JATROPHA AGROFORESTRY SENEGAL

Document Prepared By CarbonSinkGroup s.r.l.

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1 PROJECT DETAILS

1.1 Summary Description of the Project

The Jatropha Agroforestry Senegal project developes Jatropha curcas plantations in the Fatick and Kaffrine regions, in central-western agricultural region of the Senegal. The Jatropha curcas plantations will cover an area of 553.8 ha of degraded soils in the surroundings of the cities of Ourour and Kaffrine. The plantations will be located near villages around these cities to limit transport and facilitate the access of inhabitants as the project involves local hand-workers from villages. Local workers will be trained for both sustainable agricultural and forestry practices and hired for all plantation operational activities.

The planned agro-forestry system will assure a proper management of trees in cultivated lands allowing the carbon storage by plants biomass and soils, consequently providing a contribution to the greenhouse effect mitigation and the reversal of soil degradation trend.

African National Oil Corporation s.a.r.l. (ANOC) is the land-owner and so will be the owner of Jatropha plants and products. Moreover, ANOC will manage the agricultural operations (e.g., sowing, fertilizing) while rows between Jatropha plants (whether not interfering with Jatropha) will be completely at disposal of local communities. In addition, contemporary crop activities will be boosted as local farmers will be working only part-time in the Jatropha fields. The unused fallow agricultural land, where Jatropha will be grown, were legally assigned to ANOC for 20% of the available agricultural land, hence ensuring to continue to produce both food and traditional agricultural products (e.g., peanuts) as usual in the baseline scenario.

The aims of this project are:

- The sequestration of carbon dioxide (CO_2) through the nurturing of Jatropha curcas.
- The regeneration of degraded soils, protecting them against erosion processes and saving existing carbon stocks.
- The empowerment of local communities to develop sustainable agro-forestry practices.
- The provision of rotated livelihood potentialities for local communities with the possible access to alternative income for local stakeholders and the promotion of sustainable agricultural practices (e.g., Jatropha farming will harvest fruit whose seeds can be sold by villagers so as to be mechanically pressed to extract oil and generate the biodiesel fuel).
- The local production of biodiesel from Jatropha seeds will replace the scarcely-available diesel fuel, which is currently used to generate electricity; consequently, the biodiesel will provide an alternative source of energy for the sustainable development of this region.

1.2 Sectoral Scope and Project Type

The project will be a Verified Carbon Standard (VCS) project within the sectoral scope of Agriculture, Forestry and Other Land Use (AFOLU) and category Afforestation, Reforestation and Revegetation (ARR). The project will be a grouped project comprising a set of grouped project activity instances. While only one project activity instance is included in this Project Description (PD), the intention is to add more instances over time subsequent to project validation. This VCS project is hereafter referred to as "the project".

1.3 Project Proponent

African National Oil Corporation s.a.r.l. (ANOC) is the Coordinating/Managing Entity (C/ME) of the project. ANOC is a Senegalese private company owned by the Italian Bioenergy Production s.r.l. In Senegal its activities started in 2008 with the development of first nurseries in several villages and made first pilot Jatropha plantations near Ourour (Fatic region) and Kaffrine (Kaffrine region). ANOC developed the plantations respecting the environment by using sustainable agricultural practices (e.g., green manure, no mechanization), consistently with national and local laws, and cooperating with the Biofuels Division of the Senegal Ministry of Energy and Biofuels.

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Roles/responsibilities:

ANOC is the project proponent and managing entity. ANOC will manage the project activity (like agricultural operations e.g., sowing, fertilizing) and the monitor activities.

1.4 Other Entities Involved in the Project

Agroils Technologies s.r.l.

Agroils Technologies s.r.l. has been formed to provide technical assistance to Jatropha producers. Today Agroils is the European leader in Jatropha consultancy and it is a promoting partner of the Jatrophabook ONLUS, the most important stakeholders' platform in the sector. Agroils has developed a strong network with top research institutes (IFEU, Hohenheim, Wageningen) and is an active player in the international debate on sustainability (GBEP, RSB). In addition, recently Agroils has become operational as a technical consultant in the carbon sector both for voluntary and mandatory initiatives, with special focus on biofuels and AFOLU projects.

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Roles/responsibilities:

The role of Agroils Technologies s.r.l. is to give technical consultation for the project.

1.5 Project Start Date

The starting date of the project is 01 January 2009.

The evidence of the provided starting date is assured by attached documents on land property [see the enclosed Land property acts & land use rights[1]].

1.6 Project Crediting Period

The project crediting period will be 25 years and 00 months. The crediting period starting date is 01 January 2009 and the ending date is 31 December 2033.

1.7 Project Scale and Estimated GHG Emission Reductions or Removals

Project	x
Large project	

Years	Estimated GHG emission reductions or removals (tCO_2e)
2009	130

[1] Land property acts & land use rights, Republic of Senegal 2009.

2010	824
2011	2,123
2012	3,431
2013	4,415
2014	5,269
2015	5,622
2016	5,622
2017	5,622
2018	5,622
2019	5,622
2020	5,622
2021	5,622
2022	5,622
2023	5,622
2024	5,622
2045	5,622
2026	5,622
2027	5,622
2028	5,622
2029	5,559
2030	5,244
2031	4,920
2032	4,920
2033	4,920
Total estimated ERs	120,467
Total number of crediting years	25
Average annual ERs	4,819

1.8 Description of the Project Activity

The proposed project activity aims to plant 553.8 ha of Jatropha curcas in the Fatick and Kaffrine regions within the context of central-western part of the Senegal. The plantation is made within the years 2009-2011 (table 1) following the work plan [see the enclosed Work Plan 1 and Work Plan 2[2]]. Plantation establishment and management are described also below. The proposed agro-forestry system will assure a proper management of trees in cultivated lands allowing the carbon storage by plants biomass and soils, consequently providing a contribution to the

[2] Work Plan 1 and Work Plan 2, ANOC 2012.

greenhouse effect mitigation and the reversal of soil degradation trend. The lifetime of the project activity will be 25 years. More precise description of the Jatropha curcas species is presented in a separate document "Description of Jatropha curcas L.[3]

Figure 1. Jatropha samplings in a uncultivated plot in 2009 (Author: A. Madani)

[3] Description of Jatropha curcas L, CarbonSinkGroup 2013.

Figure 2. The same plot showed in figure 1 above, photographed in 2011 (Author: A. Madani)

Table 1. Planting area

Planting year	**Area planted**
2009	50.1
2010	248.08
2011	255.62
Total	553.8

Plantation Establishment

Preamble

Jatropha curcas produces seeds that can be processed into non-polluting biodiesel that, if properly exploited, can provide opportunities for fair incomes and rural development.

The production of Jatropha seeds can assist local farmers to diversify their incomes whereas its by-products (i.e., husks and press cake) can be composted and used as fertilizers or can substitute the harvested fuel-wood (i.e., currently used for cooking and charcoal production).

The introduction or mixture of woody perennials with agricultural crops or pastures, will overcome the competition with food crops; on the other hand the proposed innovative system will improve the overall productivity of the cultivated lands in the involved area.

The agro-forestry scheme would consist in a mixed-system based on the integration of trees into farms. There will be no disturbances for the plantation area because the proposed system will be based on minimal quantities of fertilizers (i.e., Urea, Manure, 10-10-20 fertilizer and no machinery). The existing non-tree vegetation will be slashed manually along the land form contour while, accordingly to the national laws, all the existing trees will not be removed from the site preparation.

The Jatropha curcas cultivation will occur by pre-growing of seedlings in dedicated nurseries and direct planting. This plant needs little care and relatively low water requirements; moreover, this species is easily adaptable to marginal areas and moderate regimes of rush. The species by-products, such as husks and press-cake, after a preliminary treatment, will be used as organic fertilizers or for biomass energy production. Furthermore, an optimization usage of current food crops and practices will be pursued in order to enhance soil conservation (e.g., introduction of nitrogen fixing crops).

All the maintenance activities (i.e., weeding, pruning and harvesting) will be conducted manually by local farmers hired, expressly employed by project participants.

Site selection

Project sites are selected according to the basic environmental requirements and local soil properties to achieve an optimal growth of the selected species (Jatropha curcas).

Figure 3. Jatropha curcas site selection and measurement (Author: L. Galbiati)

Nursery preparation

The saplings used during reforestation and enrichment operations are produced in nurseries; in particular, they derive from seeds of local origin. If possible, a part of seeds produced in the nurseries of the first plots will be used to manage the following ones. It will take 3-6 months to have some saplings from the seeds planted in a nursery. The production of Jatropha curcas seeds starts rapidly in 8-10 months and usually reaches maturity after 5 years, after which the production remains stable for 20-30 years.

Basically, nursery practices will produce saplings through a method based on saplings in seedbeds previously prepared in the soil; each local family, inhabiting the villages involved in the project area, can manage approximately 4,000 seeds. These local communities are organized in cooperatives dealing with a nursery each, near villages and water sources. For this reason, in each nursery it was planned the growth of 25% of plants more than the amount necessary to the capacity of related plots; thus, the project participants will be able to replace promptly all the dead trees.

Figure 4. Jatropha curcas nursery (Author: L. Galbiati)

Figure 5. Jatropha curcas samplings in a nursery (Author: L. Galbiati)

<u>Site preparation</u>

A few small shrubs (i.e., Nguer, Kinkeliba) have already been slashed manually due on site preparation. The soil preparation process will use only manual devices and instruments (such as hoes, machetes, spades, shovels, rakes, and pickaxes) by local people whose work will be supervised by staff members of project participants. Any pre-existing tree (with diameter > 12 cm) present in the plantation area will be left in place accordingly to the national law; however, in the selected plots the baseline tree cover is far less than 10% (i.e., approximately 5 trees/ha) (see for example figure 3 and 18). The planting activity will take place after the first rain, digging a hole for each seedling and then covering it with the soil.

Planting and fertilization

Jatropha trees are planted in rows. The marking activity is done accordingly to the triangle system, in alternating rows, and by using ropes. In the first project years plots had a distance of 2x2 m between samplings (maximum of 2,500 trees/ha), or distance of 3x2 m (maximum of 1,666 trees/ha). Later also distances of 3x3 m 4x3 m and has been applied (maximum of 1,111 trees/ha or 833 trees/ha, respectively). The distances of 3x3 and 3x4 m were found as the optimal space to be maintained between the samplings. On top of that, planting locations are marked through pits to support the rapid establishment of trees.

The survival rate of trees will be taken into account and will be measured six months after planting, during the first three years from the starting date of the planting activity, to replace dead or diseased trees as well as ensure a survival rate of at least 95%.

Prior to the planting, an inspection of each sapling root system is performed in the nursery. Insufficiently developed plants are removed and others are pruned if necessary. Upon planting, the soil surrounding the base of each sapling is compressed to avoid the root death possibly caused by air pockets. Moreover, the planting activity is carried on, early in the morning or late in the afternoon, to reduce the effects of sun-related stress on the newly planted saplings. For the same reason, when possible, the planting is carried out during cloudy days.

They are three teams working during the above mentioned operations:

First team	They dig a hole and they dispense the specific product against the nematodes, then mix with the original soil
Second team	After one week, women teams set the saplings and then cover them with the soil
Third team	Within one month, they deposit the manure and urea

The fertilization plan is expected to be as presented here below (for each plant):

- at the time of relocation, there will be placed both urea and 800 g of pulverized manure;
- at the end of the first year, there will be added both urea and 800 g of pulverized manure;
- from the third year onward, it will be used a fertilizer following the rule of 10-10-20 ratios (10% Nitrogen - 10% Phosphorus - 20% Potassium) as well as 800 g of pulverized manure, to be given once a year during the raining season.

Provisions will be arranged to protect the plantations against the risk of wildfire; in particular, it will be dug a 10 m corridor along the boundaries of each plot. Moreover, there will be implemented occasional initiatives against the grasshoppers, quite widespread in this area. On this purpose, training courses will be provided to villagers in order to enforce these practices effectively on their plantations.

Plantation Maintenance

Weeding

During the first three years, the project participants will weed the plantation twice a year. The weeding will be carried out manually (i.e., using a machete) whereas once a year a 1 m radius circle area will be cleared around seedlings and then will be fertilized. The practice of weeding is very important in the first few years after the plantations establishment in order to reduce the competition from weeds, which are usually better adapted to the local environments than the newly established seedlings; after the first three years the wedding is useless and, consequently, will no longer be performed.

Figure 6. Weeding activity (Author: L. Galbiati)

Pruning

The pruning is practiced once a year from the second year onward. It will be performed differently according to the requirements of the growing stage of each tree. While pruning requires experience and is site-specific, a range of common criteria are analyzed before pruning. These criteria include different features of individual trees such as age, crown size, health, branch diameter, and diameter of the stem where lateral branches are growing out from the trunk. The biomass derived from the pruning will be left on the land. The quantities of wood material deriving from the pruning will be around the following data: 1 kg/tree in the second year, 5 kg/tree in the third year, 10 kg/tree from the fourth year onward.

Fruit harvesting

The fruit harvesting will be carried out manually by the local villagers. The Jatropha curcas plant is a rapidly maturing species which produces seeds from the first year of age. The harvesting will start from the third year. The harvesting plan is presented below in the table 2.

Table 2. The prevision of the harvesting plan.

Intervention year	Harvesting prevision
3rd year	0.5 kg
4th year	1.5 kg
5th year	2.5 kg
6th year and the following years	3.5 kg

Figure 7. Jatropha curcas fruits (Author: L. Galbiati)

Figure 8. Jatropha curcas fruits after harvesting (Author: L. Galbiati)

Forest establishment and management organization

There are 15 villages involved in the proposed project (Table 3), even the plantation plots are actually located in the territory of only six villages. All the 15 villages (with total population of approximately 4,000 people) are providing hand-workers for the management of nurseries and plots. As presented in the graphic below (Figure 9), ANOC is the project supervisor and manager who will hire around 100 people to be directly employed by the project for the entire year (every person will have around 6 ha area). Moreover, in the period between June and September almost all the women of the 15 villages are employed due on planting and fertilizing activities, thus reaching more than 500 hand-workers employed by the project. These local workers have daily employment contracts and are organized in cooperatives. Moreover, there will be a separate "research and development unit", an Italian entity, who will periodically control the reforestation functions like nurseries and planting sites and who will be called for help also in case of specific situations like plant diseases or invasion of pests.

