

### Methodology for GHG accounting

#### Background

The Ex-Ante Carbon Balance Tool (EX-ACT)<sup>1</sup> has been developed by the Food and Agriculture Organization of the United Nations (FAO) to evaluate impacts of interventions in the Agriculture, Forestry and Other Land Use (AFOLU) sector on greenhouse gas (GHG) emissions. EX-ACT provides estimates of the mitigation potential of public or private investment projects, policies and national level programs. It helps decision makers to understand whether the planned agricultural interventions contribute to meeting climate change mitigation objectives. The EX-ACT appraisals, initially designed for ex-ante analysis, can also be conducted during the project implementation as well as ex-post for comprehensive monitoring and evaluation, both at a project and at a country level. EX-ACT calculations are based on land use data.

#### EX-ACT version 9.4.2

This appraisal uses the latest version of EX-ACT (i.e. version 9.4.2) currently available as of date. The current version of EX-ACT is primarily based on *IPCC 2019, "Refinement to the 2006 Guidelines for National Greenhouse Gas Inventories"* and *IPCC 2013, "2013 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories"*. GHG emissions for farm operations, inputs, transport and irrigation systems implementation are based on Lal (2004). These references provide EX-ACT with recognized default values for emission factors and carbon values, the Tier 1 level of precision.

The current version of the tool consists of fourteen modules (nine modules for data entry, four supporting modules and a module for the detailed results) that allow for analysis of a range of agricultural and forestry activities including crop production, land rehabilitation, forest management, livestock and grassland production systems among others. The tool calculates the changes in carbon stocks and GHG emissions including carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>) and nitrous oxide (N<sub>2</sub>O), which once converted to CO<sub>2</sub> equivalent are used to derive the carbon balance that indicates the impact of the project: positive carbon balance indicates that the project leads to greater emissions, while negative carbon balance indicates that project contributes to emissions reductions and/or increased carbon sequestration.

The evaluation assesses how the impacts of an intervention compare to the business as usual (BAU) scenario. The calculator requires data for 3 specific points in time: initial situation, without project or BAU, and with project scenario. The without project scenario or BAU represents a hypothetical situation that will prevail if the project will not be implemented.

#### Project boundaries and parameterization for GHG accounting

The project should directly benefit 1 881 002 individuals and indirectly reach 3 861 925 individuals in the following eight countries of the SURAGGWA project that are considered for the GHG accounting: Burkina Faso, Chad, Djibouti, Mauritania, Mali, Niger, Nigeria, and Senegal.

The SURAGGWA project will be implemented over 10 years. The actual implementation period varies by country depending on the country's previous experience with the GCF projects and the size of the targeted areas. It is planned for 6 years in Mali and Niger, 7 years in Djibouti, 8 years in Burkina Faso, Mauritania, Nigeria, and Senegal, and 10 years in Chad. In this analysis, following recommendations of

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<sup>1</sup> <https://www.fao.org/in-action/epic/ex-act-tool/suite-of-tools/ex-act/en/>

the IPCC, we consider in total 20-year period for implementation and capitalization phases. Following the implementation of the project, the benefits generated will continue to capitalize to for a total duration of 20 years.

The climate in the area is tropical dry. The average soil carbon in each country is presented in table 1 below. In the specific case of soil organic carbon, a constant rate over a period of 20 years from the year of planting to reach the new equilibrium is assumed. The analysis further assumes the dynamics of change (from “without project” (BAU) to “with project”) to be linear over the duration of the project. Global warming potential over 100 years from the Fifth Assessment Report (AR5) without climate carbon feedback, Climate Change 2013 - The physical science basis<sup>2</sup>.

Table 1: Global soil carbon per country

Countries	Global Soil Carbon (tC/ha)
Burkina Faso	21.28
Chad	13.47
Djibouti	23.81
Mali	15.03
Mauritania	11.91
Niger	12.12
Nigeria	17.05
Senegal	16.59

Source: earthmap.org, (August 2024)

The appraisal considers 2 components targeting to GHG emission reductions through the project activities in eight countries:

- (1) Component 1: Landscape restoration.
- (2) Component 2: Supporting the development of climate-resilient, low emission non-timber forest product value chains benefiting vulnerable communities’ livelihoods and their food and nutrition security.

