ISLAMIC REPUBLIC OF MAURITANIA
MINISTRY OF ENVIRONMENT AND SUSTAINABLE DEVELOPMENT

PROJECT "ENHANCING CAPACITY, KNOWLEDGE AND TECHNOLOGY SUPPORT TO BUILD CLIMATE RESILIENCE OF VULNERABLE DEVELOPING COUNTRIES" EBA SOUTH

BENICHAB EBA SITES
UPDATED RESTORATION PROTOCOL

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I. CONTEXT AND OBJECTIVES OF THE PROTOCOLS

I.1 Context

The project is entitled "*Enhancing capacities, knowledge and technology support for improving the climate resilience of vulnerable developing countries*". It is an interregional project benefiting 3 countries (including 2 LDCs): Mauritania (Africa), Seychelles (Indian Ocean) and Nepal (Asia). It is funded by the GEF through the Special Climate Change Fund (SCCF), executed by the National Development and Reform Commission (NDRC) of China through the Institute of Geographic Science and Natural Resources Research, Chinese Academy of Sciences (IGSNRR, CAS) and implemented by UN Environment. The part of the budget allocated to Mauritania is 828,941 USD over 5 years.

This project focuses on improving the knowledge base on vulnerability across all its dimensions and disseminating the good lessons learned in disseminating good practice and South-South cooperation. It comprises three (3) components and was estimated by the GEF as an innovative project in its approach.

Component 1: Interregional coordination and capacity building of developing countries in Africa, Asia Pacific to plan and implement an adaptive approach based on ecosystems
Component 2: On-line knowledge support on the adaptive approach based on ecosystems.
Component 3: Transfer of the adaptive approach based on ecosystems at the pilot scale (demonstrations).

The target corresponding the indicator 7 of 'area of degraded desert, dunes and savannah restored to stabilize soils against wind erosion using multi-use green belts in Mauritania' under project Component 3 in Mauritania in the year 2016 was to restore 450 hectares on 3 sites (100 hectares in Benichab (Wilaya of Inchiri) and 108 hectares in the neighborhood of Nayema (Wilaya of Trarza), and 242 hectares in Idini). After the Project Team Meeting in Hangzhou, it was agreed to change the target into 450 hectares on 2 sites (208 hectares in Benichab and 242 hectares in Idini).

I.2 Objective

The aim of this protocol is to describe in details the different operations that will be undertaken in the context of restoration of the project sites 1 and 2 of Benichab and to bring with precision the necessary additional efforts to reach the project targets on these two sites.

This protocol will describe the activities with time line and budget and refer to the early protocols that were prepared in 2015 by ENDA and consider a focus on the remaining activities taking in consideration the lessons learnt from the year 2016 and best practices available in terms of EBA concrete implementation.

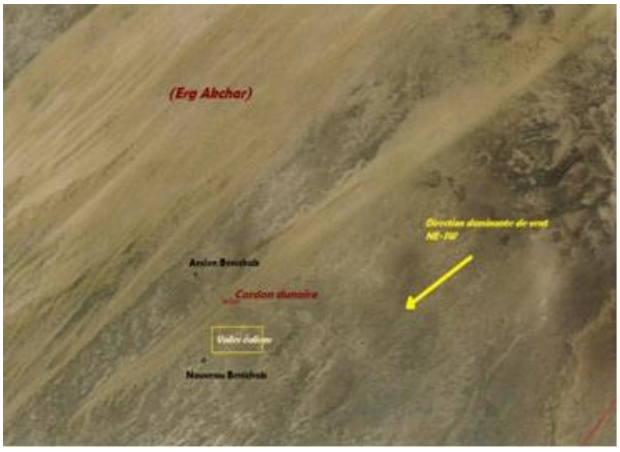
II. PRESENTATION OF THE SITES

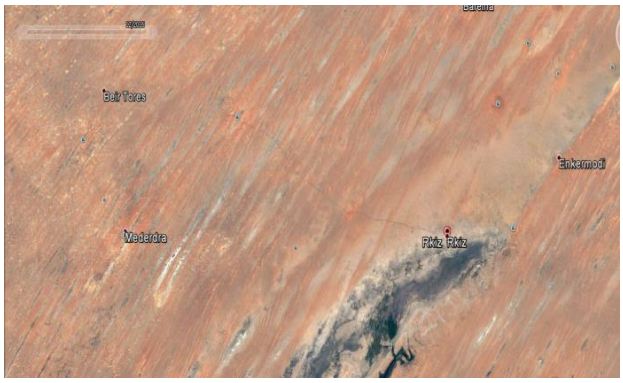
The two villages of Benichab, namely the old called Benichab Essahli and the new project of urban center located 7 km south-east of the latter, are located in a large inter-dune depression on a flat sandy-gravel ground. The presence of sparse and stunted vegetation, the hard surface of the surface with flat, uniform topography, and the steady northwesterly to southwestern winds are the main factors to wind erosion of the area.