Table 3. Population and households of the Ourour rural community

	Villages	**Population**	**Number of households (place where a group of relatives lives together)**
1	OUROUR SINTHIE	484	83
2	MAKA SOUMBEL	229	29
3	SOUMBEL GALLO NDIAYE	158	19
4	SOUMBEL MISSION	293	39
5	COLOBANE SOUMBEL	273	30
6	GOWETHE SERERE	723	76
7	GOWETHE WADENE	332	37
8	KEUR MIGNANE	385	30
9	MANDE KEUR DIEGANE THIARE'	413	48
10	KEUR MBISSANE	111	11
11	KEUR DIEGANE DIOP	77	12
12	COLOBANE LAMBAYE	680	68
13	OUROUR NDIODO	105	21
14	OUROUR KADA 1	165	29
15	OUROUR KADA 2	312	47
	TOTAL POPULATION	4.740	579

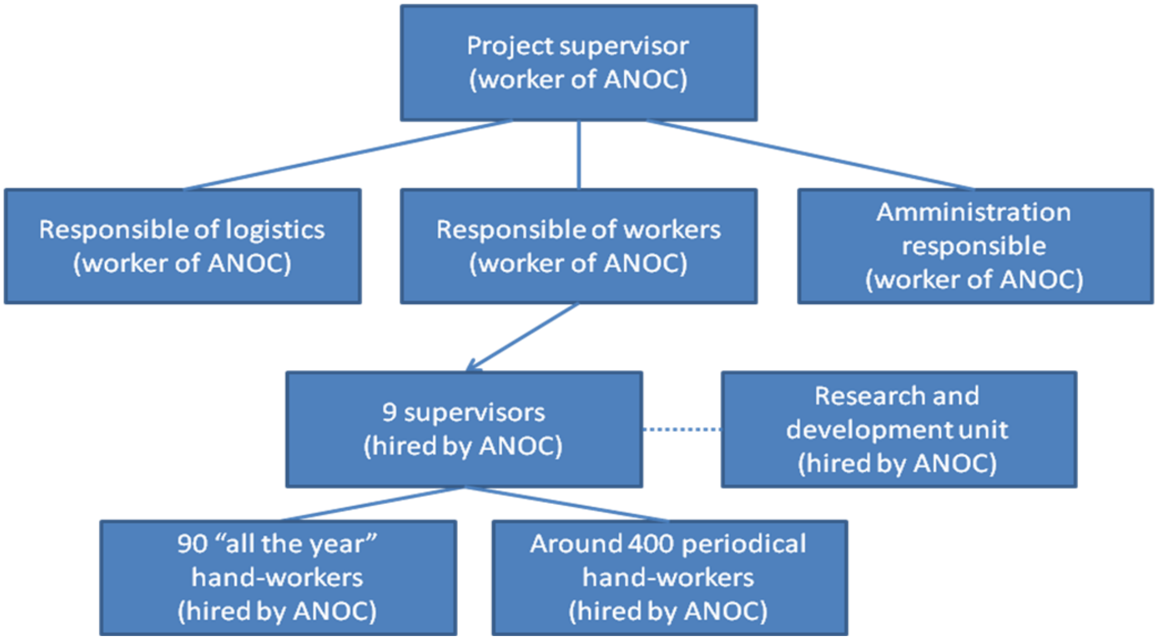

Figure 9. Organization structure of the project management

The project will include specific training courses for local farmers focused on Jatropha curcas cultivation, sustainable agricultural and forest management practices. Furthermore, a comprehensive illustrated guidebook on agricultural and forest management practices will be issued, printed and distributed among local stakeholders (i.e., farmers and representatives in schools and villages).

Figure 10. Explanation of technical methods to the local workers (Author: L. Galbiati)

1.9 Project Location

The grouped project boundary will be the regions of Fatick, Kaolack and Kaffrine (Figure 11). All the project activity instances will be within these regions.

Figure 11. Regions of Senegal (source: Wikipedia, 2013[4])

All the plantation plots of the first project instance are located in the vicinity of the major cities of Ourour and Kaffrine, within regions of Fatick and Kaffrine respectively (figure 12 and table 4). More detailed boundary of the first project instance is presented in separate files in Google Earth KLM format[5].

Figure 12. Location of the project site (source: Google Earth 19/04/2013)

[4] Wikipedia, 2013: http://en.wikipedia.org/wiki/File:Regions_of_Senegal.svg. Site visited 17/04/2013.
[5] KLM_Campagna_2011, KLM_Campagna_2010 and KLM_Campagna_2009

Table 4. Project area plots

Name	Area (ha)		
	2009	2010	2011
OUROUR CRISE 18	1.59		
OUROUR FORAGE 19	9.59		
OUROUR CADA 20	3.12		
OUROUR CADA 21	8.60		
OUROUR CAMARA 24	1.71		
OUROUR CAMARA 25	17.52		
KEUR MIGNAN 12	1.35		
KEUR MIGNAN 13	3.07		
KEUR MIGNAN 14	2.25		
NAWEL 1	1.30		
OUROUR 1		4.97	
OUROUR 2		3.70	
OUROUR 3		6.32	
OUROUR 4		5.03	
OUROUR 5		9.84	
OUROUR 6		33.35	
OUROUR 7		14.25	
OUROUR 8		3.05	
OUROUR 9		6.77	
COLOMBANE 2		5.75	
SOUMBEL 1		13.33	
SOUMBEL 2		6.65	
SOUMBEL NUOVO 3		3.35	
COLOMBANE 1		2.95	
COLOMBANE NUOVO 3		3.64	
KEUR DIEGANE 1		1.94	
KEUR DIEGANE 2		6.00	
KEUR DIEGANE 3		4.75	

KEUR MIGNAN 2		1.93	
KEUR MIGNAN 3		0.40	
OUROUR 22		2.05	
NDIOTE MOR 1		33.48	
NDIOTE MOR 2		12.75	
NDIOLEFENE 1		19.37	
DELBY 1		24.80	
DIANKE KAO 1		17.66	
OUROUR CRISE 10			18.00
OUROUR VIRAGE BAC 15			1.55
OUROUR ROUTE DE GAGNIK 16			4.16
ROUTE DE SOUMBEL 1			6.63
ROUTE DE SOUMBEL 2			0.43
ROUTE DE SOUMBEL 3			16.64
ROUTE DE SOUMBEL 4			2.51
ROUTE DE SOUMBEL 5			2.71
OUROUR 13			28.43
OUROUR 14			3.58
MAKA SOUMBEL 1			3.24
MAKA SOUMBEL 2			6.68
MAKA SOUMBEL NEW 3			2.97
SOUMBEL GALLO 1			2.96
SOUMBEL GALLO 2			3.88
SOUMBEL GALLO 3			2.19
SOUMBEL GALLO NEW 4			2.74
GOWETHE SERERE 1			1.98
GOWETHE SERERE 3			5.64
COLOBANE 4			12.00
KEUR MIGNANE DIOP 5			4.80
KEUR DIEGANE NEW 7			2.42
KEUR MIGNANE 4			0.95
KEUR MIGNANE 6			1.88
GOWETHE WADENE 1			4.84

KEUR MIGNANE 7			2.89
TEOWROUCOSOM 1			10.28
DIANKE SOUF 1			40.01
DELBY 2			25.17
NDIOTE MOR ENTREE 3			10.97
NDIOLOFEME 2			12.40
NDIAAW NEW 1			7.75
NDIAAW NEW 2			2.34
Total area (ha)	**50.10**	**248.08**	**255.62**

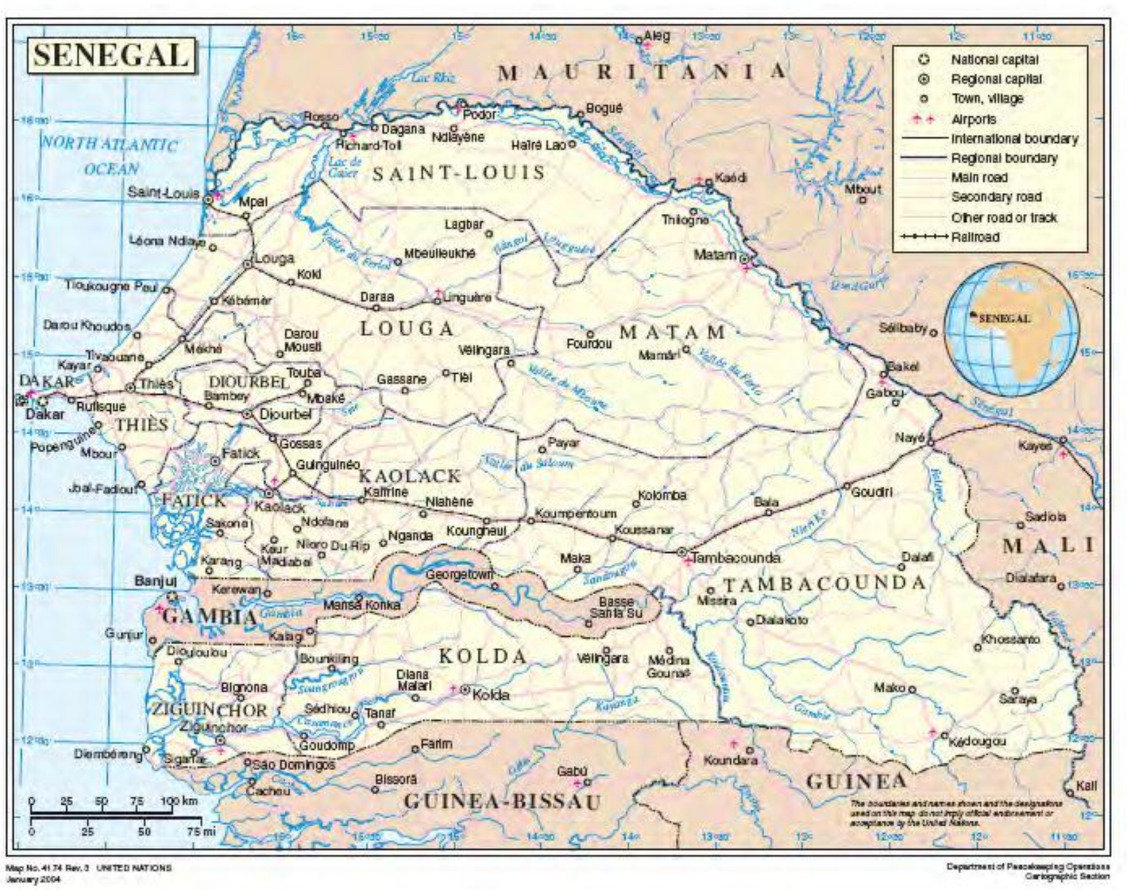

Figure 13. Political map of Senegal (source: UN, 2004[6])

[6] http://www.un.org/Depts/Cartographic/map/profile/senegal.pdf (Site visited 22/04/2013)

1.10 Conditions Prior to Project Initiation

Climate

The northern area of the project (Sine-Salom) is located in the Sudanese climate domain, whereas the southern areas (Casamance) in the Sudanese-Guinean and sub-Guinean climate domains. In the first area the annual precipitation ranges from 800 to 1,200 mm, while in the latter it ranges from 400 to 800 mm. The dry season lasts from November to April, and the rainy season (due to monsoon resulting from the anticyclone of St. Helene) lasts from May to October. During the last century, Senegal suffered three important dry periods in 1910, 1940, and the most important one, after 1968. In particular, the latest period was the most severe, lasting from 1970 to 1990, and led to the displacement of the isohyets to around 120 km south.

The mean annual temperature of the project area is around 28 ºC, with an average minimum temperature of 20-21 ºC and an average maximum temperature of 33-37 ºC. There is no occurrence of frost.

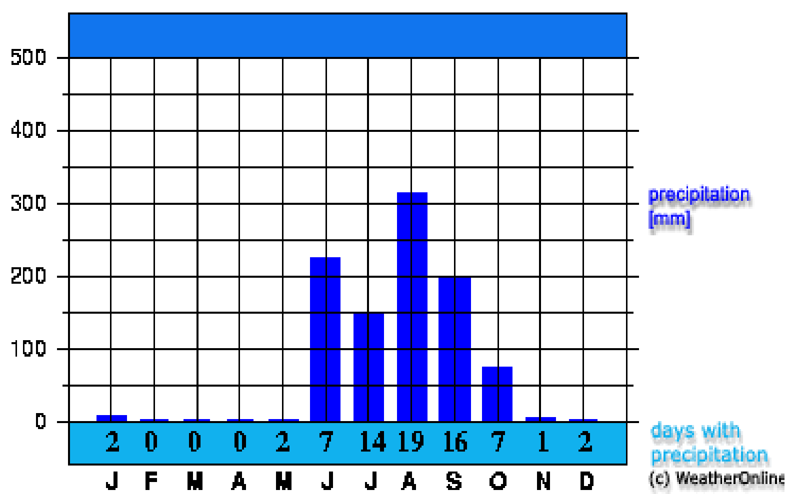

Figure 14. Precipitation trend during a whole year
(source: http://www.weatheronline.co.uk/weather/maps/city).

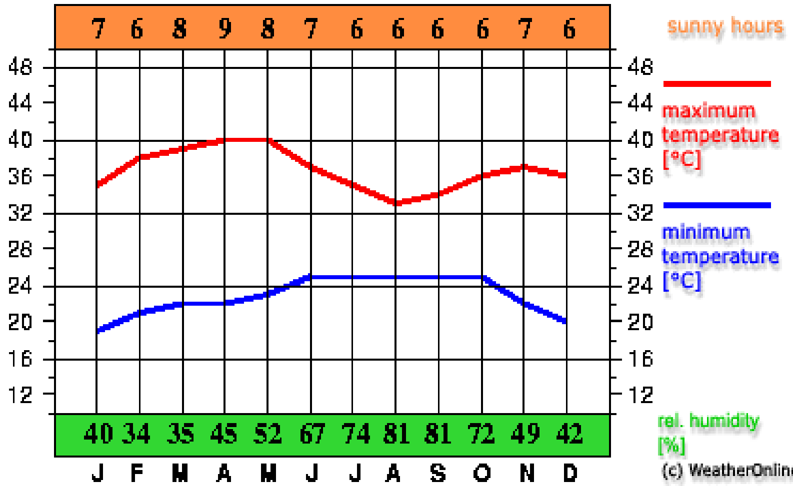

Figure 15. Temperature trend during a whole year
(source: http://www.weatheronline.co.uk/weather/maps/city)

Soils
Most cultivated soils, located in the Peanut Basin, can be classified as "generally poor to moderate soils". These soils have some limitations restricting their use, are usually of fairly low natural fertility and, generally, provide lower income than climatically adapted crops under traditional systems of management[7]. The soils can be also described as sandy soils of tropical dry climate, in accordance with the table 3 of the tool "Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities[8]". The project area does not fall in to wetland category.

