REFORESTATION PLAN

IMPLEMENTED IN THE AREA OF INFLUENCE
SHRIMP FARM “EL FARO” PROJECT
S.A. DE C.V.

PERIOD 2018 - 2019
CITY EL TRIUNFO, DEPARTAMENT OF CHOLUTECA
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1. INTRODUCTION

Mangroves are fundamental pillars in the life cycle of a great biological diversity (Calderón & Ezcurra., 2009). They produce a large amount of organic matter that allows the sustenance of various species of fauna; besides offering a very favorable environment for the development of activities and industries that without applying mitigation measures can imply their destruction (Carrere, 2002).

The environmental restoration of the mangrove forest must be considered fundamental for the sustainable development of the coastal zones, for which it must resort to the moment of natural regeneration and the development of actions for its artificial regeneration (Flores, Agraz & Benítez, 2005).

The Finca Camaronera El Faro has some production lagoons distributed over 920 hectares, where the "black mangrove" (Avicennia germinans) has naturally developed.

The application of the Environmental Compensation Measure No. 1, established by the Ministry of Energy, Natural Resources, Environment and Mines (Miambiente+), according to resolution No. 1314-2009 for the operation of the Camaronera El Faro Farm, which determines the need to carry out and execute annually a Reforestation Plan and maintenance of the mangrove forest within the area of influence of the project, it is a necessity and at the same time, an obligation of the company. This measure of environmental compensation seeks the sustainability and environmental balance of the coastal ecosystem in the mangrove area influenced by the shrimp production process, which allows the use, restricted and sustainable use of the mangrove forest under the guidelines of the Management Plan of the Habitat / Species Area the Barbary, located in the Municipality of Triunfo, Choluteca and in coordination with the Institute of Forest Conservation and Development (ICF).

This Reforestation Plan corresponds to the period of July 2018 to June 2019, and is submitted to the ICF for approval, and to be evaluated in the ICMA corresponding to the year 2019.
2. GENERAL INFORMATION

2.1. Project
Shrimp Farm “El Faro” S.A. de C.V.
Address: Aldea El Faro, Municipio de El Triunfo, Departamento de Choluteca.
Telephone: 2781-3159

2.2. Headline
Headline Name: Antonio Cano Anguiano
Address: Shrimp Packing Machine Santa Inés, desvío To Santa Elena, municipio de Choluteca, Departamento de Choluteca.
Celphone: 9697-3335

2.3. Legal Guardian
Name: Virgilio Umanzor
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Celphone: 2270-7075

2.4. Author’s data of the ICMA
Ing. Fausto Cabrera Mendoza
Provider of environmental services PSA, Generalist RI-669-03-2018
Celphone: 9697-3576
E-mail: faustocabreramendoza55@gmail.com

2.5. Technical Team of the project El Faro Farm
Lic. Emilio Campos – Biologist
Ing. Kennedy Rodríguez – Hygiene and safety
Ing. Bradys Carbajal – Hygiene and safety
Ing. Luis Alberto Rodríguez – Farm Boss.

2.6. Presented and Executed
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E-mail: ulisesp@rcningenieria.com
Celphone: 9679-2615
3. OBJECTIVES

3.1. General

Contribute with the sustainability, environmental balance and biodiversity of the habitat of the mangrove forest in the Habitat / Species Management Area La Berbería, Municipality of El Triunfo, Department of Choluteca.

3.2. Especifics

- Establish 2000 trees during the year of the next 5 years of the specie *Avicennia germinans*, waiting for behave a final density of one individual per square cubic meter in a surface of one hectare.

- Carry out the planning and execution of the monitoring, maintenance and protection of the area to be reforested.
4. BACKGROUNDS

In previous years to the elaboration of this plan of reforestation, The Shrimp Farm "El Faro" has realized diverse projects of reforestation with the aim of increasing the ecological value of the exploitation and to protect the boards of their channels of supply, receptors and boards of the lagoons of production, such as reforestation carried out in 2003, establishing Avicennia germinans and documented in the socio-environmental log of the farm. The influence of this reforestation is visible and remarkable at present for a large part of the extension of the farm.

