

Reforestation in the Colorado River to Improve the Environmental Quality of the Mexicali Valley in alliance with Groasis and Pronatura Noroeste

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Introduction

The delta of the Colorado River has suffered serious deterioration in the last 100 years, mainly due to water diversions in the basin, which has caused the loss of water. 85% of its forests and wetlands, with an impact on air quality, biodiversity and the communities in the area. In particular, the lack of vegetation cover has had an impact on the increase of suspended particles, which seriously affect the air quality of Mexicali and its Valley.

However, this ecosystem is resilient, and there are still great opportunities for restoration, which is why Pronatura Noroeste implements, together with other organizations, a restoration initiative to recover its environmental services. The initiative is based on a multidisciplinary scientific approach and the best technologies to optimize efforts. At the same time we ensure that the restoration sites have the legal protection tools to ensure their conservation, and generate community support that allows long-term success. In this context, we began the restoration of the Miguel Aleman Site, which is located in the floodplain of the Colorado River, in Baja California, Mexico (Figure 1). Crossing the river and the international line is the Hunter's Hole restoration project in Arizona, United States. The project in Mexico consists of the operation of a nursery of native plants, with capacity to produce 70,000 trees per year, operated in coordination with the local community, the operation of the demonstration plot of restoration of 3 hectares, and the implementation of the restoration project in the floodplain of the Colorado River, in total an area of 100 hectares.

Pronatura Noroeste has the authorizations of CONAGUA and SEMARNAT to implement the project, as well as the irrigation rights required in the project and the support of the communities surrounding the site, which actively participate in the process.

We started the restoration work in the Miguel Alemán Site in 2013, working hand in hand with the community of Colonia Miguel Alemán and Ejido Janitzio. This site is an old meander of the Colorado River, which was degraded with the decrease of water flows. In the second half of the 20th century, the site became a wasteland with exotic vegetation, with very low value for wildlife and with bare ground that generates dust storms (Figure 2). However, the impetus of the community and the regeneration potential of the area prompted us to start this project.