The project area is located in the most degraded zone of the whole country of Senegal, with a deep alteration of its landscape. Farmers are still abandoning their crops and so unplanned fallow are rising.

The land has fallen out of agricultural production for a variety of reasons

- Both droughts and declining rainfall of last three decades, responsible for exacerbating the risks of failure in rainfed cultivations.
- Breakdown of the agricultural economy, including a lack of seeds, agricultural credits, and technical equipment
- Several factors constraining the fertilizers use, with the results of reducing the productivity and declining the soil organic carbon percentage with a subsequent decrease of the soil fertility.

[7] USAID, 2008. Senegal biodiversity and tropical forests assessment. Available at http://www.docstoc.com/docs/674125/Senegal-biodiversity-and-tropical-forests-assessment (Site visited 15/01/2013)
[8] EB 60, Annex 12. http://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-16-v1.1.0.pdf

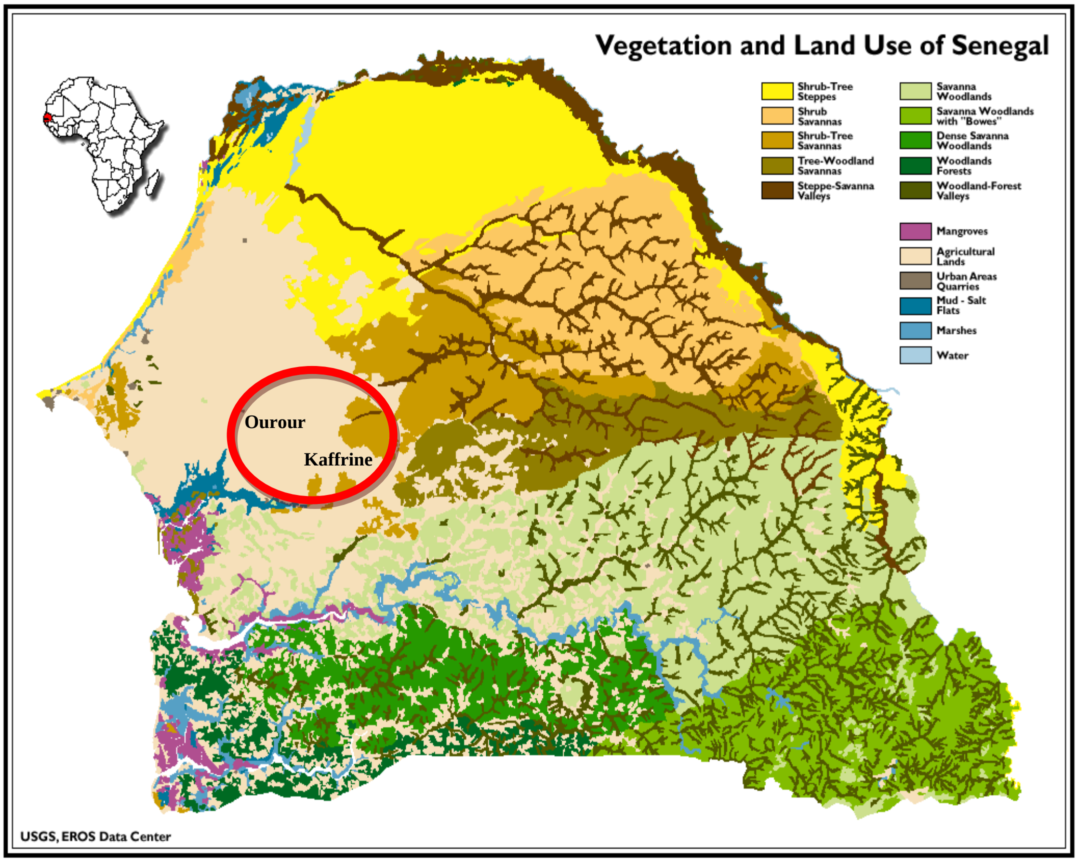

Figure 16. Map of vegetation and land use of Senegal

(source: USGS/EROS 2006; Senegal Biodiversity and Tropical forest assessment, USAID 2008).

Figure 17. Map of main agricultural macro-areas of Senegal

(source: http://www.isra.sn).

Figure 18. Typical landscape of the region (Author: L. Galbiati)

Presence of rare or endangered species and their habitats

Senegal biodiversity

The following species are found in Senegal, but not in the project site because the plots to be planted are very degraded.

The flora found in the geographical area of Senegal consists of about 2,500 species divided into three floristic zones: a northern area with 800 species, a central zone with 1,000 species and the southern area with 1,700 species[9]. Numerous vegetative species, particularly those ones characterized by Guinaean affinity, are threatened with extinction, subjected to drought and strong pressures caused by human activities. Wildlife is essentially concentrated in protected areas, particularly in national parks and wildlife reserves[10]. All classes of vertebrates are represented in Senegal[6]. Mammals are divided into 192 species, 65 genera and 32 families; 14 of these species are threatened with extinction[7]. Birds are present with 623 known species divided in 100 families. A quarter of these species are migratory and no endemic species are present[11].

Flora

Unused agricultural land (after more than 20 years) is characterized by extremely scarce vegetation. Tree vegetation includes species locally known as Baobab, Kadd, Dimb, Ngui-gis, Sump, Olom, and Loucena. No rare or endangered species were identified in the project site, because this area is severely degraded and characterized by very scarce vegetation. Pre-project land uses were basically agriculture, grazing and unmanaged lands[12].

[9] Ministere de l'environnement et de la protection de la nature (1997). Rapport National Biodiversité. http://www.cbd.int/doc/world/sn/sn-nr-01-fr.pdf (Site visited 28/12/2012)
[10] USAID, 2008. Senegal Biodiversity and Tropical Forests Assessment. Prosperity, livelihoods and conserving ecosystems. http://pdf.usaid.gov/pdf_docs/PNADL464.pdf (Site visited 28/12/2012)
[11] Morel GJ, Morel MY (1990). Les oiseaux de Sénégambie - Notices et cartes de distribution. Paris, Orstom Editions, pp. 178
[12] Mbow C, Mertz O, Diouf A, Rasmussen K, Reenberg A (2008). The history of environmental change and adaptation in eastern Saloum – Senegal. Driving forces and perceptions. *Global and Planetary Change*, 64: 210-221

Fauna

In the Table 5 are presented all rare and endangered species found within the Fatick and Kaffrine regions. These species are listed following the IUCN classification[13].

Table 5. Rare and endangered species found in the Fatick and Kaffrine regions.

SPECIES			STATUS
Primates			
Familiae	**Species**	**Common name**	
Galagidae	*Galago senegalensis*	Northern Lesser Galago	LC / Appendix II
Cercopithecidae	*Chlorocebus sabaeus*	Green Monkey	LC / Appendix II / Class B*
Cercopithecidae	*Erythrocebus patas*	Patas Monkey	LC / Appendix II / Class B*
Cercopithecidae	*Papio papio*	Guinea Baboon	NT / Appendix II / Class B*
Other mammals			
Felidae	*Felis silvestris*	Wild Cat	LC / Appendix II
Felidae	*Leptailurus serval*	Serval	LC / Appendix II
Canidae	*Vulpes pallida*	Pale Fox	DD
Viverridae	*Civettictis civetta*	African Civet	LC
Avifauna[14]			
Accipitridae	*Elanus caeruleus*	Black-Shouldered Kite	LC / Appendix II
Accipitridae	*Gyps africanus*	White-Backed Vulture	NT / Appendix II
Accipitridae	*Gyps rueppelli*	Rüppel's Griffon Vulture	NT / Appendix II
Accipitridae	*Hieraaetus spilogaster*	African Hawk-Eagle	LC / Appendix II
Accipitridae	*Melierax metabates*	Chanting Goshawk	LC / Appendix II
Accipitridae	*Melierax gabar*	Gabar Goshawk	LC / Appendix II
Accipitridae	*Milvus migrans*	Black Kite	LC / Appendix II
Accipitridae	*Necrosyrtes monachus*	Hooded Vulture	EN / Appendix II
Falconidae	*Falco ardosiaceus*	Grey Kestrel	LC / Appendix II
Otididae	*Eupodotis senegalensis*	Senegal Bustard	LC / Appendix II
Otididae	*Eupodotis melanogaster*	Black-Bellied Bustard	LC / Appendix II
Psittacidae	*Poicephalus senegalus*	Senegal Parrot	LC / Appendix II
Strigidae	*Otus scops*	Scops Owl	LC / Appendix II
Strigidae	*Bubo lacteus*	Milky Eagle-Owl	LC / Appendix II
Herpetofauna			
Boidae	*Python regius*	Royal Python	LC / Appendix II
Varanidae	*Varanus exanthematicus*	Savannah Monitor	LC / Appendix II
Chamaeleonidae	*Chamaeleo senegalensis*	Senegal Chameleon	LC / Appendix II

13 www.iucn.org (site visited 19/01/2013)
14 Morel GJ, Morel MY (1990). Les oiseaux de Sénégambie - Notices et cartes de distribution. Paris, Orstom Editions

Legend:
IUCN Red List categories: LC = Least Concern; NT = Near Threatened; EN = Endangered; DD = Data deficient
CITES (*Convention on International Trade in Endangered Species of Wild Fauna and Flora*) appendixes
*African Convention on the Conservation of Nature and Natural Resources

Description of main species

Northern Lesser Galago (*Galago senegalensis*)[15]

The Northern Lesser Galago (Figure 19) is the most widespread galago species, ranging from Senegal in the west, through the savanna and open woodland of Africa, to Sudan, Somalia and Ethiopia in the east and Kenya and Tanzania in the south. The southern limit of distribution is probably the Rufiji River. The area of sympatry with *G. moholi* in central and southern Tanzania and with *G. gallarum* in central Kenya has yet to be defined and requires investigation. There are four subspecies: *G. s. senegalensis* ranges from Senegal in the west through to Sudan and western Uganda.
It is found in all strata of savanna woodland, in dense to open bushland areas, in mountain forest, and in secondary or highly fragmented forest and woodland, including cultivated areas. It avoids areas of grassland. It builds nests in dense thorn trees or nest in tree holes. Group size is of 1-5, though they forage separately at night. Presumed to give birth to between one and two young annually.
This species is listed on Appendix II of CITES.

Figure 19. Northern Lesser Galago
(source: http://it.wikipedia.org/wiki/Galago_senegalensis).

Green Monkey (*Chlorocebus sabaeus*)[16]

The Green Monkey (Figure 20) ranges from Senegal and Guinea-Bissau to west of the Volta River system in Ghana and has been introduced to Barbados and Saint Kitts and Nevis in the Caribbean, and also to Cape Verde.

[15] http://www.iucnredlist.org/apps/redlist/details/8789/0
[16] http://www.iucnredlist.org/apps/redlist/details/136265/0

It is recorded from riverine gallery woodlands, acacia savannas, mangrove forest and at the edge of lowland tropical moist forest.
This species is listed on the CITES Appendix II and the Class B of the African Convention on the Conservation of Nature and Natural Resources.

Figure 20. Green Monkey
(source: http://it.wikipedia.org/wiki/Chlorocebus_sabaeus).

Patas Monkey (*Erythrocebus patas*)[17]

The Patas Monkey (Figure 21) ranges from north of the equatorial forests and south of the Sahara from western Senegal through to Ethiopia, south to northern, central and southern Kenya and north-central Tanzania as far as the Acacia woodlands, east of Lake Manyara.
It is found in vegetation types ranging from open grassland, to wooded savannas and to dry woodland. It is common in thinly bushed Acacia woodland and appears to have a preference for woodland-grassland margins. It is largely terrestrial, although it can climb trees when alarmed; it usually relies on its speed on the ground to escape from danger. It feeds primarily on grasses, gum, berries, fruits, beans, and seeds; its preferred species include common savanna trees and shrubs.
It is a diurnal species living in groups of around 15 individuals, with an extensive home range (e.g., 51.8 km^2 for a group of 31 specimens). At night, groups may be spread over an area of approximately 250,000 m^2 and so they are protected from predators.
This species is listed on the CITES Appendix II and the Class B of the African Convention on the Conservation of Nature and Natural Resources.

[17] http://www.iucnredlist.org/apps/redlist/details/8073/0

Figure 21. Patas Monkey
(source: http://it.wikipedia.org/wiki/Erythrocebus_patas).

Guinea Baboon (*Papio papio*)[18,19]

The Guinea Baboon (Figure 22) is a western African species ranges from southern Mauritania and Mali to Guinea and north-westerner Sierra Leone. Along its eastern limits, the Guinea baboon may be hybridising with the larger Olive Baboon *Papio anubis*.
It inhabits woodlands, savanna, and those Sahelian ecosystems assuring the presence of water. It also inhabits gallery forests and secondary forests in the south of its range. Rich food resources and good protection in the Niokolo Koba National Park in Senegal allow large aggregations of harem groups, numbering 10-200 (sometimes >500) individuals, to forage together. Guinea Baboons eat seeds, shoots, roots, fruits, fungi, invertebrates, small vertebrates, and eggs. Where agriculture has expanded, rice, maize, yams, groundnuts, and other cultivated crops are also taken.

This species is listed on the CITES Appendix II and the Class B of the African Convention on the Conservation of Nature and Natural Resources. It is effectively protected in the Niokolo-Koba National Park (Senegal) and in the Outamba-Kilimi National Park (Sierra Leone).

Figure 22. Guinea Baboon

[18] http://www.iucnredlist.org/apps/redlist/details/16018/0
[19] Rowe N (1996). The pictorial guide to the living primates. Charlestown, Rhode Island, US. Pogonias Press.

(source: http://it.wikipedia.org/wiki/Papio_papio).