The detailed information on output from each component in Table 2 below provides project scenarios and variables used for the GHG analysis. As the project presents similar interventions for the eight countries, the proposed scenarios for the GHG accounting apply to each country. The carbon balance is calculated for each country individually and then summed up to obtain the total carbon balance of the project.

Table 2: Project output considered by the EX-ACT analysis.

Description	Reference
<b>Component 1: Landscape restoration</b>	
Output 1.3 &1.5: Highly degraded land restored by local communities through a combination of soil and water conservation and revegetation techniques	Project component, & Logical Framework,
Output 1.4: Moderately degraded farmland restored with a range of genetically appropriate seeds that provide increased climate resilience.	Project component, & Logical Framework

Outputs 1.3 & 1.5: Restoration of highly degraded land: The project will restore 133 238 hectares of highly degraded land. This land is currently severely degraded and natural regeneration is blocked by poor soil conditions (from the project document). Without the project, no change is expected. Through the project’s restoration activities, this area will be transformed into tropical shrubland with local

<sup>2</sup> [https://www.ipcc.ch/site/assets/uploads/2018/02/WG1AR5\\_all\\_final.pdf](https://www.ipcc.ch/site/assets/uploads/2018/02/WG1AR5_all_final.pdf)

species (Balanites, acacia), increasing the carbon sequestered in the restored land. Output 1.5 complements output 1.3 by supporting the training of restoration technicians and establishment of networks to ensure that the 133 238 hectares of highly degraded land restored by local communities are technically self-sufficient/autonomous for restoration actions. The estimation of the mitigation potential is assessed in the Land use change module of the EX-ACT tool.

Output 1.4: Promotion of agroforestry on moderately degraded farmland. Moderately degraded farmland of 1 140 513 ha will be restored to improve crops and fodder production. These activities include agroecology and the promotion of agroforestry, leading to land use change from annual cropping systems to agroforestry systems, with perennial tree and shrub species such as Acacia and Balanites. Without the project, only annual crops will be cultivated under full tillage with low carbon storage while the crop residue is exported to feed animals. The promotion of agroforestry will increase the level of carbon storage in the soil and result in higher sequestration potential in the living biomass. The surface area per country of the different types of land that will be restored by the project is provided in table 4. With the project, highly degraded land will be restored to tropical savannah while moderately degraded land that is currently under cereal cultivation will be converted to agroforestry.

*Table 3: Biomass growth rate per type of restoration*

	Initial and Without Project	With the project
Restoration of highly degraded land	Degraded land	Tropical shrubland Average biomass growth <b>AGB:</b> 0.21 tC/ha/yr ( $\leq 20$ yrs) (IPCC, 2019) <b>BGB:</b> 0.08 tC/ha/yr ( $\leq 20$ yrs) (IPCC, 2019)
Promotion of agroforestry on moderately degraded farmland	Annual cropland with unsustainable practice (full tillage, low carbon input)  Biomass of annual cropland: 2.4 tC/ha (Africa open deal data)	Agroforestry system (parkland) with improved carbon input.  Biomass of the first year of conversion: 2.1 tC/ha (IPCC, 2019).  Av. biomass growth in the following years ABG: 0.59 tC/ha/yr (IPCC, 2019) BGB: 0.21 tC/ha/yr (IPCC, 2019) Max AGB: 11.8 tC/ha (IPCC, 2019)

*Table 4: Highly and moderately degraded land to be restored in each SURAGGWA country*

	BURKINA FASO	CHAD	DJIBOUTI	MALI	MAURITANIA	NIGER	NIGERIA	SENEGAL	Total
Highly degraded (ha)	4 000	4 500	2 500	12 440	38 083	21 403	46 812	3 500	133 238
Moderately degraded (ha)	36 300	79 500	21 000	180 280	174 900	244 215	322 818	81 500	1 140 513
Total	<b>40 300</b>	<b>84 000</b>	<b>23 500</b>	<b>192 720</b>	<b>212 983</b>	<b>265 618</b>	<b>369 630</b>	<b>85 000</b>	<b>1 273 751</b>