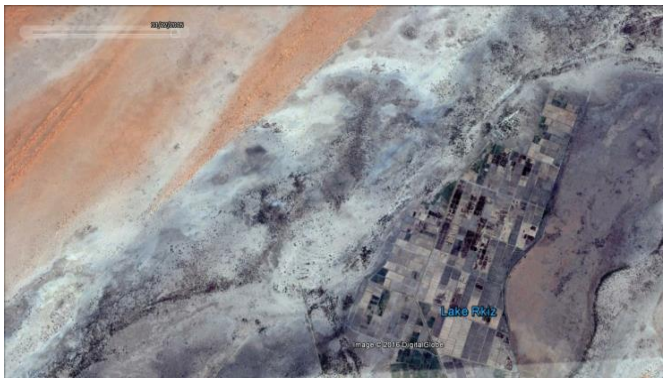
The significant wind sails and the small mounds (1-3 m) are the most frequent dune forms in the area and those that threaten in particular the city and the socio-economic infrastructures of the municipality.

These dunes formations take their sources from ancient alluvial deposits here of the Ogolian cord which is Erg Akchar.

According to the Bibliography, the speed of advance of these dune formations is of the order of (22 to 80 m / year) and it is proportional to the frequency of the active winds.







III. BASELINE AND MAIN LESSONS FROM THE INITIAL PROTOCOL

The initial protocol, for Benichab site EBA implementation that has been approved and implemented is considered satisfactory but some issues need to be taken into account, including some factors that are necessary to monitor and to manage for a successful implementation and that were considered as implementation risks. Among these factors:

- The origin of the seeds and the difference between the biotypes. When the seedlings were acquired according to the Ministry procedures, it was not possible to ensure that the seeds to be used in Benichab site were originated from the Inchiri or the northern region.

It is known that planting with seeds originating from Trarza or from the eastern region of Benichab will not necessarily provide the same results given than seeds originated from Benichab area and then physiologically adapted to the ecoclimatic conditions

Based on this fact, seeds will be acquired only from the region and potential providers are being identified.

- The availability of the water with the increasing demand for important volumes.

In order to maintain the seedlings in the nursery, they should be watered daily with watering cans, twice a day at the coldest times of the day, at a rate of 20 liters / m^2 by watering as recommended for the growth of the plants.

At 15 days before planting, we reduce the frequency of water supply (to reach two or three waterings per week) to wean and condition the plants in their future environment. This will accustom the plant to the aridity which characterizes the environment.

Tanks should be provided to transport water and transport it to the sub-sites to be reforested.

For each of the plants once planted, it will be necessary to water it with about 5 liters of water (200 000 liters for the 40 000 plants) in order to reinforce the moisture of the soil so that it last for the time that the roots of the young shrubs become acclimatized to their new environment. Given the very arid nature of Benichab it will be necessary to provide for the rental of a tank that will transport the water into the sub-sites for additional watering as soon as one finds shrubs to be water-stressed. In anticipation of such water stress, two watering per week have been made and over all the period of operations. The number of supplementary watering sessions would then be 12 and the quantity of water to be expected would be 12 watering x 200,000 liters = 2400 m^3 ie 480 tanks of 5 m3. For each irrigation session, it will require 200,000 liters of water or 40 cisterns of 5 m^3. The costs for backup watering are summarized in the Excel file.

- The size of an increasing workforce on the site

During the seedling preparation period and nursery preparation, the number of workers was limited to 10 but from the time the plantation is officially launched, the number has been increased with a decreasing activity of the nursery.

Despite this, the daily watering and the maintenance under very hot and windy conditions sometimes required to progressively reconsider the size of the workforce on the site and do the workers remobilization on the site.

- The necessity to maintain active nursery and to examine when possible to add new local species

This factor corresponds to the needs in replacement of the non surviving seedlings and to the recommendations to increase the percentage of some species especially Acacia.