Serval (*Leptailurus serval*)[20]

The Serval (Figure 23) occurs widely through sub-Saharan Africa, with the exception of tropical rainforest and the Saharan desert. North of the Sahara, there are recent records of specimens in Morocco and in northern Algeria.
In sub-Saharan Africa, these animals are found in long-grass environments such as the well-watered savanna and are particularly associated with reedbeds and other riparian vegetation types. They also range up into alpine grasslands, up to 3,800 m on Mount Kilimanjaro. They can penetrate the dense forest along waterways and through grassy patches, but are absent from rainforests of Central Africa as well as desert environments. In Northern Africa, they are found in different environments, from semi-desert to cork oak forest on the Mediterranean Basin coasts. This species is able to tolerate agricultural areas, provided cover is available, and may also benefit from forest clearance and the resulting encroachment of savanna at the edges of the equatorial forest belt. Its diet is specialized on small mammals, in particular rodents, with birds of secondary importance.
This species is listed on the CITES Appendix II.

Figure 23. Serval
(source: http://it.wikipedia.org/wiki/Leptailurus_serval).

Pale fox (*Vulpes pallida*)[21]

The Pallid Fox (Figure 24) is disseminated in the semi-arid Sahelian region of Africa, bordering the Sahara from Mauritania and Senegal across Nigeria, Cameroon and Chad to the Red Sea. The southern limit of this geographical range extends into northern Guinean savanna zones.
It typically inhabits very dry sandy and stony sub-Saharan desert and semi-desert areas, but extending to some extent southwards into moister Guinean savannas. Therefore, it is characterized by a rather extensive distribution within an unstable and fluctuating ecological band lying between the desert and the Guinean savannas. It can be found near human settlements and cultivated fields, because of direct availability of food.
This species is not listed on the CITES Appendices. Likely to occur in several protected areas and reserves throughout the entire home range of the species, but no reliable information is available.

[20] http://www.iucnredlist.org/apps/redlist/details/11638/0
[21] http://www.iucnredlist.org/apps/redlist/details/23052/0

Figure 24. Pale fox
(source: http://en.wikipedia.org/wiki/Pale_fox).

White-Backed Vulture (*Gyps africanus*)[22]

The White-Backed Vulture (Figure 25) is the most widespread and common vulture in Africa. It occurs from the Western Africa (Senegal, Gambia and Mali), throughout the Sahel region to the Eastern Africa (Ethiopia and Somalia), to the Southern Africa (Mozambique, Zimbabwe, Botswana, Namibia and South Africa). Consistently with other vulture species, it has declined by over 90% in Western Africa.
Principally it is a lowland species of open wooded savanna, particularly present in the areas with lots of *Acacia* plants. Tall trees are required for nesting by loose colonies. It is a gregarious species congregating at carcasses, in thermals and at roost sites.
Since there is evidence that this species is captured for international trade, it is listed on the CITES Appendix II.

Figure 25. White-Backed Vulture
(source: http://it.wikipedia.org/wiki/Gyps_africanus).

[22] http://www.iucnredlist.org/apps/redlist/details/106003373/0

Hooded Vulture (*Necrosyrtes monachus*)[23]

The Hooded Vulture (Figure 26) is widespread in sub-Saharan Africa: from Senegal and southern Mauritania through southern Niger and Chad, to southern Sudan, Ethiopia and western Somalia, southwards to northern Namibia and Botswana, and through Zimbabwe to southern Mozambique and north-eastern South Africa. Generally it is a sedentary species, with some dispersal by non-breeders and immature birds, and movements in response to rainfall in the Sahel of Western Africa. Data and observations of varying coverage and quality from various parts of its range suggest that it is undergoing a very quick decline in its global population.
It is often associated with human settlements, but is also found in open grassland, forest edge, wooded savanna, desert and along coasts. It feeds mainly on carrion, but also takes insects. It is an arboreal nester and lays a clutch of one egg.
Major threats to this species include non-target poisoning, capture for traditional medicine and bushmeat, and direct persecution. Declines have also been attributed to land conversion through development and improvements to abattoir hygiene and rubbish disposal in some areas. Moreover, it may be threatened by avian influenza (H5N1). This species is listed on the CITES Appendix II.

Figure 26. Hooded Vulture
(source: http://it.wikipedia.org/wiki/Necrosyrtes_monachus).

Senegal Parrot (*Poicephalus senegalus*)[24]

The Senegal Parrot (Figure 27) occurs through the savanna woodland belt of Western Africa, north of the rainforest belt from Mauritania through to south-western Chad, north-eastern Cameroon, and northern Central African Republic. The species undertakes seasonal movements in some parts of its range, moving into dryer areas during the wet season.
This species has been heavily traded: from 1994-2003, over 410,000 wild-caught individuals were exported from range states[25]. It is one of the most popular avian pets, since it is regarded as a small and quiet bird that bonds well. This species is listed on the CITES Appendix II.

[23] http://www.iucnredlist.org/apps/redlist/details/106003372/0
[24] http://www.iucnredlist.org/apps/redlist/details/106001499/0
[25] UNEP-WCMC CITES Trade Database, October 2005. http://www.unep-wcmc-apps.org/citestrade/expert_accord.cfm?CFID=50036137&CFTOKEN=74457752 (Site visited 28/12/2012)

Figure 27. Senegal Parrot
(source: http://www.google.it/).

Royal Python (*Python regius*)[26]

The Royal Python (Figure 28) has a wide distribution from Sudan and Uganda across Central Africa and throughout Western Africa to Senegal.
It inhabits dry areas, from grassland to open forests. It can also be found in agricultural lands. Basically, it is an important species as involved in the rodents pest control.
This species is listed on the CITES Appendix II.

Figure 28. Royal Python
(source: http://it.wikipedia.org/wiki/Python_regius).

Senegal Chameleon (*Chamaeleo senegalensis*)[27,28]

The Senegal Chameleon (Figure 29) is widely distributed in Western Africa, from Senegal and Mali to Cameroon, with a total extent of occurrence in excess of 2,000,000 km^2. It inhabits the moist savanna.

[26] http://www.iucnredlist.org/apps/redlist/details/177562/0
[27] http://www.iucnredlist.org/apps/redlist/details/176312/0
[28] Tilbury CR, Tolley KA (2009). A re-appraisal of the systematics of the African genus *Chamaeleo. Zootaxa*, 2079: 57-68. http://www.mapress.com/zootaxa/taxa/Reptilia.html (Site visited 28/12/2012)

This species is listed on the CITES Appendix II.

Figure 29. Senegal Chameleon
(source: http://www.shutterstock.com/pic-32285065/stock-photo-senegal-chameleon-chamaeleo-senegalensis-isolated-on-black-background.html).

Project was not implemented for subsequent GHG reductions, removal or destruction

The Project Proponent declares this project was not implemented to create GHG emissions for the purpose of their subsequent reduction, removal or destruction. A project identification note was written before the project start, thus clearly demonstrating that GHG revenues (i.e., income due carbon credit marketing) were accounted before the implementation of the initial project plan. The long term funding of the project is totally dependent on the revenue stream provided by a long-term tree growth.

1.11 Compliance with Laws, Statutes and Other Regulatory Frameworks

Currently no laws and regulations prevent or enforce the project activity or baseline land use scenarios. Laws and regulations do not prevent or prescribe either agriculture and cattle breeding in the project area, nor forest conversion.

1.12 Ownership and Other Programs

1.12.1 Right of Use

ANOC is the land-owner and so will be the owner of Jatropha plants and products. Moreover, ANOC will manage the agricultural operations (e.g., sowing, fertilizing) while rows between Jatropha plants (whether not interfering with Jatropha) will be completely at disposal of local communities. The unused fallow agricultural land, where Jatropha will be grown, were legally assigned to ANOC for 20% of the available agricultural land, hence ensuring to continue to produce both food and traditional agricultural products (e.g., peanuts) as usual in the baseline scenario.

See the enclosed Land Property Acts & Land Use Rights[29].

[29] Land property acts & land use rights, Republic of Senegal 2009.

1.12.2 Emissions Trading Programs and Other Binding Limits

The Project Proponent declares that net GHG emission reductions or removals generated by the project will not be used for compliance with an emissions trading program, or to meet binding limits on GHG emissions.

1.12.3 Participation under Other GHG Programs

The Project Proponent declares the project has not been registered, nor is seeking registration under any other GHG programs.

1.12.4 Other Forms of Environmental Credit

The Project Proponent declares this project does not create another form of GHG-related environmental credit for GHG emission reductions or removals claimed under the VCS Program, or that any such credit has been, or will be, cancelled from the relevant program.

1.12.5 Projects Rejected by Other GHG Programs

The Project Proponent declares this project has not been rejected by any other GHG programs.

1.13 Additional Information Relevant to the Project

Eligibility Criteria

The eligibility of the new project activity instances, as part of the grouped project, is demonstrated following "Procedures to demonstrate the eligibility of lands for afforestation and reforestation CDM project activities (Version 01)"[30]:

(a) Demonstrate that the land at the moment the project starts does not contain forest by providing transparent information that:

- (i) Vegetation on the land is below the forest thresholds (tree crown cover or equivalent stocking level, tree height at maturity in situ, minimum land area) adopted for the definition of forest by the host country under decisions 16/CMP.1 and 5/CMP.1 as communicated by the respective DNA[31]; and
- (ii) All young natural stands and all plantations on the land are not expected to reach the minimum crown cover and minimum height chosen by the host country to define forest; and
- (iii) The land is not temporarily unstocked, as a result of human intervention such as harvesting or natural causes.

[30] EB 35, Annex 18. http://cdm.unfccc.int/Reference/Procedures/methAR_proc03.pdf

[31] Senegal defines the minimum area of a "forest" as 0.5 hectare with a minimum tree crown cover of 30% and with a single minimum tree height of 2 meters (http://cdm.unfccc.int/DNA/index.html)

(b) Demonstrate that the activity is a reforestation or afforestation project activity:

(i) For reforestation project activities, demonstrate that the land was not forest by demonstrating that the conditions outlined under (a) above also applied to the land on 31 December 1989.

(ii) For afforestation project activities, demonstrate that for at least 50 years vegetation on the land has been below the thresholds adopted by the host country for definition of forest.

VCS rules and requirements take anyhow precedence over the CDM requirement for reforestation projects to be implemented on land that was not forested on 31 December 1989, and the requirements related to the definition of forest[32]. Eligibility requirement 1 (b) is therefore not applicable.

The following factors summarized below explains in general level the dynamics of land use in Senegal.

- Demographic growth: the Senegal population grew nearly threefold between 1960 and 2000[33], with direct consequences on land use patterns in the country.
- Deforestation: since 1990, Senegal has lost 675,000 ha or 7.2% of its forest. Deforestation is caused by a number of factors, including felling for fuelwood, charcoal and logging and burning to clear land for agriculture[34].
- Expansion of agriculture and livestock production.

It is confirmed from the satellite imagery as well as during the site visit in year 2012 (see for example figure 3 and 18) that the site did not contain forest at the start of project activities (thereby satisfying eligibility requirements 1.a.i and ii) and that the site is either not temporarily unstocked i.e. a forest area expected to revert back to a forest (thereby satisfying eligibility requirement 1.a.iii). Satellite imagery of the first project activity instance near the project start year (Google Earth imagines) and around ten years before the project start (Landsat imagines) are available for validation/verification. Similar imagery will be provided for all project activity instances added later to the grouped project.

Moreover, to evaluate each eligible polygon added to the grouped project, the following activities will be carried out:

- Field samples will be collected to learn about vegetation existing in project sites.
- All polygons will be geo-referenced to construct a database in GIS (Geographic Information System) format.
- Interviews will be conducted on the historical use with former farm owners as well as with persons who have resided in the zone for a long time.
- Studies of the zone conducted by ANOC at the time of purchase will be reviewed.
- Information on agro-ecological (e.g., soils, fertility, erosion, etc.) variables in sites within the project's boundaries will be collected.
- Information on pre-existing woody and non-woody vegetation will be reviewed.

[32] AFOLU Guidance: Additional guidance for VCS Afforestation, Reforestation and Revegetation projects using CDM Afforestation/Reforestation Methodologies (8 March 2011) http://v-c-s.org/sites/v-c-s.org/files/VCS%20Guidance%2C%20CDM%20AR%20Methodology%20for%20VCS%20Reveg%20Project_0.pdf

[33] http://www.cartographie.ird.fr/SenegalFIG/croissance.html (Site visited 28/12/2012)

[34] Afropedia.net. http://www.afropedia.net/index.php?title=The_Forests_of_Senegal (Site visited 18/01/2013)

Leakage Management

In accordance with the Priority Action Plan 2006-2010[35] the proposed project aims to reduce the vulnerability of agricultural activities (i.e., fighting against soil degradation, parasites and insects), foster land development and productive investments, increase and diversify farming incomes, diversify energy sources and technologies, combat desertification and preserve fauna and flora.

Under applicability conditions of the applied methodology the only leakage emissions that can occur are the GHG emissions due to displacement of pre-project activities. Each project activity phase will be conducted with specific attention to limit potential GHGs emissions:

Fossil fuel emission: All the maintenance needed for land preparation, planting and crop maintenance will be conducted manually. The is no need for transportation as the main field work is done by local villagers. Furthermore, no biomass will be collected for purposes of firewood. The harvested wood will be left on the plantation sites to contribute to soil regeneration.

Displacement of farming activities: Rows between Jatropha plants (whether not interfering with Jatropha) will be completely at disposal of local communities and thus there will be no need for displacement of farming activities. Livestock rearing is not common at the project area.

Displacement of primary fuel supply: The production of Jatropha seeds can assist local farmers to diversify their incomes whereas its by-products (i.e., husks and press cake) can be composted and used as fertilizers or can substitute the harvested fuel-wood (i.e., currently used for cooking and charcoal production).The local production of biodiesel from Jatropha seeds can also replace the scarcely-available diesel fuel, which is currently used to generate electricity; consequently, the biodiesel will provide an alternative source of energy for the sustainable development of this region.

Commercially Sensitive Information

There is not any commercially sensitive information excluded from the public version of the project description.

Further Information

Not applicable.

2 APPLICATION OF METHODOLOGY

2.1 Title and Reference of Methodology

The project will use an UNFCCC approved CDM A/R baseline and monitoring methodology, called AR-ACM0003 “A/R Large-scale Methodology: Afforestation and reforestation of lands except wetlands” (Version 01.0.0).