### Additional GHG mitigation impacts included in the appraisal

#### **Improved Livestock production under component 1.**

Under component 1, improved crop and fodder production will also contribute to productivity growth in livestock and reduce the grazing pressure exercised by transhumant livestock. This would increase animal productivity and thus enteric fermentation. Livestock emissions in the “with project” scenario are estimated based on the average number of livestock held by beneficiaries in the project area (ref. EFA). The total livestock owned by the beneficiaries is estimated at 172 000 for large ruminants (cattle) and 580 000 for small ruminants (goats and sheep). This livestock tends to produce low yields due to poor feed quality and health condition. The project’s assumption is that the increased availability of

fodder production and livelihood diversification would encourage the communities to invest in improving livestock productivity and health and reduce the need to increase livestock numbers. Therefore, no change in the number of livestock heads is expected between the WOP and WP scenarios.

### Non-Timber Forest Product (NTFP) value chains supported under component 2 (Activity 2.1.3 and 2.1.4)

Activities proposed in component 2 consisting of building sustainable and inclusive Non-Timber Forest Product (NTFP) value chains for Smallholders and Small and Medium Enterprises (SMEs) can potentially reduce emissions. Specifically, capacity enhancement activities to improve quality of product and sustainable management of natural resources (activity 2.1.3), the technical training to improve processing, packaging and labelling of products (Activity 2.1.4) would lead to the adoption of improved technology (eco-stoves, solar). This would reduce the emissions related to the use of firewood in the processing activities. The table below presents the scenarios to account for these additional GHG mitigation impact of the project.

Table 5: Improved livestock productivity

	Quantity	Without project	With project
Small ruminants:	580 000 heads	% of pasture use: 80% (IPCC, 2019)  Enteric fermentation: 5 kgCH <sub>4</sub> /head (IPCC, 2019)	Reduction in the rate of pasture use by 10 % due to increased fodder production  Increase in enteric fermentation: 6.5 kgCH <sub>4</sub> /head (assumed 30% an average between low productivity and high productivity systems)
Large ruminants:	172 000 heads	% of pasture use: 70% (assumption) <sup>3</sup> Enteric fermentation 48kgCH <sub>4</sub> /head (IPCC, 2019)	Reduction in the rate of pasture use by 10 % due to increased fodder production  Increase in enteric fermentation: 52 kgCH <sub>4</sub> /head (IPCC, 2019)

Table 6: Change in Wood consumption

Activities	Without project	With project
Activity 2.1.3: Training to enhance the capacity producers/collectors to improve the quality of the products and sustainable management of natural resources.	Wood: 1 629 tdm/yr  (EFA analysis)	Wood: 698 tdm/yr (EFA analysis)  Emission from wood consumption: 1.895 tCO <sub>2</sub> -eq/tdm (IPCC, 2019)
Activity 2.1.4: Technical training to improve the processing, packaging and labelling of the selected products		

## Results of the EX-ACT analysis:

The detailed results obtained with EX-ACT are presented per country and per output, each reflecting different activities of the project intervention. The restoration of the highly degraded land (Outputs 1.3 & 1.5) will generate a carbon balance estimated at **– 5 765 049 tCO<sub>2</sub>-eq over 20 years** (Table 7). This result is the net difference between the carbon flux from the baseline scenario where no reforestation activities are undertaken and the carbon flux of the “with project” scenario.

The promotion of agroforestry with selected indigenous species (including Balanites, Acacia) on annual cropland (Output 1.4) would contribute to creating carbon sinks. The quantity of GHG that will be sequestered is estimated at **– 60 193 185 tCO<sub>2</sub>-eq over 20 years** (Table 7). These results include the carbon balance of the first year of land conversion from annual cropland to agroforestry (other land use change), the reduced emission in annual cropland as farmers progressively abandon unimproved

<sup>3</sup> Assumption based on the level of pastoralism described in the literature: [PASTURE DYNAMICS AND FORAGE AVAILABILITY IN THE SAHEL: Israel Journal of Botany: Vol 28, No 3-4 \(tandfonline.com\)](#); [Pasture deficits in the Sahel to continue until at least July 2018 \(fewes.net\)](#); [content \(fao.org\)](#);

practices and the increased carbon sequestration from improved management practices of the newly established agroforestry systems.

