spent collecting firewood. Agricultural Labor: Programs that support sustainable farming practices (e.g., improved seeds, drought-resistant crops) reduce the amount of labor needed for farming due to higher yields and reduced effort. Ex. Figure: In areas where agroforestry have been adopted, household labor required for agricultural tasks has decreased, though specific figures vary depending on the local context. Food Preparation: Improved stoves or cooking technologies can reduce the time spent on food preparation and fuel use, as reported in some resilience programs in the Sahel. Example Figure: The introduction of improved stoves can reduce cooking times by 30%–40%. We consider a reduction rate of around 30% on the minimum benefit brought by water structure improvement only: 1000$	Mission reports (Chad, Niger, Mali, BFA)
12	Saving from food losses: In average, 20% of food produce saved based on post -harvest losses prevention training. This represent the equivalent of 200 kg of food saved per year – meaning 1MT in 5 years saved for consumption or sale. This represent approx. 500USD/ household in 3 years (direct benefit) during the implementation period – that includes grains and fresh foods.	Average Income FAO	1. Reduction in Post-Harvest Losses: WFP's PHM interventions have reported significant reductions in post-harvest losses for key staple crops such as maize, millet, sorghum, and cowpeas. Losses that previously ranged from 20% to 30% have been reduced to below 10% in some instances where hermetic storage was adopted. For instance, hermetic storage systems (e.g., PICS bags and metal silos) have consistently demonstrated their ability to reduce grain losses from insects and moisture, directly contributing to food availability and economic savings. 2. Monetary Equivalent of Reduced Food Losses: Reduced food losses translate into direct economic benefits for smallholder farmers. A WFP evaluation in West Africa indicated that farmers using hermetic storage technologies experienced up to a 25% increase in income due to the preservation of food quality and quantity. The exact monetary savings from PHM interventions are context-specific, but typical calculations from WFP interventions suggest that reductions in post-harvest losses can save smallholder farmers between 10% to 20% of their annual agricultural revenue. For example, if a farmer initially loses 25% of a $1000 crop yield (PHM technologies can reduce those losses to 15%), translating to an additional $150 in retained value per season.	https://www.wfp.org/publications/integrated-resilience-sahel 1. World Food Program USA 2. WFP Resources on Post-Harvest Losses 3. Average Income FAO Regular monitoring Assesment - Niger

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13	Reduction of debt burden: reduced acute moderate and severe malnutrition would lead to several health benefits, increased solidarity, jobs creation, floods protection, recharge of water table, and other tangible and intangible benefits. To correctly assess the total gain associated, more accurate estimates and studies are needed. However, in this analysis, the main assumption is that reducing moderate and severe malnutrition would result in a saving of approximately min 300 USD/ household in 3 years only on direct health expenditure. Evaluate to increase up to 900 USD.	References: PLOS Medicine on Malnutrition Costs BMC Public Health - Economic Impacts World Bank - The Cost of Malnutrition World Food Programme - Malnutrition in the Sahel International Food Policy Research Institute - The Cost of Hunger	Households with stunted or malnourished children face significant financial burdens over three years due to increased health care costs, reduced productivity, and higher food expenditures. Here are key considerations: Estimating the financial burden on a Sahel household with children affected by malnutrition involves considering healthcare costs, loss of productivity, and indirect social costs over three years. KEY COST FACTORS Healthcare Costs: Treating moderate and severe acute malnutrition (SAM and MAM) requires interventions such as Ready-to-Use Therapeutic Foods (RUTF) and medical care. The cost for SAM treatment is estimated to be about $200 per child, including follow-ups and community management. Over three years, with potential relapses or additional children affected, this could rise to $600 or more per household for healthcare (PLOS). Further, Health Care Expenditures: Families with malnourished children often incur substantial medical expenses. The World Bank estimates that nutrition-related diseases lead to increased healthcare costs, which can average around $16 per capita annually in sub-Saharan Africa. Productivity Loss: Malnutrition leads to long-term stunted growth and cognitive development issues, which reduce future earning potential. According to estimates from the World Bank, the economic loss due to stunting and malnutrition can be up to 10% of lifetime earnings. In the Sahel, where average annual household income is around $500-$1000, this loss could amount to $50-$100 per year per individual affected, or $150-$300 over three years. Indirect Costs: Households may also face costs related to missed work, lower productivity due to caregiving, and loss of household labor. If one parent needs to care for the child, the opportunity cost in a region where informal labor income can be vital could range from $1-$2 per day. Over three years, this could equate to $300-$700 in lost income. ESTIMATION SUMMARY For a household with children affected by malnutrition in the Sahel, over three years, the estimated financial burden would be: . Healthcare costs: $600 . Lost future productivity: $150-$300 . Opportunity costs (missed work, caregiving): $300-$700 This brings the total burden up to $1050-$1600 per household over three years. We further apply an additional 5% discount rate from year 1 to year 10, to include the risk of non materialisation of debt burden reduction. Therefore, the adjusted estimated financial burden on a household with children affected by malnutrition in the Sahel, considering a 5% discount rate over three years, ranges from approximately $906 to $1,381. We take the minimum value (900 $).	

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