- Absence of fencing at some sites

The necessary time for a seedling to grow and to reach an adult stage

IV. FENCED AREA

The total targeted area of 100 hectares has been fenced by the EBA SOUTH Project. To meet the objective of 208 ha fenced and restored, 108 ha remain to be fenced.

The interest of His Excellency the President of the Republic is seen as an asset for these sites and the perspective of ambitious results on the ground supported also by MEDD.

V. PLANTED AREA AND USED SPECIES

For Benichab site, the planting operations involved the local communities, NGOs but were directly supervised by MEDD technical staff. On average, the initial planting operations respected the 5 meters distance between seedlings and the number of 400 seedlings for each hectare with the expectation that some percentages will not succeed. Planting operations were undertaken according to the usual practice. The work is continuously monitored and evaluated with precision to assess the survivorship rate. Given the local conditions, this continuous monitoring is required to track the seedling process in the mid-run.

By end of December 2017, 92 hectares were planted, with 31700 seedlings, including replacements. This target corresponds to the standards of planting 400/300 plants in each hectare with a distance of 4-6 meters between two seedlings. This number does not include *Moringa* and *Delonix* that were planted with negligible numbers. Seedlings on each line are alternated from the different species.
About 600 seedlings of *Prosopis juliflora* were planted in the peripheral area as windbreaker. 'The total *Prosopis* plants will be removed after an average period of 18 months so that they do not become invasive

Alien species: *Prosopis* is planted along the fence to protect the other plants and some plantings inside the site but will be removed in due time. *Azadirachta indica*, *Moringa oleifera* and *Delonix regia* were planted, but in negligible quantity, posing no risks.

Presently, *Moringa oleifera* and *Delonix regia* are inexistent in the EBA site but in the neighboring village of Benichab. *Azadirechta indica* (species present in Mauritania since 45 years) present in negligible quantities (less than 200). Moringa oleifera is a medicinal plant and has a proved nutritive and therapeutic value. It is promoted by different projects of the UN Environment and UNDP. *Delonix regia* is a recommended species for the households and has can act also as a very good windbreakers.

Species	Number
Acacia tortilis	120
Acacia senegal	30
Balanites aegyptiaca	30
Panicum turgidum	40
Leptadenia pyrotechnica	20
Ziziphus lotus	30
Tamarix aphylla	50
Euphorbia balsamifera	20
Autres (Prosopis, *Azadirechta Moringa* and *Delonix*	20
Total	**400**

The types of species planted at Benichab are : *Prosopis juliflora*, *Balanites aegyptiaca, Acacia tortilis, Acacia senegal, Ziziphus mauritiana, Panicum turgidum*. The species present before the reforestation are *Maerua crassifolia*, *Panicum turgidum*, *Acacia radiana, Capparis decidua*. The other species being almost non-existent due to pressure on the use of resources and climatic constraints.

As stipulated in the protocols and recommended by local populations, *Prosopis* have been planted at a limited percentage as wind breakers and will be removed by the end of 2018 on ministry extra budget. *Prosopis* will be replaced by *Tamarix aphila* that have been found to grow very well in the region.

VI. REMAINING ACHIEVEMENTS FOR 2018

The site 2 has been identified and will be restored with eastern side at 1800 meters at the west and north west of the village of Benichab. The soil of this area is sandy but does not present specific constraints toward the restoration.