[35] Poverty Reduction Strategy Paper 2006. IMF Country Report No. 07/316. Available at http://www.imf.org/external/pubs/ft/scr/2007/cr07316.pdf (Site visited 15/01/2013)

The methodology is available at UNFCCC website:
http://cdm.unfccc.int/methodologies/ARmethodologies/approved

2.2 Applicability of Methodology

VCS revegetation projects may use CDM afforestation/reforestation methodologies, where:

1) The methodology is followed in full, other than requirements related to the definition of forest, and its application shall not negatively impact the conservativeness of the quantification of GHG emissions reductions or removals; and
2) Project activities meet the VCS definition of revegetation (noting that it is not required for such projects to result in the creation of a forest).

The proposed project activity fulfills all of the applicability conditions of the methodology AR-ACM0003 (Version 01.0.0):

Applicability conditions	Justification
(a) The land subject to the project activity does not fall into wetland category	All the areas included in the project boundary are defined as grasslands and thus they don´t fall into wetland category as demonstrated in section 1.10.
(b) Soil disturbance attributable to the afforestation and reforestation (A/R) clean development mechanism(CDM) project activity does not cover more than 10 per cent of area in each of the following types of land, when these lands are included within the project boundary (i) Land containing organic soils (ii) Land which, in the baseline, is subjected to land-use and management practices and receives inputs listed in appendices 1 and 2 to this methodology.	Site preparation or other project activities doesn´t include removing of litter, ploughing/ ripping/ scarification as demonstrated in section 1.8 and thus soil disturbance attributable to the project activity does not cover more than 10% of the project area.

2.3 Project Boundary

Project boundary

According the applied methodology the "project boundary" geographically delineates the afforestation or reforestation project activity under the control of the PPs. The project activity may contain more than one discrete area of land. Each discrete area of land shall have a unique geographical identification. The project boundary is described in section 1.9.

GHG sources

Based on the applied methodology the only possible sources of GHG emissions from the project implementation is caused by burning of woody biomass. GHG emissions generated by the project (i.e. GHG sources) and associated GHGs selected for accounting of GHG emissions are shown in Table 6.

Table 6. Emission sources and GHGs selected for accounting of GHG emissions

Source	Gas	Included?	Justification/Explanation
Burning of woody biomass	CO_2	No	CO_2 emissions due to burning of biomass are accounted as a change in carbon stock
	CH_4	Yes	CH_4 emissions due to burning of biomass can be significant
	N_2O	Yes	N_2O emissions due to burning of biomass can be significant

GHG sinks and reservoirs:

According to the applied methodology carbon pools for consideration are above- and below-ground biomass, dead wood, litter and soil organic carbon (SOC). Table 7 shows the carbon pools selected for the project.

Table 7. Carbon pools selected for accounting of carbon stock changes

<table>
<tr><th colspan="2">Source</th><th>Gas</th><th>Included?</th><th>Justification/Explanation</th></tr>
<tr><td rowspan="8">Baseline</td><td rowspan="4">Above- and below ground biomass</td><td>CO_2</td><td>Yes</td><td>Carbon stock in this pool is expected to increase due to the implementation of the project activity</td></tr>
<tr><td>CH_4</td><td>No</td><td>Not required by the methodology</td></tr>
<tr><td>N_2O</td><td>No</td><td>Not required by the methodology</td></tr>
<tr><td>Other</td><td>N/A</td><td></td></tr>
<tr><td rowspan="4">Dead wood, Litter, Soil organic carbon (SOC)</td><td>CO_2</td><td>No</td><td>Carbon stock in these pools may increase due to implementation of the project activity. The applied methodology also provides anyhow a conservative choice of not accounting for carbon stock changes in any of these pools if such choice is identical for both the baseline and the project scenarios.</td></tr>
<tr><td>CH_4</td><td>No</td><td>Not required by the methodology</td></tr>
<tr><td>N_2O</td><td>No</td><td>Not required by the methodology</td></tr>
<tr><td>Other</td><td>N/A</td><td></td></tr>
<tr><td rowspan="4">Project</td><td rowspan="4">Above- and below ground biomass</td><td>CO_2</td><td>Yes</td><td>Carbon stock in this pool is expected to increase due to the implementation of the project activity</td></tr>
<tr><td>CH_4</td><td>No</td><td>Not required by the methodology</td></tr>
<tr><td>N_2O</td><td>No</td><td>Not required by the methodology</td></tr>
<tr><td>Other</td><td>N/A</td><td></td></tr>
</table>

Source		Gas	Included?	Justification/Explanation
	Dead wood, Litter, Soil organic carbon (SOC)	CO_2	No	The applied methodology provides the conservative choice of not accounting for carbon stock changes in dead wood, litter and soil organic carbon if such choice is identical for both the baseline and the project scenarios
		CH_4	No	Not required by the methodology
		N_2O	No	Not required by the methodology
		Other	N/A	

Leakage:

According the applied methodology the only leakage emissions that can occur are the GHG emissions due to displacement of pre-project activities.

2.4 Baseline Scenario

The baseline scenario of the project activity implemented under the applied methodology is continuation of the pre-project land use.

At present, shifting cultivation is the only agricultural method used in the project area. Plots of land are farmed during the rainy season with food crops (e.g., millet, maize, peanuts) and then abandoned for quite long periods to restore their fertility. At the end of fallow period (called jachère) the vegetation is cleared and then cultivated again. In addition, natural fires occur frequently in unmanaged fallow areas. The baseline situation can be thus described as “unmanaged grassland with wildfire-dominated ecological conditions and natural re-growth dynamics”.

The project activity is implementing a voluntary coordinated action and not a mandatory policy/regulation; it would not be implemented in the absence of the carbon revenues. A project identification note was written before the project start, thus clearly demonstrating that CDM revenues (i.e., income due on ICERs marketing) were accounted before the implementation of the initial project plan. Moreover, there are either no alternative land uses that can be reasonably expected as described in section 2.5. Thus the baseline scenario “continuation of the current situation i.e. continuation of the pre-project land use” can be justified. Below is summarized the current problems occurring generally in the area of “Peanut Basin”.

- density of the rising population;
- fragile and endangered natural environment and, in some areas, also a severe degradation already underway;
- extension of cultivated lands to the detriment of grazing and forested terrains;
- low-income from productions;
- declining fertility of soils;
- low-income from animal husbandry;

- lack of valorization of rural production and absence of diversification of rural activities;
- weakness of agricultural revenue hastening the exodus from rural areas (nowadays not just seasonal but lasting to extended periods);
- slow modernization of indigenous crafts and weak development of local factories, which could, if developed, increase local employment and produce both equipment and material needed to improve the life quality in rural areas;
- established approach of technical development, dictated by people outsider to these rural areas, oriented towards a single-cash-crop production predominantly for export (e.g., peanuts) rather than a healthy-for-the land diversification, and mainly focused on men whilst ignoring any possible involvement of women.

2.5 Additionality

The demonstration and assessment of the additionality of the project is made in accordance with the applied methodology (AR-ACM0003, Version 01.0.0) following the steps of the “Combined tool to identify the baseline scenario and demonstrate additionality in A/R CDM project activities” (Version 05.0.0)[36]

Step 0: Demonstration whether the proposed project activity is the first-of-its-kind

Currently there are not any reforestation projects following the AR-ACM0003 methodology in Senegal. For example, until now the only registered CDM reforestation project in Senegal is a mangrove reforestation projects implemented on wetlands[37]. Moreover the biggest difference for the other earlier reforestation projects is the new type of co-working model with the local families. In practice from each family who have given the concession a part of a land will be hired a person who will be taking care of his part of the project plantation (roughly equal to 6 ha) under the supervision of ANOC. Thus the project is not a “common practice” of the area.

Conclusion: The proposed project activity is the first-of-its-kind.

Step 1: Identification of alternative scenarios

Step 1a: Define alternative scenarios to the proposed CDM project activity

Below is presented a list of alternative scenarios that (a) are available to the project participants, (b) cannot be implemented in parallel to the proposed project activity, and (c) provide the same output as the proposed CDM project activity.

S1: The proposed project activity, reforestation of the area of 553,8 ha with Jatropha curcas, undertaken without being registered as a CDM project activity

S2: No investment is undertaken by the project participants but third party(ies) undertake(s) investments or actions which provide the same output to users of the project activity

[36] TOOL 02. Combined tool to identify the baseline scenario and demonstrate additionality (Version 05.0.0) http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-02-v5.0.0.pdf
[37] http://cdm.unfccc.int/Projects/projsearch.html: Oceanium mangrove restoration project (Site visited 08/03/2013).

S3: The continuation of the current situation, not requiring any investment or expenses to maintain the current situation i.e. continuation of the pre-project land use.

Step 1b: Consistency with mandatory applicable laws and regulations

The alternative scenarios to the project activity presented above in Step 1a are all in compliance with mandatory legislation and regulations taking into account the enforcement in the region or country and Board decisions on national and/or sectoral policies and regulations.

Step 2: Barrier analysis

Step 2a: Identify barriers that would prevent the implementation of alternative scenarios

Below is presented a list of barriers that may prevent alternatives scenarios to occur.

a) Investment barriers, other than economic/financial barriers

The proposed project instance is unlikely to be the most financially attractive option. Jatropha currently does not appear to be economically viable for small scale farming when grown either within a monoculture or intercrop plantation model. At the time being, many of the small scale initiatives are failing or going bankrupt because of the difficulty to reach the break-even and pay back (which, in most of pilot cases, occurs not before the fifth and sixth year respectively from the plantation set up) due to the initial low seed production yield. This period is too long for small farmers. The financial benefits obtainable through the carbon finance, could represent a way to overpass these obstacles.

b) Technological barriers

1) Lack of access to planting materials, constraining in using fertilizers, breakdown of the agricultural economy (including lack of seeds, agricultural credits, and agricultural equipment) are among the major technological barriers. The result of these constraints is to reduce the productivity (increase the farm gate cost of fertilizers) and declines the soil organic carbon content with a resultant declines in soil fertility.

2) Local communities are committed to plant Jatropha, but without the carbon component they do not have adequate access to technical and organizational assistance. Villagers need the support of ANOC to implement and maintain the project.

c) Barriers due to prevailing practice

Lack of training for local workers in sustainable agricultural and forestry practices.

d) Barriers due to local ecological conditions

1) Degraded soils.

2) Catastrophic natural and/or human-induced events (e.g., natural fires frequently occurring in unmanaged fallow areas).

3) Unfavourable meteorological conditions: the droughts and declining rainfall of the past 30 years exacerbated the risks in rainfed cultivation.

Step 2b: Eliminate alternative scenarios which are prevented by the identified barriers

The alternative scenarios S1 and S2 are prevented by at least one of the barriers listed in Step 2a, thus these alternative scenarios are eliminated from further consideration.

The only alternative scenario not prevented by any barrier is the scenario S3 "The continuation of the current situation, not requiring any investment or expenses to maintain the current situation i.e. continuation of the pre-project land use". In accordance with the applied tool this alternative scenario is identified as the baseline scenario.

Outcome: The proposed project activity can be considered additional as the outcome of the Step 0 is that the proposed project activity is the first-of-its-kind and Step 2b is that the only alternative scenario not prevented by any barrier is the scenario S3 "The continuation of the current situation, not requiring any investment or expenses to maintain the current situation i.e. continuation of the pre-project land use.

2.6 Methodology Deviations

The project and project monitoring plan meet all of the requirements of the applied methodology and does not deviate from the baseline scenario, additionality determination, or inclusion of project GHG sources, sinks and reservoirs.

3 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

3.1 Baseline Emissions

Procedures to be used for calculation of *ex ante* baseline net GHG removals by sinks are detailed in the AR-ACM0003 methodology (Version 01.0.0) under the section 5.4 "Baseline net GHG removals by sinks". According the methodology baseline net GHG removals by sinks are calculated with the following equation:

$$\Delta C_{BSL,t} = \Delta C_{TREE\_BSL,t} + \Delta C_{SHRUB\_BSL,t} + \Delta C_{DW\_BSL,t} + \Delta C_{LI\_BSL,t} \qquad \text{(equation 1)}$$

Where:

$\Delta C_{BSL,t}$ Baseline net GHG removals by sinks in year t; tCO_2-e

$\Delta C_{TREE\_BSL,t}$ Change in carbon stock in baseline tree biomass within the project boundary in year t, as estimated in the tool "Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities[38]"; tCO_2-e

[38] AR-TOOL14. http://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-14-v3.0.0.pdf

$\Delta C_{SHRUB\_BSL,t}$ Change in carbon stock in baseline shrub biomass within the project boundary, in year t, as estimated in the tool "Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities[39]"; tCO_2-e

$\Delta C_{DW\_BSL,t}$ Change in carbon stock in baseline dead-wood biomass within the project boundary, in year t, as estimated in the tool "Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities[40]"; tCO_2-e

$\Delta C_{LI\_BSL,t}$ Change in carbon stock in baseline litter biomass within the project boundary, in year t, as estimated in the tool "Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities[41]"; tCO_2-e

Below is demonstrated that $\Delta C_{TREE\_BSL,t} = 0$, $\Delta C_{SHRUB,t} = 0$, $\Delta C_{DW\_BSL,t} = 0$ and $\Delta C_{LI\_BSL,t} = 0$ and thus also the baseline net GHG removals are equal to zero as the equation 1 presented above can be written as follows:

$$\Delta C_{BSL,t} = 0 + 0 + 0 + 0 \qquad \text{(equation 2)}$$

$$\Delta C_{BSL,t} = 0 \qquad \text{(equation 3)}$$

Carbon stock in trees

According the tool "Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities[42] change in carbon stock in trees in the baseline is estimated using the following stepwise procedure:

a) Select the technique and use the appropriate equation for estimating the carbon stock in trees.