July period of 2017 to June 2018, a reforestation of "red mangrove" (Rhizophora mangle) was carried out, in an attempt to increase the biodiversity of the farm.

There are records of said reforestation, as well as records of irrigation of the reforested hectare and the monitoring of it. Due to the poor success of this reforestation (percentage of survival of 10-15%, after one year since its establishment). The technical team of Farm El Faro decided to focus efforts on reforesting with the species of the area, in this case the Avicennia germinans.

5. SELECTION OF THE SPECIES TO STABILISH

The specie selected is Avicennia germinans known in the area how "Black mongrove o corumo (Seed)". There was select to the reforestation, because it is typical of the area and the one that best adapts to the environmental and physicochemical conditions of the soil in Shrimp Farm "El Faro", precisely in the place provided by the technical department of the farm.
6. DESCRIPTION OF THE SPECIES TO ESTABLISH

6.1. Specie: *Avicennia germinans*

*Synonymos:* *Avicennia nitida* Jacq. *Avicennia tomentosa* Jacq.

Tree belonging to the family of the Avicenniaceae, can reach up to 30 meters in height and 60 cm in diameter, umbellate cup, blackish gray bark, clear and open foliage with ascending branches, straight shaft, cylindrical and pneumophores around the base (Image 1) (Lamb & Boshier, 2003). Its root system is modified (pneumatophores) to allow the absorption of oxygen in the swamp (CONABIO, 2009).

![Picture 1. Avicennia germinans Forest](image1)

6.2. Leaves

Simple leaves, opposite, entire border and blade 8-12 cm long, with acute tip, dark green beam and gray underside (Picture 2) (Cordero & Boshier, 2003). They have structures in the leaves called hydótodos by which they can expel the excess of salt, which circulates by the interior of the plant until arriving at the surface of the leaves, falling when the amount is very high (Ambientalist Blue Fundation, s.f.)
6.3. Inflorescences

His flowers are very small and they ground in groups at the tip of specialized twigs that measure 2 to 6 cm in length (CONABIO, 2009). They are white and small and occur in clusters between May and June (Thirakul, 1998).

6.4. Fruits

The propagules are small and resemble a small mango (Thirakul, 1998). They are 2-3 cm long capsules, which open into two leaflets and contain a single seed, 14-20 mm long (Cordero & Boshier, 2003). A distinctive seedling develops before the fall of the fruit of the parent tree (viviparous), which, when they fall, is transported by the currents of the tides (SEMARNAT, 2009). They are dark brown, oval and flattened at their ends, preferably should be collected from the soil (Conservation project and repopulation of threatened areas of the mangrove forest of the Panamanian Pacific, 2005). It is recommended that the collection of the propagules be carried out on the same day of sowing in the nursery, because the viability of these decreases due to desiccation and time (SEMARNAT, 2009).
6.5. Wood

The wood is hard and heavy. (0.8-1.0 gr/cm³) therefore, it is difficult to work, due to its density, cross-linked grain and the presence of mineral crystals (Benítez and Montesinos, 1988). The light brown color in the sapwood and blackish chestnut in the heartwood, is characterized by its use for firewood (Cordero & Boshier, 2003). Its drying is medium, moderately easy to preserve, medium to high natural durability, very susceptible to termite attack (Benítez & Montesinos, 1988).

7. SELECTION AND LOCATION OF THE AREA TO BE REFORESTED

The site designated for the establishment of the reforestation is approximately one (1) hectare, of a reserve area not intervened for the productive tasks of the farm. Said area comprises an area comprising a total area of 40 hectares. This reserve area is within the concession granted for the operation of the shrimp farm “El Faro”, and as the whole extension of the shrimp farm, within the area of influence of the Habitat / Species Protected Area "The Barberry".

The area to be reforested is located in the following boundaries:

To the North: Shrimp Farm “El Faro”
To the South: Nicaragua Republic
To the east: Shrimp Farm “El Faro”
To the west: T National lands of the Management Area H / E “La Berbería”
Precisely within the UTM coordinates described in Table 1:

<table>
<thead>
<tr>
<th>No.</th>
<th>Area</th>
<th>Coordinates</th>
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<tbody>
<tr>
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<td>6.</td>
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<td>7.</td>
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Table 1. Coordinates UTM of the plot where the reforestation plan will be developed.