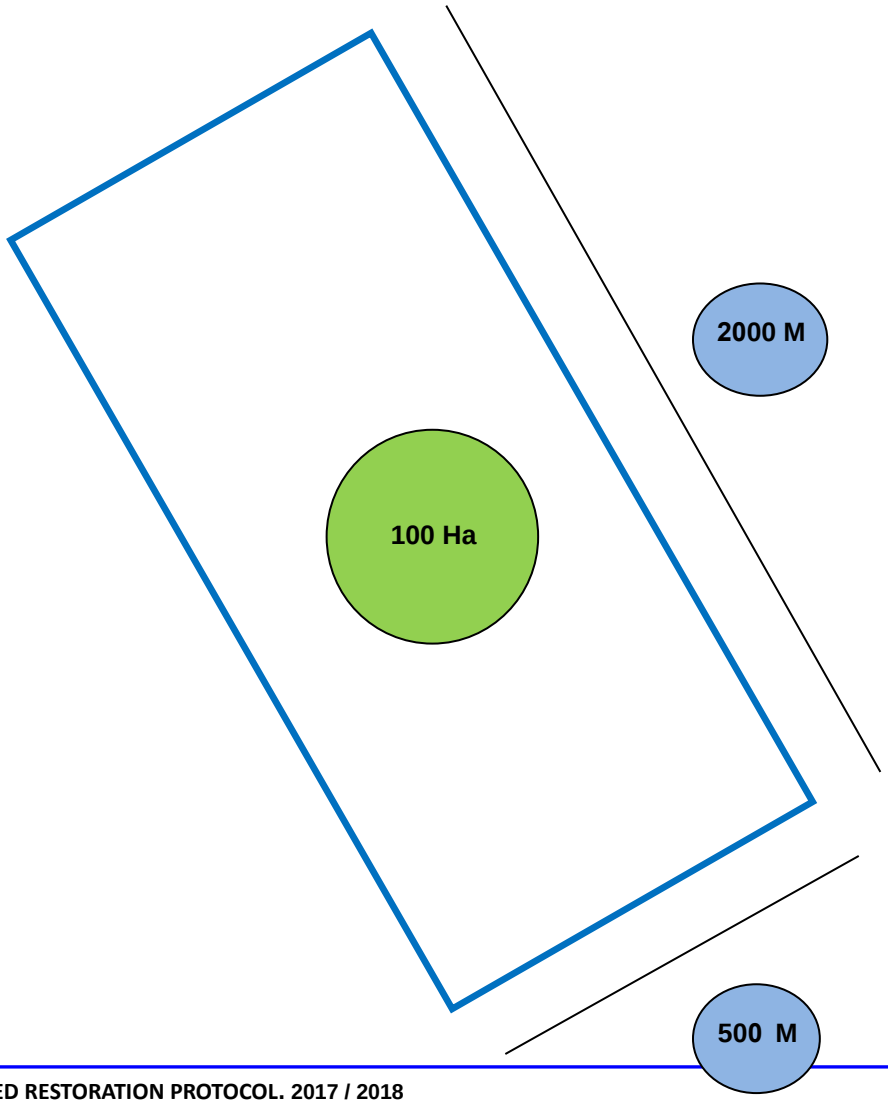
VI.1 Fencing

Additional fencing of 108 hectares will be undertaken in Benichab site. Site 2 will cover an area of 100 hectares and 8 hectares will be planted as extension of the subsite 1B. This will add up to the 108 ha required to meet the overall objective of 208 ha fenced.

Fencing operations will be organized according to the Ministry rules and procedures from February 1st and completed by March 15. The following materials will be acquired by the way of a tender:

- Galvanized wire mesh unit of 25 M in length and 150 cm in height
- Iron pegs angle of 2m length
- Gauge iron posts and 12 x 12 cm reinforcement. 2 meters in length
- Barbed Roll unit of 250 meters
- Kg of tie wire
- Kg of galvanized tensioning wire
- Portland Cement T42,5 SR
- Tons of seashells
- Workforce for execution
- Package transportation of materials on site
- Barrels of 200 liters empty with stopper
- Supplement in Tons of Water

The identified area to be protected by fencing has been identified with a common agreement and joint mission with the involved ministries. The Benichab site 2 will have the following dimensions:



In terms of linear meters, the fencing will be of a total length (Lt) of
Lt (mtr) = 2000 m + 500 m + 2000 + 500 = 5000 mtr
The fencing will take the necessary materials:

ITEM / ELEMENT	NUMBER	PRICE UNIT	PRICE TOTAL
Galvanized wire mesh unit of 25 M in length and 150 cm in height	210	22 000	5 632 000
Iron pegs angle of 2^{m} length	1 600	530	848 000
Gauge iron posts and 12 x 12 cm reinforcement. 2 meters in length	510	4 000	2 040 000
Barbed Roll unit of 250 meters	88	350	30 800
Kg of tie wire	64	4 350	278 400
Synthetic windbreakers (ML)	6 400	500	3 200 000
Kg of galvanized tensioning wire	160	4 100	656 000
Portland Cement T42,5 SR	8	600	4 800
Tons of seashells or stones	4	13 500	14 000
Package transportation of materials on site	FF*		1 400 000
Barrels of 200 liters empty with stopper	20	5 500	110 000
Supplement in Tons of Water	FF		0
Technical Working needs	FF		3 000 000
TOTAL MRO			**13 014 000**

VI.2 Nursery costing Biological Resources and seedlings production

53000 seedlings from the different local species will be prepared between February and May 2018. The number of seedlings corresponds to 108 hectares X 400 = 43200 seedlings and 9800 additional seedlings for the replacements and the reinforcement of the windbreaks.