The emission of methane resulting from increased livestock productivity, assessed in grassland and livestock module of EX-ACT, could reach **892 461 tCO<sub>2</sub>-eq** over 20 years. The emissions per kg of meat or liter of milk produced, however, would be lower under the WP scenario than under the WOP scenario. This is because a considerable share of current methane emissions is due to low-protein, poor-quality livestock fodder.

Based on the expected change in firewood use (ref to the EFA), this co-benefit is assessed in the input and investment module of EX-ACT indicating a mitigation potential of **– 29 028 tCO<sub>2</sub>-eq** over 20 years. Indirectly, improved production and marketing of NTFP would also increase smallholder incentives to conserve trees and (agro-)forests. This is likely to generate further emissions reductions, including in areas outside the immediate restoration perimeters, but these are harder to estimate, and have not been included in the calculation of the CO<sub>2</sub> results of the project.

Overall, the successful implementation of the project's activities is expected to generate an important GHG mitigation potential. The estimated total carbon balance of the restoration activities is **– 65 094 801 tCO<sub>2</sub>-eq over 20 years** over a total land area of **1 273 751 ha**, corresponding to **- 2.56 tCO<sub>2</sub>-eq per hectare and per year**. Tables 8 to 15 present the carbon balance for each of the eight SURAGGWA countries.

*Table 7: Global appraisal of the carbon Balance*

Countries Activities	Restoration of Highly degraded land	Restoration of Moderately degraded land	Livestock	Reduced wood consumption	Total carbon balance (tCO <sub>2</sub> -eq)	Total area (ha)	Average carbon per ha and per year (tCO <sub>2</sub> -eq)
	Afforestation	OLUC: Annual to Agroforestry	Input (tCO <sub>2</sub> -eq)	Input (tCO <sub>2</sub> -eq)			
	(tCO <sub>2</sub> -eq)	(tCO <sub>2</sub> -eq)					
Burkina Faso	-222 107	-1 969 986	80 462	-15 832	-2 127 464	40 300	-2.64
Chad	-168 468	-3 812 106	101 676		-3 878 898	84 000	-2.31
Djibouti	-156 261	-1 197 363	23 299		-1 330 325	23 500	-2.83
Mali	-574 422	-9 937 939	163 544	-13 601	-10 362 418	192 720	-2.69
Mauritania	-1,413 337	-8 850 530	195 043	157	-10 068 668	212 983	-2.36
Niger	-858 235	-13 166 915	241 626	249	-13 783 275	265 618	-2.59
Nigeria	-2 210 136	-16 984 933	86 811		-19 108 257	369 630	-2.58
Senegal	-162 083	-4 273 413			-4 435 496	85 000	-2.61
<b>Total</b>	<b>-5 765 049</b>	<b>-60 193 185</b>	<b>892 461</b>	<b>-29 028</b>	<b>-65 094 801</b>	<b>1 273 751</b>	<b>-2.56</b>

## Annex: Detailed results per country

Table 8: Burkina Faso

<b>Project name</b>	SURAGGWA-BURKINA FASO		
<b>Continent</b>	Western Africa	<b>Project duration (in years)</b>	
<b>Country</b>	Burkina Faso	Implementation Phase	8
<b>Climate</b>	Tropical	Capitalization Phase	12
<b>Moisture</b>	Dry	Total Duration of Accounting	20
		<b>Total area (ha)</b>	40,300
		Mineral soil	40,300
		Organic soil	0
		Waterbodies	0