Here is chosen "Baseline default technique"

$$C_{TREE,BSL,i} = \frac{44}{12} * CF_{TREE\_BSL} * B_{FOREST} * (1 + R_{TREE\_BSL}) * CC_{TREE\_BSL,i} * A_{BSL,i} \qquad \text{(equation 4)}$$

$$C_{TREE,BSL} = \sum_{i=1}^{M} C_{TREE\_BSL,i} \qquad \text{(equation 5)}$$

Where:

$C_{TREE,BSL}$ Carbon stock in living trees in the baseline, in the project boundary, at the start of the A/R CDM project activity; t CO2-e

[39] AR-TOOL14. http://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-14-v3.0.0.pdf
[40] EB 67, Annex 23. http://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-12-v2.0.0.pdf
[41] EB 67, Annex 23. http://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-12-v2.0.0.pdf
[42] AR-TOOL14. http://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-14-v3.0.0.pdf

$C_{TREE,BSL,i}$ Carbon stock in living trees in the baseline, in baseline stratum i, at the start of the A/R CDM project activity; t CO2-e. Baseline strata are delineated on the basis of tree crown cover

CF_{TREE_BSL} Carbon fraction of tree biomass in the baseline; t C (t.d.m.)$^{-1}$ A default value of 0.47 t C (t.d.m.)$^{-1}$ is used

B_{FOREST} Default above-ground biomass content in forest in the region/country where the A/R CDM project is located; t d.m. ha^{-1}

R_{TREE_BSL} Root-shoot ratio for the trees in the baseline; dimensionless. A default value of 0.25 is used unless transparent and verifiable information can be provided to justify a different value

$CC_{TREE\_BSL,i}$ Crown cover of trees in the baseline, in baseline stratum i, at the start of the A/R CDM project activity, expressed as a fraction (e.g. 10% crown cover implies $CC_{TREE\_BSL,i} = 0.10$); dimensionless

$A_{BSL,i}$ Area of stratum i in the baseline, delineated on the basis of tree crown cover at the start of the A/R CDM project activity; ha

i 1, 2, 3, … tree biomass estimation strata within the project boundary

b) Select the method and use the appropriate equation for estimating the carbon stock change in trees.

Here is chosen “Baseline default method”

$$\Delta C_{TREE,BSL,i} = \frac{44}{12} * CF_{TREE\_BSL} * B_{FOREST} * (1 + R_{TREE\_BSL}) * CC_{TREE\_BSL,i} * A_{BSL,i}$$

(equation 6)

$$\Delta C_{TREE,BSL} = \sum_{i=1}^{M} \Delta C_{TREE\_BSL,i}$$ (equation 7)

Where:

$\Delta C_{TREE,BSL}$ Average annual change in carbon stock in tree biomass in the baseline; t CO2-e yr^{-1}

$\Delta C_{TREE,BSL,i}$ Average annual change in carbon stock in tree biomass in the baseline in baseline stratum i; t CO2-e yr-1

CF_{TREE_BSL} Carbon fraction of tree biomass in the baseline; t C (t.d.m.)$^{-1}$ A default value of 0.47 t C (t.d.m.)$^{-1}$ is used

ΔB_{FOREST} Default average annual increment of above-ground biomass in forest in the region/country where the A/R CDM project is located; t d.m. ha^{-1} yr^{-1}

R_{TREE_BSL} Root-shoot ratio for the trees in the baseline; dimensionless. A default value of 0.25 is used unless transparent and verifiable information can be provided to justify a different value

$CC_{TREE\_BSL,i}$ Crown cover of trees in the baseline, in baseline stratum i, at the start of the A/R CDM project activity, expressed as a fraction (e.g. 10% crown cover implies $CC_{TREE\_BSL,i} = 0.10$); dimensionless

$A_{BSL,i}$ Area of stratum i in the baseline, delineated on the basis of tree crown cover at the start of the A/R CDM project activity; ha

i 1, 2, 3, … tree biomass estimation strata within the project boundary

As the baseline mean tree crown cover for all the project area is assumed to be 6% or less thus $CC_{TREE\_BSL} = 0$ and thus, calculated with above mentioned equations the average annual change in carbon stock in tree biomass in the baseline is also zero.

Carbon stock in shrubs

According the tool “Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities[43] change in carbon stock in shrubs in the baseline is estimated:

$$C_{SHRUB,t} = \frac{44}{12} * CF_s * (1 - R_s) * \sum_i A_{SHRUB,i,t} * B_{SHRUB,i,t} \qquad \text{(equation 8)}$$

$$B_{SHRUB,i,t} = BDR_{SF} \times B_{FOREST} \times CC_{SHRUB,i,t} \qquad \text{(equation 9)}$$

$C_{SHRUB,t}$ Carbon stock in shrub biomass within the project boundary at a given point of time in year t; t CO2-e

CF_s Carbon fraction of shrub biomass; t C $(t.d.m.)^{-1}$ IPCC default value of 0.47 t C $(t.d.m.)^{-1}$ is used

R_s Root-shoot ratio for shrubs; dimensionless

$A_{SHRUB,i,t}$ Area of shrub biomass stratum i at a given point of time in year t; ha

$B_{SHRUB,i,t}$ Shrub biomass per hectare in shrub biomass stratum i at a given point of time in year t; t d.m. ha^{-1}

BDR_{SF} Ratio of shrub biomass per hectare in land having a shrub crown cover of 1.0 and default above-ground biomass content per hectare in forest in the region/country where the A/R CDM project is located; dimensionless

[43] AR-TOOL14. http://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-14-v3.0.0.pdf

B_{FOREST} Default above-ground biomass content in forest in the region/country where the A/R CDM project is located; t d.m. ha^{-1}

$CC_{SHRUB,i,t}$ Crown cover of shrubs in shrub biomass stratum i at a given point of time in year t expressed as a fraction (e.g. 10% crown cover implies t i SHRUBCC , , = 0.10); dimensionless

i 1, 2, 3, … shrub biomass strata delineated on the basis of shrub crown cover

t 1, 2, 3, … years counted from the start of the A/R CDM project activity

As the crown cover of shrubs for all the project area is assumed to be less than 5 % for all the project area (thus $CC_{SHRUB,,t}$ can be set as zero and thus carbon stock in shrub biomass in the baseline ($C_{SHRUB,t}$) and the change in carbon stock in baseline shrub biomass ($\Delta C_{SHRUB,t}$) are also zero.

Carbon stocks in dead wood and litter

The carbon stock in dead wood and litter are not selected (See table 7) and thus in accordance with the applied methodology these pools are set to zero.

3.2 Project Emissions

Procedure to be used for calculation of *ex ante* actual net GHG removals by sinks are detailed in the AR-ACM0003 methodology (Version 01.0.0) under the section 5.5 “Actual net GHG removals by sinks”. According the methodology the actual net GHG removals by sinks is calculated as follows:

$$\Delta C_{ACTUAL,t} = \Delta C_{P,t} - GHG_{E,t} \qquad \text{(equation 10)}$$

Where:

$\Delta C_{ACTUAL,t}$ Actual net GHG removals by sinks, in year t; tCO_2-e

$\Delta C_{P,t}$ Change in the carbon stocks in project, occurring in the selected carbon pools, in year t; tCO_2-e

$GHG_{E,t}$ Increase in non-CO_2 GHG emissions within the project boundary as a result of the implementation of the A/R CDM project activity, in year t, as calculated in the tool “Estimation of non-CO_2 GHG emissions resulting from burning of biomass attributable to an A/R CDM project activity[44]”; tCO_2-e

For ex ante situation the increase in non-CO_2 GHG emissions within the project boundary as a result of the implementation of the A/R CDM project activity ($GHG_{E,t}$) is accounted as zero as the

[44] EB 65, Annex 31. http://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-08-v4.0.0.pdf

project implementation plan is not including 1) fire used in site preparation, 2) fire used to clear the land of harvest residue prior replanting of the land.

Change in the carbon stocks in project, occurring in the selected carbon pools, in year *t* is calculated as follows:

$$\Delta C_{P,t} = \Delta C_{TREE\_PROJ,t} + \Delta C_{SHRUB\_PROJ,t} + \Delta C_{DW\_PROJ,t} + \Delta C_{LI\_PROJ,t} + \Delta SOC_{AL,t}$$ (equation 11)

Where:

$\Delta C_{P,t}$	Change in the carbon stocks in project, occurring in the selected carbon pools, in year t; tCO_2-e
$\Delta C_{TREE\_PROJL,t}$	Change in carbon stock in tree biomass in project in year t, as estimated in the tool "Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities[45]"; tCO_2-e
$\Delta C_{SHRUB\_PROJL,t}$	Change in carbon stock in shrub biomass in project in year t, as estimated in the tool "Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities[46]"; tCO_2-e
$\Delta C_{DW\_PROJL,t}$	Change in carbon stock in dead-wood biomass in project in year t, as estimated in the tool "Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities[47]"; tCO_2-e
$\Delta C_{LI\_PROJL,t}$	Change in carbon stock in litter biomass in project in year t, as estimated in the tool "Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities[48]"; tCO_2-e
$\Delta SOC_{AL,t}$	Change in carbon stock in SOC in project, in year t, in areas of land meeting the applicability conditions of the tool "Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities[49]", as estimated in the same tool; tCO_2-e

3.3 Leakage

According the applied methodology the only leakage emissions that can occur are the GHG emissions due to displacement of pre-project agricultural activities. Procedure to be used for calculation of *ex ante* leakage is described in AR-ACM0003 methodology (Version 01.0.0) under the section 5.6 "Leakage". Leakage emissions are estimated as follows:

45 AR-TOOL14. http://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-14-v3.0.0.pdf
46 AR-TOOL14. http://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-14-v3.0.0.pdf
47 EB 67, Annex 23. http://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-12-v2.0.0.pdf
48 EB 67, Annex 23. http://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-12-v2.0.0.pdf
49 EB 60, Annex 12. http://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-16-v1.1.0.pdf

$$LK_t = LK_{AGRIC,t}$$ (equation 12)

Where:

LK_t	GHG emissions due to leakage, in year t; tCO_2-e
LK_{AGRICt}	Leakage due to the displacement of agricultural activities in year t, as estimated in the tool "Estimation of the increase in GHG emissions attributable to displacement of pre-project agricultural activities in A/R CDM project activity[50]"; tCO_2-e

If the application of the "Guidelines on conditions under which increase in GHG emissions attributable to displacement of pre-project crop cultivation activities in A/R CDM project activity is insignificant[51]" and the "Guidelines on conditions under which increase in GHG emissions related to displacement of pre-project grazing activities in A/R CDM project activity is insignificant[52]" leads both to the conclusion that the applicable increase in GHG emissions is insignificant, then leakage from displacement of agricultural activities is estimated to be zero.

At the baseline situation, shifting cultivation is the only agricultural method used in the project area. Plots of land are farmed during the rainy season with food crops (e.g., millet, maize, peanuts) and then abandoned for quite long periods to restore their fertility. At the end of fallow period (called jachère) the vegetation is cleared and then cultivated again. At the project scenario, the rows between Jatropha plants (whether not interfering with Jatropha) will be completely at disposal of local communities. In addition, contemporary crop activities will be boosted as local farmers will be working only part-time in the Jatropha fields. The unused fallow agricultural land, where Jatropha will be grown, were legally assigned to ANOC for 20% of the available agricultural land, hence ensuring to continue to produce both food and traditional agricultural products (e.g., peanuts) as usual in the baseline scenario and thus there will be no displacement of pre-project agricultural activities and thus neither any leakage.

3.4 Summary of GHG Emission Reductions and Removals

According the applied methodology the net anthropogenic GHG removals by sinks are calculated as follows:

$$\Delta C_{AR-CDM,t} = \Delta C_{ACTUAL,t} - \Delta C_{BSL,t} - LK_t$$ (equation 13)

Where:

$\Delta C_{AR\text{-}CDM,t}$	Net anthropogenic GHG removals by sinks, in year t; tCO_2-e
$\Delta C_{ACTUAL,t}$	Actual net GHG removals by sinks, in year t; tCO_2-e
$\Delta C_{BSL,t}$	Baseline net GHG removals by sinks, in year t; tCO_2-e
LK_t	GHG emissions due to leakage, in year t; tCO_2-e

[50] EB 51, Annex 15. http://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-15-v1.pdf
[51] EB 51, Annex 14. http://cdm.unfccc.int/Reference/Guidclarif/ar/methAR_guid29.pdf
[52] EB 51, Annex 13. http://cdm.unfccc.int/Reference/Guidclarif/ar/methAR_guid28.pdf

Years	Estimated baseline emissions or removals (tCO_2e)	Estimated project emissions or removals (tCO_2e)	Estimated leakage emissions (tCO_2e)	Estimated net GHG emission reductions or removals (tCO_2e)
2009	0	130	0	130
2010	0	824	0	824
2011	0	2,123	0	2,123
2012	0	3,431	0	3,431
2013	0	4,415	0	4,415
2014	0	5,269	0	5,269
2015	0	5,622	0	5,622
2016	0	5,622	0	5,622
2017	0	5,622	0	5,622
2018	0	5,622	0	5,622
2019	0	5,622	0	5,622
2020	0	5,622	0	5,622
2021	0	5,622	0	5,622
2022	0	5,622	0	5,622
2023	0	5,622	0	5,622
2024	0	5,622	0	5,622
2045	0	5,622	0	5,622
2026	0	5,622	0	5,622
2027	0	5,622	0	5,622
2028	0	5,622	0	5,622
2029	0	5,559	0	5,559
2030	0	5,244	0	5,244
2031	0	4,920	0	4,920
2032	0	4,920	0	4,920
2033	0	4,920	0	4,920
Total	0	120,467	0	120,467

4 MONITORING

4.1 Data and Parameters Available at Validation

Data Unit / Parameter:	**Location of project area**
Data unit:	Latitude and longitude
Description:	Single point location of a discrete project area
Source of data:	GPS measurement
Value applied:	See the attached file “Coordinate Appezzamenti”
Justification of choice of data or description of measurement methods and procedures applied:	Direct measurement of latitude and longitude of a point within a project area using a GPS. Used to provide a simple location of a discrete project area.
Any comment:	N/A

Data Unit / Parameter:	**Boundary of project area**
Data unit:	Latitude and longitude
Description:	Multiple points of latitude and longitude that describe the boundary of a discrete project area
Source of data:	GPS measurement
Value applied:	See attached KML files for all results
Justification of choice of data or description of measurement methods and procedures applied:	Direct measurement of points of latitude and longitude along the boundary of each discrete project area. The points are collected with a GPS while walking the perimeter of the project area.
Any comment:	N/A

Data Unit / Parameter:	**Project area**
Data unit:	ha
Description:	Size of the area where the project activity has been implemented
Source of data:	GPS measurement
Value applied:	See the attached file “Coordinate Appezzamenti”
Justification of choice of data or description of measurement methods and procedures applied:	A calculated quantity based on the latitude and longitude values collected with the GPS to determine each project area boundary.
Any comment:	N/A

Data Unit / Parameter:	**$BEF_{2,j}$**
Data unit:	Dimensionless
Description:	Biomass expansion factor for conversion of stem biomass to above-ground tree biomass, for tree species j
Source of data:	IPCC default value
Value applied:	3.4
Justification of choice of data or description of measurement methods and procedures applied:	The use of IPCC default value is justified as there are not available more precise national or regional information.
Any comment:	N/A

Data Unit / Parameter:	**CF_{TREE}**
Data unit:	Carbon fraction of tree biomass
Description:	Carbon fraction of dry matter for species or group of species j
Source of data:	Default value
Value applied:	0.47
Justification of choice of data or description of measurement methods and procedures applied:	According to the applied tool "Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities"[53] a default value of 0.47 is used as there is not

[53] AR-TOOL14. http://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-14-v3.0.0.pdf

	available transparent and verifiable information to justify a different value.
Any comment:	N/A

Data Unit / Parameter:	D_j
Data unit:	t d.m. m^{-3}
Description:	Density (overbark) of tree species j
Source of data:	Literature[54]
Value applied:	0.26
Justification of choice of data or description of measurement methods and procedures applied:	The use of the above mentioned value is justified as there are not available more precise national or regional information.
Any comment:	N/A

Data Unit / Parameter:	R_j
Data unit:	Dimensionless
Description:	Root-shoot ratio for tree species j
Source of data:	IPCC default value
Value applied:	0.27
Justification of choice of data or description of measurement methods and procedures applied:	The use of IPCC default value is justified as there are not available more precise national or regional information.
Any comment:	N/A

Data Unit / Parameter:	$V_{TREE,j,p,i,t}$
Data unit:	m^3
Description:	Stem volume of trees of species j in sample plot p of stratum i at a point of time in year t, estimated by using the tree dimension(s) as entry data into a volume table or volume equation
Source of data:	Calculated based on the literature[55]

[54] Achten WMJ, Verchot L, Franken YJ, Mathijs E, Singh VP, Aerts R, et al. 2008. Jatropha bio-diesel production and use. Biomass and Bioenergy.
[55] Achten WMJ, Verchot L, Franken YJ, Mathijs E, Singh VP, Aerts R, et al. 2008. Jatropha bio-diesel production and use. Biomass and Bioenergy.