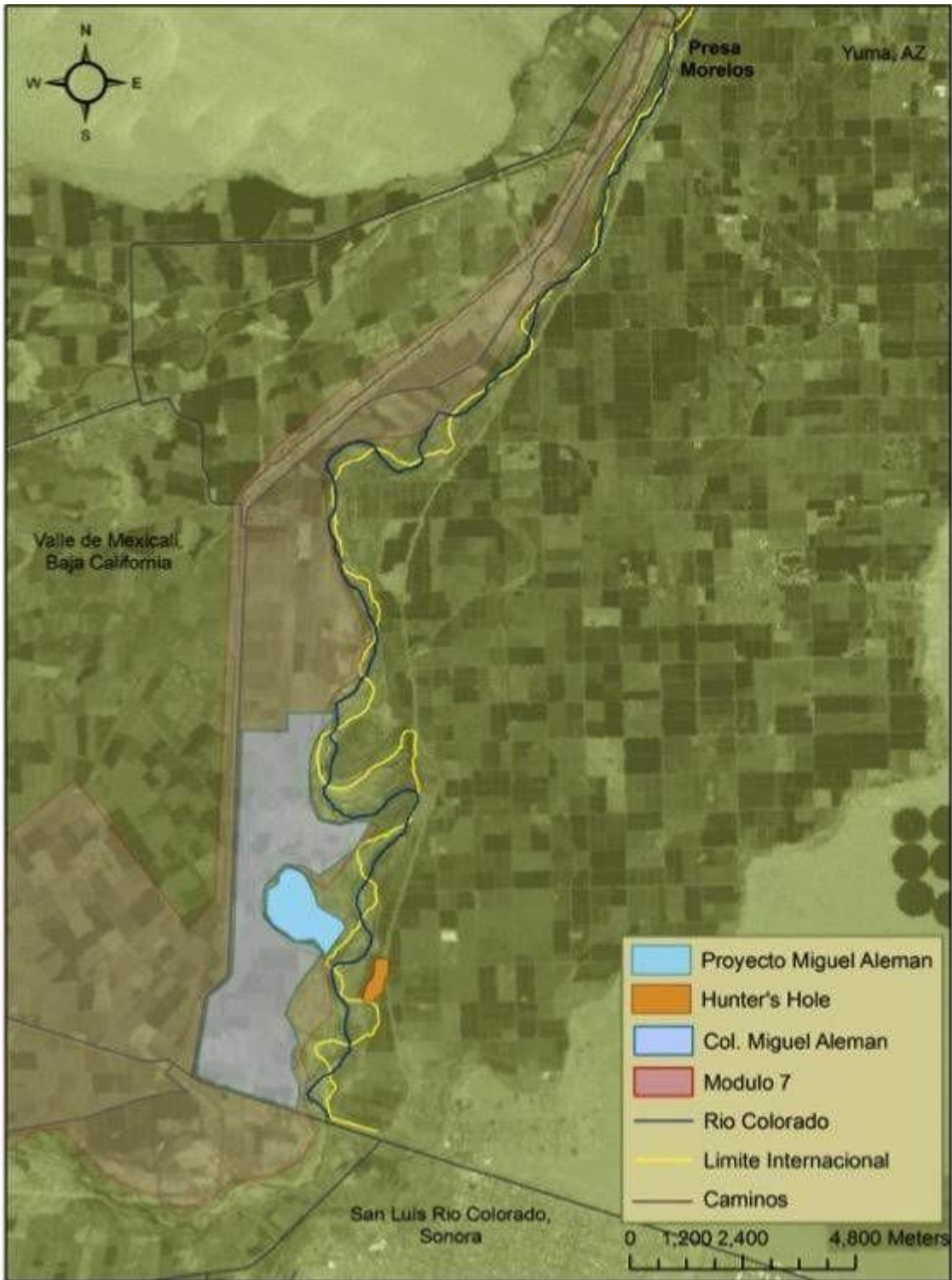


Figure 1: Project location Miguel Alemán, Mexicali, Baja California, in the border section of the Colorado River, 5 km upstream from San Luis Río Colorado, Sonora.

The first efforts focused on generating a detailed baseline of the topography, type and quality of soils, and depth of the water table, with this information to generate a restoration design on 250 hectares. At the same time, we began the negotiations with CONAGUA, CILA and SEMARNAT to designate this site as a binational priority project in the Act 319, guarantee its protection through a concession for environmental purposes, and obtain the necessary permits for the restoration works.



Figure 2: Aerial photography of the Miguel Alemán site, before initiating reforestation actions in the area. The native forests disappeared due to lack of water.

In this new stage of the project, Groasis joins the reforestation effort, with the technology of the Growboxx®, which will extend the scope of the efforts, reach areas where there is no irrigation infrastructure, and optimize the use of water for maintenance of the trees planted, ensuring their survival.

The Groasis Ecological Water Saving Technology is a Dutch technology of planting based on the practices of nature. Through special technology, the tree is stimulated to develop vertically descending roots that penetrate more than 3 meters deep in the first year. Once it is at this depth, the tree does not need watering to survive. However, the planted tree must be able to cope with the circumstances. The system allows to plant up to four other seedlings (plants or plants, or bushes, or a mixture of plants) along with each tree.

The Groasis Ecological Water Saving Technology consists of 5 integrated steps:

1. A mechanical system to increase the infiltration of water in the soil with the Groasis Terracedixx that builds 15,000 meters of mini-terraces per hour to stimulate the infiltration and micro-capture of rainwater from an average of 25% to 90%;
2. A mechanical system to make seeding holes that leave the capillary system intact with the Groasis capillary drills;
3. Mycorrhizae (fungi) that support the root system;
4. Intelligent bucket for a healthy microclimate and water, called the biodegradable Growboxx® and it is made from recycled paper that provides nutrients when degraded;
5. Biodegradable BioGrowsafe plant protector that protects plants against grazing animals.

The Groasis Technology, named National Icon by the Dutch Government in 2016, allows to plant throughout the year with a survival rate of 90 to 95%, and on average a growth of up to 30% faster.

Thanks to the support received by the Secretary of Environmental Protection of the Government of the State of Baja California, it was possible to have an alliance between Pronatura Noroeste and Groasis to implement in the reforestation project native trees within the restoration site using the Growboxx®.

General purpose

Optimize the skills of the Mexicali Valley to attract investments by improving environmental quality and quality of life, through the reforestation of the Colorado River with native plants, generating forests that help clean the air by trapping suspended particles, capture carbon to help reduce the impact of climate change, restore habitat for wildlife and create natural spaces for the Valley's population.

Specific objectives

Reforest 5 hectares, planting 2,250 native trees at a density of 450 trees per hectare in the Colorado River plain.

Project activities

WEEK 1

DECEMBER 18 TO 22, 2017

PREPARATION OF THE SITE

The site preparation activities began with a work meeting where Ing. José G. Gastelum, who serves as technical advisor to the company Groasis and Mr. Alberto Ruiz Ortega, Restoration Coordinator of Pronatura Noroeste A.C. ; event that had the purpose of generating the necessary coordination in the restoration efforts. Among the topics discussed were the times for receiving the Growboxx® technology and the need to acquire the services of a backhoe to speed up the reforestation process.

In addition, several routes were carried out within the site to achieve the location of the 5 hectares of surface to be restored.