GROSS FLUXES				SHARE PER GHG OF THE BALANCE					Tier 2 Specific GHG fluxes
In tCO2-e over the whole period analysis				In tCO2-e over the whole period analysis					
PROJECT COMPONENTS		WITHOUT	WITH	BALANCE	CO2 BIOMASS	CO2 SOIL	N <sub>2</sub> O	CH <sub>4</sub>	ALL NON-AFOLU EMISSIONS*
Land use changes	Deforestation	0	0	0	0	0	0	0	
	Afforestation	0	-222,107	-222,107	-54,818	-167,289	0	0	
	Other land-use	0	-167,993	-167,993	35,937	-203,930	0	0	
Cropland	Annual	122,890	24,578	-98,312	0	-104,231	5,919	0	
	Perennial	0	-1,703,680	-1,703,680	-1,703,680	0	0	0	
Grasslands & Livestock	Flooded rice	0	0	0	0	0	0	0	
	Grasslands	0	0	0	0	0	0	0	
	Livestock	670,669	751,130	80,462			14,599	65,863	
	Forest mngt.	0	0	0	0	0	0	0	
	Inland wetlands	0	0	0	0	0	0	0	
Fisheries and aquaculture	Coastal wetlands	0	0	0	0	0	0	0	
		0	0	0	0	0	0	0	0
	Inputs & Invest.	33,469	17,637	-15,832		0	0		-15,832
Total emissions, tCO2-e		827,028	-1,300,435	-2,127,464	-1,722,561	-475,451	20,518	65,863	-15,832
Total emissions, tCO2-e/ha		20.5	-32.3	-52.8	-42.7	-11.8	0.5	1.6	-0.4
Total emissions, tCO2-e/ha/yr		1.0	-1.6	-2.6	-2.1	-0.6	0.0	0.1	0.0
+ = Source / - = Sink									

+ = Source / - = Sink

Table 9: CHAD

<b>Project name</b>	SURAGGWA-CHAD		
<b>Continent</b>	Central Africa	<b>Project duration (in years)</b>	
<b>Country</b>	Chad	Implementation Phase	10
<b>Climate</b>	Tropical	Capitalization Phase	10
<b>Moisture</b>	Dry	Total Duration of Accounting	20
		<b>Total area (ha)</b>	84,000
		Mineral soil	84,000
		Organic soil	0
		Waterbodies	0

GROSS FLUXES				SHARE PER GHG OF THE BALANCE					Tier 2 Specific GHG fluxes
In tCO2-e over the whole period analysis				In tCO2-e over the whole period analysis					
PROJECT COMPONENTS		WITHOUT	WITH	BALANCE	CO2 BIOMASS	CO2 SOIL	N <sub>2</sub> O	CH <sub>4</sub>	ALL NON-AFOLU EMISSIONS*
Land use changes	Deforestation	0	0	0	0	0	0	0	
	Afforestation	0	-168,468	-168,468	-56,785	-111,683	0	0	
	Other land-use	0	-186,334	-186,334	78,705	-265,039	0	0	
Cropland	Annual	170,363	42,591	-127,772	0	-135,464	7,692	0	
	Perennial	0	-3,498,000	-3,498,000	-3,498,000	0	0	0	
Grasslands & Livestock	Flooded rice	0	0	0	0	0	0	0	
	Grasslands	0	0	0	0	0	0	0	
	Livestock	994,349	1,096,025	101,676			22,405	79,271	
	Forest mngt.	0	0	0	0	0	0	0	
	Inland wetlands	0	0	0	0	0	0	0	
Fisheries and aquaculture	Coastal wetlands	0	0	0	0	0	0	0	
		0	0	0	0	0	0	0	0
	Inputs & Invest.	0	0	0		0	0		0
Total emissions, tCO2-e		1,164,712	-2,714,186	-3,878,898	-3,476,080	-512,187	30,097	79,271	0
Total emissions, tCO2-e/ha		13.9	-32.3	-46.2	-41.4	-6.1	0.4	0.9	0.0
Total emissions, tCO2-e/ha/yr		0.7	-1.6	-2.3	-2.1	-0.3	0.0	0.0	0.0

+

= Source

/ - = Sink

+ = Source / - = Sink

Table 10: DJIBOUTI

<b>Project name</b>	SURAGGWA-DJIBOUTI			
<b>Continent</b>	Eastern Africa	<b>Project duration (in years)</b>		<b>Total area (ha)</b> 23,500
<b>Country</b>	Djibouti	Implementation Phase	7	Mineral soil 23,500
<b>Climate</b>	Tropical	Capitalization Phase	13	Organic soil 0
<b>Moisture</b>	Dry	Total Duration of Accounting	20	Waterbodies 0