Value applied:	See the Excel-file called “Calculations_ex_ante”
Justification of choice of data or description of measurement methods and procedures applied:	The use of volume equation is in accordance with the applied the applied tool "Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities"[56].
Any comment:	N/A

4.2 Data and Parameters Monitored

Data Unit / Parameter:	**Number of project trees**
Data unit:	Number of trees
Description:	Number of trees in a project area by strata
Source of data:	Trees are physically counted in the field (sample plots)
Description of measurement methods and procedures to be applied:	Counting on sample plots made by ANOC
Frequency of monitoring/recording:	Number of trees in sample plots is counted and recorded every five years by ANOC
Value applied:	For the preliminary values see the Excel-file called “Calculations_ex_ante”
Monitoring equipment:	N/A
QA/QC procedures to be applied:	Part of overall QA/QC procedures discussed in Section 4.3.
Calculation method:	N/A
Any comment:	N/A

Data Unit / Parameter:	B_D
Data unit:	mm
Description:	Diameter at stem base
Source of data:	Physical measurements
Description of measurement methods and procedures to be applied:	Physical measurement of the trees in the sample plots, measurement taken at stem base.
Frequency of monitoring/recording:	B_D of trees in sample plots is measured and

[56] AR-TOOL14. http://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-14-v3.0.0.pdf

	recorded every five years by ANOC
Value applied:	N/A
Monitoring equipment:	Computer and database
QA/QC procedures to be applied:	Part of overall QA/QC procedures discussed in Section 4.3.
Calculation method:	N/A
Any comment:	N/A

Data Unit / Parameter:	Total CO_2
Data unit:	tonnes
Description:	Total CO_2-e sequestered by the trees
Source of data:	Calculated
Description of measurement methods and procedures to be applied:	The biomass of each stratum will be estimated using the allometric equation (observed by Ghezehei et al, 2009)[57]. After average biomass of a tree in each stratum is calculated and multiplied by number of trees in each stratum, biomass is converted to CO_2-e and the CO_2-e of the results from each stratum are summed.
Frequency of monitoring/recording:	Calculation takes place with each monitoring report
Value applied:	For the preliminary values see the Excel-file called “Calculations_ex_ante”
Monitoring equipment:	Computer and database
QA/QC procedures to be applied:	Part of overall QA/QC procedures discussed in Section 4.3.
Calculation method:	N/A
Any comment:	N/A

4.3 Description of the Monitoring Plan

The monitoring plan of the project activity meets the requirements established by the applied methodology AR-ACM0003 (Version 01.0.0). In accordance with the applied methodology the monitoring plan shall provide for collection of all relevant data necessary for

[57] B Ghezehei, JG Annandale and CD Everson. 2009. Shoot allometry of Jatropha curcas, Southern Forests. Volume: 71, Issue: 4, Pages: 279-286. http://www.mendeley.com/catalog/shoot-allometry-jatropha-curcas/ (Site visited 28/12/2013)

(a) Verification that the applicability conditions listed under paragraphs 3 and 4 have been met;

(b) Verification of changes in carbon stocks in the pools selected; and

(c) Verification of project emissions and leakage emissions.

The data collected shall be archived for a period of at least two years after the end of the last crediting period of the project activity. The precision requirements are those listed in the Verified Carbon Standard and in the in the tool “Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities”[58].

Moreover, Information shall be provided, and recorded in the project design document (PDD), to establish that the commonly accepted principles and practices of forest inventory and forest management in the host country are implemented. If such principles and practices are not known or available, standard operating procedures (SOPs) and quality control/quality assurance (QA/QC) procedures for inventory operations, including field data collection and data management, shall be identified, recorded and applied. Use or adaptation of SOPs available from published handbooks, or from the “IPCC Good Practice Guidance for Land Use, Land-Use Change and Forestry 2003”, is recommended.

The organizational structure of monitoring is presented before in figure 9.

a) Verification that the applicability conditions listed under paragraphs 3 and 4 have been met

The verification of the applicability conditions is done through the project boundary monitoring and through forest establishment monitoring.

<u>Monitoring of project boundary</u> will be conducted with field surveys concerning the project boundary within which the project activity has occurred, site by site, measuring geographical positions using GPS and checking that the afforested/reforested areas are in coherence with the eligibility criteria. Project boundaries, as well as any stratification inside the boundary, of all the discrete areas forming each project instance will be defined at the start of the project and every five years from the date of the initial verifications. Geographic coordinates of the measurements will be recorded in a database and archived.

The periodically monitoring of the boundary is done to demonstrate that the actual area afforested conforms to the afforestation area outlined in the project plan. If the forest area changes during the crediting period, for instance, because deforestation occurs on the project area, the specific location and area of the deforested land will be identified. Similarly, if the planting on certain lands within the project boundary fails these lands will be documented. Personnel involved in the monitoring will be trained to identify the changes in the boundary and to record changes in the project database for reporting of project verification.

[58] AR-TOOL14. http://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-14-v3.0.0.pdf

The forest planting and management plan of each project instances will be provided together with a record of the plan as actually implemented during the project for validation and verification. The record of the plan as actually implemented will be used to ensure that the assumptions made in the *ex ante* assessment still holds in the *ex post* situation

Monitoring of forest establishment and forest management will be done to ensure that it is compliant with this VCS-PD during the complete establishment period, including all major activities that can affect carbon stocks or generate GHG emissions. The inventory operations, including field data collection and data management, will be done following standard operating procedures (SOPs) and control/quality assurance (QA/QC) procedures. Established stands will be also monitored with respect to the species and strata pre-defined in the VCS-PD. Any deviation from the planned forest establishment will be documented and justified.

The survival of the sampling will be quantified in the field approximately six months after the planting of each plot. The survival check will repeated every 6^{th} month during the first three years after the planting. If the survival is below 95% of the initial quantity planted, the stand will be replanted with the same species, seeking to maintain the lots homogeneous in terms of age and development. The estimate is made through a simple count of the individuals within each plot, taking on account their vitality state, determining the density of live individuals and finally comparing it to the initial quantity. In case of extensive outbreaks caused by pests, diseases or fire, trees will be replanted.

b) Verification of changes in carbon stocks in the pools selected

Forest management activities (e.g., planting, re-planting, pruning and fruit harvesting) as well as unexpected natural disturbances occurring during the crediting period (e.g., due to fire, pests or disease outbreaks) will be monitored to guarantee that the correct practices are applied in accordance with the management plan and to ensure the health of the stands.

The growth of individual trees on sample plots will be measured at each monitoring event for the estimation of above-ground tree biomass using allometric model based on stem base diameter. The below ground biomass will be extrapolated from above-ground biomass. In the monitoring plots, diameters at stem base (D) of each tree will be measured.

Pre-existing (baseline) trees and non-tree vegetation will not be measured and accounted for, making the monitoring conservative. Pre-existing and planted trees can be differentiated because pre-existing species are different to the planted (Jatropha curcas L.).

If after measuring all permanent plots it is found that the targeted precision level (95/15) is not met, then additional permanent plots will established and measured until the targeted precision level is achieved.

Plots establishment and trees measurements will be done with the following equipment:

- diametric tape or caliper;
- GPS;
- compass;

- measuring tape;
- PVC rods.

Carbon stock changes in living planted trees can be estimated through biomass expansion factors or allometric equations. In this case the biomass will be estimated using species specific allometric equation observed by Ghezehei et al. (2009)[59]. This allometric equation is wildly site independent[60] and it has been demonstrated, for example, to be site-adapted for the conditions of Mali[61]. Thus the equation can be considered adapted also for the project area of this project.

$$fj(B_D) = \frac{a \cdot B_D{}^b}{10^6} \qquad \text{(equation 14)}$$

$a \approx 2.83 \cdot 10^{-4}$
$b \approx 3.529$

Where:

$fj(B_D)$	Above ground biomass per tree (t d.m.)
B_D	Basal diameter at stem base (mm)

c) Verification of project emissions and leakage emissions

According the applied methodology the only increase in GHG emissions within the project boundary which needs to be accounted for is the non-CO_2 GHG emissions from burning of woody biomass for site preparation and/or forest management. The monitoring of emissions is required only if the emissions are considered significant; if insignificant, evidence should be provided (e.g., in the relative part of the monitoring plan of each project instances that the assumption for the exclusion made in the *ex ante* assessment still hold in the *ex post* situation.

As stated in section 1.8 of this document there will be no burning of biomass for site preparation or for forest management. Thus the emissions by sources are considered insignificant and the monitoring of emissions is not needed. Anyway, while monitoring the forest management activities evidences will be provided that the assumption made in the *ex ante* assessment still hold in the *ex post* situation. If needed, the monitoring and estimation of GHG emissions will be done in accordance with the latest version of the tool “Estimation of non-CO_2 GHG emissions resulting from burning of biomass attributable to an A/R CDM project activity[62]”.

[59] B Ghezehei, JG Annandale and CD Everson (2009), Shoot allometry of Jatropha curcas, Southern Forests, 2009.
[60] B Ghezehei, JG Annandale and CD Everson (2009), Shoot allometry of Jatropha curcas, Southern Forests, 2009, p.284: “While the inclusion of data from additional sites may make the equations developed here more generalised, the fact that widely differing tree spacing management and growing conditions had no significant effect on allometry indicates that these equations show a potential relevance to other sites.”
[61] Jatropha Curcas grouped project in Mali. https://vcsprojectdatabase2.apx.com/myModule/Interactive.asp?Tab=Projects&a=2&i=829&lat=13.1828259998737&lon=-9.32054409999992&bp=1 (site visited 09/04/2013)
[62] EB 65, Annex 31. http://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-08-v4.0.0.pdf

Under applicability conditions of the applied methodology the only leakage emissions that can occur are the GHG emissions due to displacement of pre-project activities. As described in section 2.4 of this document there will be no displacement of the pre-project activities outside the project boundary since the baseline activities can be continued in the rows between the planted Jatropha curcas trees. Thus the leakage is not monitored.

d) Stratification

According the applied methodology if biomass distribution over the project area is not homogeneous, stratification should be carried out to improve the precision of biomass estimation. Different stratifications may be required for the baseline and the project scenarios. In particular:

- For baseline net GHG removals by sinks, it is usually sufficient to stratify the area according to major vegetation types and their crown cover and/or land-use types;
- For actual net GHG removals by sinks the stratification for *ex ante* estimations is based on the project planting/management plan and the stratification for *ex post* estimations is based on the actual implementation of the project planting/management plan. If natural or anthropogenic impacts (e.g. local fires) or other factors (e.g. soil type) significantly alter the pattern of biomass distribution in the project area, then the *ex post* stratification is revised accordingly.

Stratification of project area is done *ex ante* based on the project planting/management plan and updated *ex post* as necessary subsequent to project implementation. The stratification for *ex post* estimations will be based on the actual implementation of the project planting/management plan and thus the number and boundaries of strata defined *ex ante* may change during the crediting period. If natural or anthropogenic impacts or other factors add variability to the growth pattern of the biomass in the project area, then the *ex post* stratification will be revised accordingly. Established strata may be merged if reasons for their establishing have disappeared.

The changes to project strata during the crediting period will be monitored adjusting the sampling frame to the changes in the number and extension of strata. Table 10 shows the seven *ex ante* strata defined for project activities based on the plantation age and the planting density.

Table 10. *Ex ante* stratification

***Ex ante* strata**	**Planting year**	**Planting density (trees/ha)**	**Area (ha)**
Stratum 1	2009	2,500	30.95
Stratum 2	2009	1,666	17.85
Stratum 3	2009	1,111	1.30
Stratum 4	2010	1,666	152.77
Stratum 5	2010	1,111	95.31
Stratum 6	2011	1,111	146.70
Stratum 7	2011	833	108.92

The *ex post* stratification will be updated periodically because the following events are likely to affect current strata:

- Unexpected disturbances occurring during the crediting period (e.g., due to fire, pests or disease outbreaks), affecting differing impacts on various parts of an originally homogenous stratum;
- Forest management activities (e.g., planting, pruning, re-planting) that are implemented in different intensities, dates and spatial locations differing from the original plan;
- Two or more different strata may be similar enough to allow their merging into one stratum.

Monitoring of strata and stand boundaries will be done using a Geographic Information System (GIS), which allows data from different sources to be integrated (including field data, GPS coordinates and possible remote sensing data).

e) Sampling framework

Sample size

Permanent sampling plots will be used for sampling over time to measure and monitor changes in carbon stocks. The size of each sampling plot will be 0.015 ha (10m x 15m). This size is chosen to guarantee that there will be approximately at least 10 trees within the plot boundaries at the end of the crediting period; As the smallest initial density of plantation will be 833 trees per hectare (see table 10) and as the recovery rate of plantations is assumed to be 96%, then 150 m^2 sized plot will be needed to guarantee 12 trees within it at the end of the crediting period, and thus a conservative sampling plot size is proposed to be 0.015 ha.