All of the seedlings will be grown in the new Benichab nursery located in subsite 2.
The concrete plantation on the site 2 will consider distance of 6 meters from each two seedlings as recommended by the NRE.

The nurseries will be put in place the best practices that we acquired and considered the different lessons learned. The necessary equipments and products will be acquired according to the Ministry of Environment rules and procedures. The nursery will be operated from the 1st February 2018 and for a period of 7 months.

Seeds will be purchased according to local standards and the following species will be exclusively used certified seeds from the Inchiri region. The species will be

- *Acacia tortilis*
- *Acacia senegal*
- *Tamarix aphylla*
- *Balanites aegyptiaca*

- *Panicum turgidum*
- *Leptadenia pyrotechnica*
- *Ziziphus lotus*
- *Euphorbia balsamifera*
- *Maerua crassifolia*

Seeds will be provided according to the quantities shown below. The estimated cost of the seeds (3 Kgs from each species) will be about **1 817 000 MRO.**

Species	*Cost*
Acacia tortilis	**128 000**
Acacia senegal	**169 000**
Tamarix aphylla	**199 000**
Balanites aegyptiaca	**234 000**
Panicum turgidum	**251 000**
Leptadenia pyrotechnica	**280 000**
Ziziphus lotus	**188 000**
Euphorbia balsamifera	**141 000**
Maerua crassifolia	**227 000**
Sub-Total	**1 817 000**

In terms of equipments, the different necessary horticultural materials will be acquired in quantity and quality. The following equipment and instruments will be acquired and exploited. Cost of the nursery according to the local market assessment confirmed in January 2018 will be as follows.

ITEM	NUMBER	PRICE UNIT	PRICE TOTAL
Watering Cans	20	7 600	152 000
Round Shovels	20	2 800	56 000
picks	20	1 100	22 000
Large buckets	20	2 300	46 000
Small buckets	1 400	800	1 120 000
pruners	20	3 800	76 000
Water Fuses	30	3 000	90 000
wheelbarrows	50	4 600	230 000
Iron rods	10	7 000	70 000
Seed bags	120 000	80	9 600 000
Tank covers	3	20 000	60 000
5T water reserves	10	92 000	920 000
rakes	20	3 800	76 000
cords	100	600	60 000
Fitted tent	1	85 000	85 000
Total MRO			**12 663 000**

The estimated cost of the equipments and materials will be about **12 663 000 MRO.**

THE total nursery cost will be 14480000 MRO

Water needs on the nursery will be covered by MEDD as cofinance.

Water needs for the nursery will be supported by MEDD through a facility that is already prepared with the Mayor of Benichab and the Ministry of Water. This contribution is considered as co finance from the MEDD side.

VI.3 Workforce

The Benichab nursery and plantation activities will be operated by a permanent staff of 6 workers under the supervision of 2 technical forest inspectors from the project and the Ministry.

The costing will be: 6 workers X 50000 MRO X 7 months = **2100000 MRO**
The planting operations will be undertaken by 22 workers corresponding to following cost.
22 workers X 50000 MRO X 7 months = **7700000 MRO**
The total costing of the working force will be **9800000 MRO**

VI.5 Water Supply Scheme

Water supply issues have been definitely solved with equipment of the 2 wells that are located on sub site 1B and operated by the project. A water pipeline will permanently connect the site 2 to the water network of sub site 1A that will receive the water from the production of the wells that are owned and operated by EBA Project.

However, it will be necessary that the Project invests in some equipment.
The necessary equipments are:
40 PEHD 63 pipes roll (100 m) X 65000 MRO = **2600000 MRO**
50 PEHD 25 pipes roll (100 m) X 12000 MRO = **600000 MRO**
Total cost for water equipments is **3200000 MRO**

Different equipments will be provided by MEDD as cofinance.

VII. BUDGET

Only necessary budgets have been considered in this updated protocol for the period from February to august 2018. The estimation was made according to the recent study of the local market and according to the signed documents. All the lessons learnt from 2016 / 2017 were taken into consideration.

BL	Category	Benichab	
		MRO	USD
BL1	Fencing	13 014 000	37 397
BL3	Working force	9 800 000	28 000
BL4	Water supply facilities and equipments	3 200 000	9 142
BL5	Nursery and planting equipment	14 480 000	41 370
BL6	Administrative fees	2 300 000	37 356
	Sub-total		
	Total MRO	**40 533 000**	
	Total USD		**115 809**