Tier 2  
Specific GHG  
fluxes

GROSS FLUXES

In tCO2-e over the whole period analysis

PROJECT COMPONENTS		WITHOUT	WITH	BALANCE
Land use changes	Deforestation	0	0	0
	Afforestation	0	-156,261	-156,261
	Other land-use	0	-115,338	-115,338
	Annual	79,546	13,921	-65,625
Cropland	Perennial	0	-1,016,400	-1,016,400
	Flooded rice	0	0	0
Grasslands & Livestock	Grasslands	0	0	0
	Livestock	174,253	197,552	23,299
	Forest mngt.	0	0	0
	Inland wetlands	0	0	0
	Coastal wetlands	0	0	0
	Fisheries and aquaculture	0	0	0
	Inputs & Invest.	0	0	0
Total emissions, tCO2-e		253,799	-1,076,526	-1,330,325
Total emissions, tCO2-e/ha		10.8	-45.8	-56.6
Total emissions, tCO2-e/ha/yr		0.5	-2.3	-2.8

SHARE PER GHG OF THE BALANCE

In tCO2-e over the whole period analysis

CO2 BIOMASS	CO2 SOIL	N <sub>2</sub> O	CH <sub>4</sub>	ALL NON-AFOLU EMISSIONS*
0	0	0	0	
-35,618	-120,642	0	0	
20,790	-136,128	0	0	
0	-69,576	3,951	0	
-1,016,400	0	0	0	
0	0	0	0	
0	0	0	0	
		3,550	19,749	
0	0	0	0	
0	0	0	0	
0	0	0	0	0
0	0	0		0
-1,031,228	-326,346	7,501	19,749	0
-43.9	-13.9	0.3	0.8	0.0
-2.2	-0.7	0.0	0.0	0.0

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= Source / - = Sink

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Table 11: MALI

<b>Project name</b>	SURAGGWA-MALI			
<b>Continent</b>	Western Africa	<b>Project duration (in years)</b>		<b>Total area (ha)</b> 192,720
<b>Country</b>	Mali	Implementation Phase	6	Mineral soil 192,720
<b>Climate</b>	Tropical	Capitalization Phase	14	Organic soil 0
<b>Moisture</b>	Dry	Total Duration of Accounting	20	Waterbodies 0

GROSS FLUXES				SHARE PER GHG OF THE BALANCE					Tier 2 Specific GHG fluxes
In tCO2-e over the whole period analysis				In tCO2-e over the whole period analysis					
PROJECT COMPONENTS		WITHOUT	WITH	BALANCE	CO2 BIOMASS	CO2 SOIL	N2O	CH4	ALL NON-AFOLU EMISSIONS*
Land use changes	Deforestation	0	0	0	0	0	0	0	
	Afforestation	0	-574,422	-574,422	-183,991	-390,431	0	0	
	Other land-use	0	-581,568	-581,568	178,477	-760,045	0	0	
	Annual	431,068	64,660	-366,408	0	-388,468	22,059	0	
Cropland	Perennial	0	-8,989,963	-8,989,963	-8,989,963	0	0	0	
	Flooded rice	0	0	0	0	0	0	0	
Grasslands & Livestock	Grasslands	0	0	0	0	0	0	0	
	Livestock	1,255,375	1,418,920	163,544			28,303	135,241	
	Forest mngt.	0	0	0	0	0	0	0	
	Inland wetlands	0	0	0	0	0	0	0	
	Coastal wetlands	0	0	0	0	0	0	0	
	Fisheries and aquaculture	0	0	0	0	0	0	0	0
	Inputs & Invest.	27,061	13,460	-13,601		0	0		-13,601
Total emissions, tCO2-e		1,713,505	-8,648,912	-10,362,418	-8,995,476	-1,538,944	50,363	135,241	-13,601
Total emissions, tCO2-e/ha		8.9	-44.9	-53.8	-46.7	-8.0	0.3	0.7	-0.1
Total emissions, tCO2-e/ha/yr		0.4	-2.2	-2.7	-2.3	-0.4	0.0	0.0	0.0

+ = Source / - = Sink

Table 12: MAURITANIA

Project name	SURAGGWA-MAURITANIA				
Continent	Western Africa	Project duration (in years)		Total area (ha)	212,983
Country	Mauritania	Implementation Phase		8	212,983
Climate	Tropical	Capitalization Phase		12	0
Moisture	Dry	Total Duration of Accounting		20	0
				Waterbodies	0