Area to be reforested is surrounded by mangrove forest of Avicennia germinans as shown in picture 3.

*Picture 3. Satellite Picture of the area to be reforested*
8. DESCRIPTION OF THE BIOPHYSICAL AREA

Surface hydrology is influenced by the tidal cycle or hydroperiod, this influence is daily (every 12 hours and 56 minutes), being more marked when the level reached by the tides is high (3.8 meters) and minimum (0.2 meters), which occurs every seven days per month approximately (Management plan for habitat / species management area La Berberia, 2005).

The weather of this region is determined by the atmospheric phenomena of the subtropics and the same area. The climate that predominates most in the Habitat / Barbary species management area is the Tropical Dry.

The characteristics of the Gulf of Fonseca have been classified as an area with rainy weather, with a very dry winter, due to the existence of a low rainy season in July (canicula) between the rainiest months of the area, June and September (Management plan area for habitat / species management La Berbería, 2005).

The temperature in the south area is much higher than in the rest of the country, because the trade winds when arriving to the south have gained heat of condensation in their displacement throughout the territory. In the La Berbería lagoon, due to its location with respect to sea level, which is in the range of 0 to 10 meters of altitude and an average annual temperature of 28.2 °C. The highest temperatures are recorded at the end of the dry season, reaching up to 38.2 °C during the months of March and April, the lowest temperatures are recorded during November and December down to 16.5 degrees Celsius (Management plan management area of habitat / species La Berberia, 2005).

In the area of Management Habitat-Species La Berbería, the soils are alluvial of poorly drained fine texture and of moderate natural fertility with some redoubts of dry forest. Where mangroves, wetlands-marshes and swamps occur, the soils are made up of marine sediments with very fine texture, poor drainage and low natural fertility (Management plan area for habitat / species management La Berberia, 2005).
9. METHODOLOGY FOR THE REFORESTATION

The area to be reforested will be equipped with a channel of adequate dimensions for the entrance of tidal water from the nearest estuary, considering that the conditions of the site (degree of salinity, level of flood, tides, type of soil) are the more suitable for the species to be planted.

In the reforestation of the selected area, direct sowing will be used as a method to artificially regenerate the propagules of the Avicennia germinans.

The collection of the same will be done by selecting those that have already detached from the tree and are floating in the estuaries and channels near the farm or within it, since these propagules have a germination started before their detachment from the tree.

In case that sufficient propagules are not obtained, they will be harvested directly from seed trees, selecting those of greater vigor and with better phenotypic characteristics (that do not present withering, breaks, deformations, visibly healthy, among others).

The collection will be done by hand, located in a container with the apex upwards to protect the propagules.

The propagules will be sown immediately after collection, since their viability decreases with drying and time elapsed.

In case of needing a reseeding for low percentages of arrest (after a period of six months), these will be carried out in February; when the Avicennia germinans returns to produce propagules.
10. MAINTENANCE AND PROTECTION OF THE REFORESTATION

The reforested area will be subject to periodic observation on a quarterly basis to determine the percentage of germination, initial seeding and the rate of growth of the mangrove, making a measurement and quantification every three months, accompanied by a photographic memory in order to have a sequence of development of the regeneration.

11. SCHEDULE

<table>
<thead>
<tr>
<th>Objectives</th>
<th>No.</th>
<th>Activity</th>
<th>Jul</th>
<th>August</th>
<th>Sep</th>
<th>Oct</th>
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<tbody>
<tr>
<td>Planting of 2000 mangrove propagules in the area of influence of the project, at the site arranged by the technical team of Shrimp Farm El Faro and with the approval of the ICF.</td>
<td>1.</td>
<td>Elaboration of the reforestation plan.</td>
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<td>3.</td>
<td>Preparation of the land for the plantation (canalization, cleaning, marking)</td>
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<td>Sowing activity</td>
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<td>5.</td>
<td>Analysis of the field visit by the ICF.</td>
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<td>Replanting (if necessary)</td>
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12. BIBLIOGRAPHY