The total number of permanent sampling pots is estimated the tool “Calculation of the number of sample plots for measurements within A/R CDM project activities” (version 02.1.0)[63].

[63] EB 58, Annex 15. Calculation of the number of sample plots for measurement within A/R CDM project activities (Version 02.1.0). http://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-03-v2.1.0.pdf

Sample plots will be located systematically with a random start and measured at least every five years, for verification purposes.

Number of sample plots is calculated with the following equation:

$$n = \frac{N \cdot t_{VAL}{}^2 \cdot \left(\sum_i w_i \cdot s_i \right)^2}{N \cdot E^2 + t_{VAL}{}^2 \cdot \sum_i w_i \cdot s_i{}^2} \quad \text{(equation 15)}$$

Where:

Parameter	Description	Comment
n	Number of sample plots required for estimation of biomass stocks within the project the project boundary; dimensionless	Calculated with equation 15
N	Total number of possible sample plots within the project the project boundary (i.e., the sampling space or the population); dimensionless	36,920 which is equal to the project area (553.8 ha) divided by the size of the sample plot (0.015 ha)
t_{VAL}	Two-sided Student´s t-value, at infinite degrees of freedom, for the required confidence level; dimensionless	1.960 as presented in the used tool (Confidence level of 95%, degree of freedom of "infinite")
w_i	Relative weight of the area of stratum *i* (i.e., the area of the stratum *i* divided by the project area); dimensionless	The relative weight of the area of stratum *i* is equal to the area of the stratum *i* divided by the project area
s_i	Estimated standard deviation of biomass stock in stratum *i*; t.d. (t d.m. ha^{-1})	A standard deviation of 50% of the mean biomass stock within the stratum is used [64]
E	Acceptable margin of error (i.e., one-half the confidence interval) in estimation of biomass stock within the project boundary (i.e., in the units used for s_i); t d.m. (or t d.m. ha^{-1})	A default value equal to 15% of the mean biomass stock within the project is used
i	*1,2,3...* Biomass stock estimation strata within the project boundary	See the table 10

The total number of sample plots will be 64 (Table 11). The number is calculated with the equation 15 presented above and then added 5% more plots as additional quality guarantee.

[64] Paragraph 6 of "Guidelines on conservative choice and application of default data in estimation of the net anthropogenic GHG removals by sinks" (version 02): http://cdm.unfccc.int/Reference/Guidclarif/ar/methAR_guid26.pdf

The number of sample plots will be recalculated before the first verification using the actual data from the measurements.

Plots location

The allocation of sample plots among the strata is estimated by following the tool "Calculation of the number of sample plots for measurements within A/R CDM project activities" (version 02.1.0)[65] using the following equation (equation 16):

$$n_i = n \cdot \frac{w_i \cdot s_i}{\sum_i w_i \cdot s_i} \qquad \text{(equation 16)}$$

Where:

Parameter	Description	Comment
n_i	Number of sample plots allocated to stratum *i*, dimensionless	Calculated with equation 16
n	Number of sample plots required for estimation of biomass stocks within the project boundary; dimensionless	Calculated with equation 15
w_i	Relative weight of the area of stratum *i* (i.e., the area of the stratum *i* divided by the project area); dimensionless	The relative weight of the area of stratum *i* is equal to the area of the stratum *i* divided by the project area
s_i	Estimated standard deviation of biomass stock in stratum *i*; t.d. (t d.m. ha^{-1})	A standard deviation of 50% of the mean biomass stock within the stratum is used [66]
i	*1,2,3*... Biomass stock estimation strata within the project boundary	See the table 10

Table 11. Number and allocation of the sample plots for the *ex ante* stratums

Stratum	Number of sample plots allocated to stratum *i* (n_i)
Stratum 1	$n_1 = 5$
Stratum 2	$n_2 = 1$
Stratum 3	$n_3 = 1$
Stratum 4	$n_4 = 20$
Stratum 5	$n_5 = 9$
Stratum 6	$n_6 = 19$
Stratum 7	$n_7 = 9$
Total number of sample plots (n)	**n = 64**

[65] EB 58, Annex 15. Calculation of the number of sample plots for measurement within A/R CDM project activities (Version 02.1.0). http://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-03-v2.1.0.pdf
[66] Paragraph 6 of "Guidelines on conservative choice and application of default data in estimation of the net anthropogenic GHG removals by sinks" (version 02). http://cdm.unfccc.int/Reference/Guidclarif/ar/methAR_guid26.pdf

Permanent sample plots will be located systematically with a random start, using roads and paths as a reference for easy location. Plots will be located using GPS and marked. Plot markers will not be prominently displayed to ensure that permanent plots do not receive differential treatment. Plots will also be marked on printed maps at a scale of 1:10,000 to facilitate their location during field work. The geographical position (GPS coordinate), administrative location, stratum, stand and identification code of each plot will be recorded and archived. Sampling plots will be evenly distributed in each stratum. If the stratum consists of discrete sites, then the plots to be allocated to each site will be in proportion of the site area to the total stratum area.

Maps will document altitudes, rugged terrain, road infrastructure and stands. There will be also a general map of stands and strata, summarizing the maps generated for the field monitoring that will serve as a support to plan the monitoring. For each monitoring period, maps will be updated and the data on new planted areas will be included.

f) Monitoring frequency

Although the verification and certification will be carried out every five years after the first verification until the end of the crediting period, the monitoring interval can be less than five years so that enough information can be collected for management purposes. However, it is possible that only the data to be used for verification will be recorded in the database structure used for verifications. Additional data may be kept in a separate bookkeeping system.

g) Quality Assurance/Quality Control plan

Quality assurance

A quality assurance/quality control (QA/QC) plan will be implemented to ensure the net anthropogenic GHG removals by sinks are measured and monitored precisely, credibly, verifiably and transparently. QA/QC control includes steps to control the errors in project boundary, stratification, sampling, measurement, data entry, data analysis, and data maintenance and archiving. This plan will be implemented in two phases, as follows:

First phase: The objective of this phase is to train the measurement groups assigned in each area. The groups will consist of local people whose work will be supervised by the ANOC workers (see Figure 9). The training includes teaching the group leaders to manage and calibrate the various measuring instruments (caliper, diametric tape, compass, GPS, etc.) and to understand and analyze their use. The models and parameters needed for calculating are also explained and analyzed in the first phase.

The first phase will include also specifics trainings for local farmers in Jatropha cultivation, sustainable agricultural and forest management practices. A comprehensive illustrated book on agricultural and forest management practices will be produced, printed and distributed among farmers and representatives in schools and villages.

Second phase: All the theoretical knowledge acquired in the first phase is put into practice in this phase. This will include a practice of the use the instruments. The following activities will be conducted to confirm the proper use of the instruments:

- With the compass and GPS, the groups assigned to each area will establish and measure permanent plots, and calculate their area.
- Once plots are established, information on the trees found inside them will be collected, using appropriated instruments and the forms designed for this purpose. To check the accuracy of the information, the specialist from ANOC will conduct separate measurement and the results will be compared with those obtained by the trained groups.
- Using the information collected, data will be processed to calculate the biomass in plots using the corresponding equations.

Quality control

ANOC will be responsible for planning and for designing a system to control the quality of growth measurements. ANOC will develop formats that will be used to collect random samples which will be used to make comparisons with the information collected by the teams assigned to each area.

This quality control activity will be conducted with the same frequency as that of the measurements (i.e., during the first five years of tree stand growth) about 10 to 15 days after the measurements are taken. Meetings will be held with the persons responsible for processing information in order to review formats, the screening system for information collected, and the databases and calculations.

Survey data are entered into a computer-based information system especially designed for the project. This makes it possible to record, calculate and analyze all inventory information, including calculations of the biomass of permanent parcels. To minimize the possible errors in the process of data entry, the entered data will be reviewed by an independent expert and, where necessary, compared with independent data to ensure that the data are realistic. Communication between all personnel involved in measuring and analyzing of data will be used to resolve any apparent anomalies before the final analysis of the monitoring data. If there are any problems with the monitoring plot data that cannot be resolved, the plot is not used in the analysis. All the electronic data and reports will be copied on durable media, such as compact discs (CDs), and copies of them will be stored in multiple locations.

Conservative approach and uncertainties

The guidelines provided in the document "Guidelines on conservative choice and application of default data in estimation of the net anthropogenic GHG removals by sinks" (Version 02)[67] will be used to ensure that application of default data in estimation of the net anthropogenic GHG removals by sinks results in conservative, but not overly conservative, estimates.

[67] EB 50, Annex 23. Guidelines on conservative choice and application of default data in estimation of the net anthropogenic GHG removals by sinks. http://cdm.unfccc.int/Reference/Guidclarif/ar/methAR_guid26.pdf

h) Record system

A database will include all information related to the monitoring of project activities. At higher levels it will contain the following fields:

Project name, country, approved A/R CDM methodology, total area, starting date, operational period, ending date, crediting period, carbon pools, type of project emissions, leakage sources, number of discrete areas, stratification criteria.

On the other hand, at lower levels, it is composed of all the fields described in the Monitoring Plan above.

The database presented above ensures that all afforested and/or reforested areas within a specific project instance are uniquely defined and are included exclusively in one project, thereby avoiding double accounting of emission removals. The project participant (ANOC) belonging to this grouped project activity and all of its project instances will be the owner of the lands where the project activities are implemented. The procedure to ensure that double accounting does not occur is the confirmation that a new project instances are not included in the above mentioned project database or in the CDM's project activities database (UNFCCC).

5 ENVIRONMENTAL IMPACT

No significant negative environmental impact is foreseen. In relation to Annex I and II of the Government Decree N° 2001 – 282 dated 12 of April 2001 Containing the Application of the Environmental Code and according to the Law Nº 2001 – 01 dated 15 of January 2001 Containing the Environmental Code, there is no need to perform an Environmental Impact Assessment.

Here below is anyhow listed the synthesis of environmental benefits of the project:

- Reduction of soil erosion. Jatropha curcas has proven effective in reducing the erosion of soil by rainwater and wind. The taproot anchors the plant in the ground while the profusion of lateral and adventitious roots near the surface both binds the soil and keeps it from being washed out by heavy rains. Moreover, by lessing wind velocity it also reduce the wind erosion. It improves rainwater seepage especially when planted in lines to form contour bunds. However, these anti-erosion effects are limited by dry season leaf drop. This can be ameliorated by growing drought-resistant ground cover in the agro-forestry system.

- Degraded land rehabilitation. Jatropha curcas acts as a nutrient pump, the taproots are able to extract minerals that have leached down through the soil profile and then return them to the surface through leaf fall, fruit debris and other organic remains.

- Increase of soil organic matter. Thanks to leaves senescence, pruning, fruit coats and press-cake the organic matter is expected to increase. This will lead to an improvement of soil aggregation and soil stability increasing the overall resilience of the ecosystem.

The inter-cropped food crops will benefit of a natural protection against grazing, natural phyto-protective action against pests and pathogens.

- Introduction and adoption of agricultural sustainable practices.

- Decreased occurrence of natural fires due to improved land management.

- Fight against Climate Change and Global Warming. The sustainable development of bio-energy crops and the upcoming production of vegetable oil to be used as substitute of fossil fuel will have a positive impact on GHGs emissions. This fully responds to environmental and energy priorities of Senegal, EU and UNFCCC' Convention of Parties (CoPs).

The description of socio-economic benefits of the project is described in a separate document "Socio economic impact analysis"[68].

6 STAKEHOLDER COMMENTS

Recently it has been developed a dedicated web-page (http://www.carbonsink.it/ar-jatropha-agroforestry-senegal-project/) in order to disseminate the results of the initiative, give the opportunity of check the state of the project in real time, and interact directly with project participants through the feeds on social networks (e.g., facebook, twitter) as well as updated tools (e.g. project blog).

A coherent series of discussion groups/seminars aimed at specific targeted public were organized. In total, approximately 600 people participated providing different levels of information and reflection. Thanks to concise presentations, the objective was to inform people about the implementation of the proposed project activity as well as show expected impacts and benefits. A great deal of time was dedicated to the listening of local participants and answering their queries.

In particular, discussion groups took place with male and female hand-workers[69] in the following dates and places:

- 15/12/2011 in the Ourour rural community;

- 05/01/2012 in the Colobane Grand Place;

- 10/01/2012 in the Ourour village centre.

[68] Socio economic impact analysis, CarbonSinkGroup 2013.
[69] Local stakeholders meeting (1), Local stakeholders meeting (2) and Local stakeholders meeting (3)

Figure 30. Meeting with local stakeholders (Author: L. Galbiati)

The main comments provided by local stakeholders during the above mentioned discussion groups were:

- The vast majority of the population knows and approves the proposed reforestation project.
- Local people requires particular attention to be given to the issues related to the land use.
- The water lack is a fundamental problem in this region; in the center of Ourour village the drinkable water is slightly salty due on limited deepness of the present sources (Figure 31)
- Some worries have been expressed regarding the risk of fires.
- The most important expectation concern the job creation and infrastructures maintenance.
- Several villages wish to benefit from reforestation project activities.

Figure 31. People who are procuring water from a well (Author: L. Galbiati)

The answers given by project participants were as follows:

- Concerning issues related to land use and possible population flows, the meetings have defined that the project implementation would allow an improved control of these two factors (thanks to the permanent presence on site of staff members in charge of management).
- A key-objective is the building of some wells in the area, to improve the drinking water quality and to irrigate the nurseries dedicated to provide samplings for the Jatropha curcas plots.
- Regarding the risk of fires, the proposed project will improve the management of the land around the villages and the surroundings territory, besides of reforestation that will improve the trees cover of the land as well as the deletion of the herbs responsible in the fire events during the dry season.
- The project will create both permanent and temporary jobs. In the beginning, the priority will be given to local recruitment but, generally speaking, the policy will be “recruitment, training, and selection” so as to set up a team of expert specialists (e.g., highly skilled, qualified, etc.) in all involved disciplines.
- In response to these expectations, the research and development unit planned in the flow chart (Figure 9) will be able to develop proper forestry techniques and a adequate working methodology, for example through the system of local cooperatives.