GROSS FLUXES

In tCO2-e over the whole period analysis

PROJECT COMPONENTS	WITHOUT	WITH	BALANCE
Land use changes			
Deforestation	0	0	0
Afforestation	0	-1,413,337	-1,413,337
Other land-use	0	-376,777	-376,777
Annual	331,391	66,278	-265,113
Cropland			
Perennial	0	-8,208,640	-8,208,640
Flooded rice	0	0	0
Grasslands & Livestock			
Grasslands	0	0	0
Livestock	1,263,535	1,458,578	195,043
Forest mngt.	0	0	0
Inland wetlands	0	0	0
Coastal wetlands	0	0	0
Fisheries and aquaculture	0	0	0
Inputs & Invest.	490	646	157
Total emissions, tCO2-e	1,595,416	-8,473,252	-10,068,668
Total emissions, tCO2-e/ha	7.5	-39.8	-47.3
Total emissions, tCO2-e/ha/yr	0.4	-2.0	-2.4

SHARE PER GHG OF THE BALANCE

In tCO2-e over the whole period analysis

CO2 BIOMASS	CO2 SOIL	N <sub>2</sub> O	CH <sub>4</sub>	ALL NON-AFOLU EMISSIONS*
0	0	0	0	
-521,915	-891,422	0	0	
173,151	-549,928	0	0	
0	-281,074	15,961	0	
-8,208,640	0	0	0	
0	0	0	0	
0	0	0	0	
0	0	18,471	176,571	
0	0	0	0	
0	0	0	0	
0	0	0	0	0
0	0	0		157
-8,557,404	-1,722,424	34,432	176,571	157
-40.2	-8.1	0.2	0.8	0.0
-2.0	-0.4	0.0	0.0	0.0

Tier 2  
Specific GHG  
fluxes

+ = Source / - = Sink

Table 13: NIGER

Project name	SURAGGWA-NIGER					
Continent	Western Africa	Project duration (in years)		Total area (ha)	265,618	
Country	Niger	Implementation Phase		6	Mineral soil	265,618
Climate	Tropical	Capitalization Phase		14	Organic soil	0
Moisture	Dry	Total Duration of Accounting		20	Waterbodies	0

GROSS FLUXES

In tCO2-e over the whole period analysis

PROJECT COMPONENTS	WITHOUT	WITH	BALANCE
Land use changes			
Deforestation	0	0	0
Afforestation	0	-858,235	-858,235
Other land-use	0	-588,475	-588,475
Annual	470,885	70,633	-400,252
Cropland			
Perennial	0	-12,178,188	-12,178,188
Flooded rice	0	0	0
Grasslands & Livestock			
Grasslands	0	0	0
Livestock	1,901,495	2,143,121	241,626
Forest mngt.	0	0	0
Inland wetlands	0	0	0
Coastal wetlands	0	0	0
Fisheries and aquaculture	0	0	0
Inputs & Invest.	732	981	249
Total emissions, tCO2-e	2,373,112	-11,410,163	-13,783,275
Total emissions, tCO2-e/ha	8.9	-43.0	-51.9
Total emissions, tCO2-e/ha/yr	0.4	-2.1	-2.6

SHARE PER GHG OF THE BALANCE

In tCO2-e over the whole period analysis

CO2 BIOMASS	CO2 SOIL	N2O	CH4	ALL NON-AFOLU EMISSIONS*
0	0	0	0	
-316,555	-541,680	0	0	
241,773	-830,248	0	0	
0	-424,349	24,097	0	
-12,178,188	0	0	0	
0	0	0	0	
0	0	0	0	
0	0	44,137	197,489	
0	0	0	0	
0	0	0	0	
0	0	0	0	
0	0	0	0	0
0	0	0		249
-12,252,971	-1,796,276	68,234	197,489	249
-46.1	-6.8	0.3	0.7	0.0
-2.3	-0.3	0.0	0.0	0.0

Tier 2  
Specific GHG  
fluxes

+ = Source / - = Sink



Table 14: NIGERIA

Project name	SURAGGWA-NIGERIA				
Continent	Western Africa	Project duration (in years)		Total area (ha)	369,630
Country	Nigeria	Implementation Phase		Mineral soil	369,630
Climate	Tropical	Capitalization Phase		Organic soil	0
Moisture	Dry	Total Duration of Accounting		Waterbodies	0

GROSS FLUXES

In tCO2-e over the whole period analysis

PROJECT COMPONENTS	WITHOUT	WITH	BALANCE
Land use changes			
Deforestation	0	0	0
Afforestation	0	-2,210,136	-2,210,136
Other land-use	0	-1,133,480	-1,133,480
Annual	875,633	175,127	-700,507
Cropland			
Perennial	0	-15,150,946	-15,150,946
Flooded rice	0	0	0
Grasslands & Livestock			
Grasslands	0	0	0
Livestock	613,948	700,759	86,811
Forest mngt.	0	0	0
Inland wetlands	0	0	0
Coastal wetlands	0	0	0
Fisheries and aquaculture	0	0	0
Inputs & Invest.	0	0	0
Total emissions, tCO2-e	1,489,581	-17,618,676	-19,108,257
Total emissions, tCO2-e/ha	4.0	-47.7	-51.7
Total emissions, tCO2-e/ha/yr	0.2	-2.4	-2.6

SHARE PER GHG OF THE BALANCE

In tCO2-e over the whole period analysis

CO2 BIOMASS	CO2 SOIL	N <sub>2</sub> O	CH <sub>4</sub>	ALL NON-AFOLU EMISSIONS*
0	0	0	0	
-641,531	-1,568,605	0	0	
319,590	-1,453,070	0	0	
0	-742,680	42,174	0	
-15,150,946	0	0	0	
0	0	0	0	
0	0	0	0	
0	0	10,630	76,181	
0	0	0	0	
0	0	0	0	
0	0	0	0	0
0	0	0	0	0
-15,472,886	-3,764,356	52,804	76,181	0
-41.9	-10.2	0.1	0.2	0.0
-2.1	-0.5	0.0	0.0	0.0

Tier 2  
Specific GHG  
fluxes

+ = Source / - = Sink

Table 15: SENEGAL

Project name	SURAGGWA-SENEGAL				
Continent	Western Africa	Project duration (in years)		Total area (ha)	85,000
Country	Senegal	Implementation Phase	8	Mineral soil	85,000
Climate	Tropical	Capitalization Phase	12	Organic soil	0
Moisture	Dry	Total Duration of Accounting	20	Waterbodies	0

GROSS FLUXES

In tCO2-e over the whole period analysis

PROJECT COMPONENTS	WITHOUT	WITH	BALANCE	
Land use changes	Deforestation	0	0	0
	Afforestation	0	-162,083	-162,083
	Other land-use	0	-276,265	-276,265
Cropland	Annual	215,102	43,020	-172,081
	Perennial	0	-3,825,067	-3,825,067
Grasslands & Livestock	Flooded rice	0	0	0
	Grasslands	0	0	0
	Livestock	0	0	0
	Forest mngt.	0	0	0
	Inland wetlands	0	0	0
	Coastal wetlands	0	0	0
Fisheries and aquaculture		0	0	0
	Inputs & Invest.	0	0	0
Total emissions, tCO2-e		215,102	-4,220,395	-4,435,496
Total emissions, tCO2-e/ha		2.5	-49.7	-52.2
Total emissions, tCO2-e/ha/yr		0.1	-2.5	-2.6

SHARE PER GHG OF THE BALANCE

In tCO2-e over the whole period analysis

CO2 BIOMASS	CO2 SOIL	N2O	CH4	ALL NON-AFOLU EMISSIONS*
0	0	0	0	
-47,966	-114,117	0	0	
80,685	-356,950	0	0	
0	-182,441	10,360	0	
-3,825,067	0	0	0	
0	0	0	0	
0	0	0	0	
		0	0	
0	0	0	0	
0	0	0	0	
0	0	0	0	
0	0	0	0	0
	0	0		0
-3,792,348		-653,509	10,360	0
-44.6		-7.7	0.1	0.0
-2.2		-0.4	0.0	0.0

Tier 2  
Specific GHG  
fluxes

+ = Source / - = Sink