It is important to point out that as an eligibility criterion it was considered vital to identify future water intakes and the access of the backhoe to the sites, since not having these elements would increase the time needed for restoration.

As a result of the field trips, it was determined to divide the 5 hectares into 4 polygons; located in the vicinity of the area of aspersion of the site (Figure 3).



Figure 3: Polygons where reforestation was carried out using Growboxx®

Due to the characteristics of the soil type, water table level and taking as reference the existing native vegetation in the area to be restored, it was decided that the restoration design would be a high terrace habitat, with the following native species:

- Sweet Mezquite (*Prosopis glandulosa*)
- Palo Fierro (*Olneya tesota*)
- Palo Verde (*Parkinsonia microphylla*)
- Palo Verde Amarillo
- Cat's claw

In the restoration design, the following density was considered plants per hectare in each of the 4 polygons:

Polygon	Surface (Ha)	Total plants	Density x Ha
1	1.28	749	585.15
2	2.72	1,051	386.39
3	.40	180	450
4	.60	270	450
Total	5	2,250	450

It is important to mention that the average density of the plantation was designed at 450 trees per hectare; However, polygons 1 and 2 were assigned an average of 585.15 and 386.39 respectively, seeking to generate a habitat that resembles a natural regeneration of the ecosystem.

**WEEK 2
08 TO 13 JANUARY 2018**

RECEPTION OF GROWBOXX®

2,250 Growboxx® were received (Figure 4) with the following characteristics:

- 1 water storage container
- 1 Cover
- 1 Ceramic ball
- 1 moisture retention sheet
- 1 Tree protector



Figure 4: Growboxx® reception at the restoration site.

RECEPTION OF PERFORATION EQUIPMENT (DRILL)

In order to carry out the reforestation with Growboxx® it is necessary to use a drill bit which was provided by Groasis to carry out the excavation to plant the trees (Figure 5).



Figure 5: Receiving the drill

DELIMITATION OF THE PERIMETER OF THE 4 POLYGONS

As part of the activities prior to the start of the plantation, the team of Pronatura Noroeste A.C. performed the delimitation activity of the perimeter in the 4 polygons mentioned above. This activity was developed with the support of a GPS team and stakes. Each stake was placed at an average distance of 30 meters (Figure 6) in order to visually locate the work area.

In addition, within each polygon, stakes were placed transversely at a distance of approximately 10 meters from each other, the objective of which was to facilitate the location of each of the reforested plants in order to obtain a homogeneous density in the indexes already described and to identify the access of units and machinery in the restoration process.



Figure 6: Stake installation to determine the reforestation polygons.

PROOF OF EXCAVATION WORK

Excavation tests were performed using a drill that is patented by Groasis which was installed on the backhoe arm. Derived from the fact that the type of soil located in the restoration zone is sandy, it was determined to carry out 20 excavations in the polygon 1 to evaluate the performance of the drill in this type of soil (Figure 7).

As a result of it was verified that the performance of the excavation team was favorable for what was considered to use this tool in the reforestation process.





Figure 7: Excavation tests to carry out the reforestation in the determined polygons.

WEEK 3-4

15 TO 26 JANUARY 2018

PLANTATION OF NATIVE TREES TEST PERIOD

In order to visualize the logistics needs within the framework of the efforts of restoration, as well as knowing the capacity of water retention in the Growboxx® technology, this derived from the high permeability in the area to be restored, tests were carried out reforesting 400 native plants in the polygon 1 (Figure 8).



Figure 8: Reforestation tests in the polygon 1.

The steps to carry out the plantation of the native trees (Figure 9) were the following:

- 1.- Exact location of the placement of the native plant.
- 2.- Realization of the perforation with the support of the backhoe.
- 3.- Irrigation through a nurse tank to moisten the area, prior to planting.
- 4.- Native tree plantation.
- 5.- Placement of moisture retention leaf around the stem of the native tree.
- 6.- Placement of the water storage container in Growboxx®.
- 7.- Water supply inside Growboxx®, which has a storage capacity of up to 20 liters.
- 8.- Placement of the lid.
- 9.- Placement of the native tree protector.
- 10.- Place the ceramic ball in the recharge hole located in the cap of Growboxx®.





Figure 9: Supervision of plantation by Groasis on the site.

During the trial period, a verification of the Growboxx® sowed was carried out and it was concluded to remove them, this was because there was little water retention, since it was the first production batch of the boxes and it was decided that it was necessary to have a greater pressure in the pressing phase within their production, which after a trial period assured them its good functioning.

WEEK 5-10

FEBRUARY 26 TO MARCH 30

REFORESTATION ACTIONS WITH NATIVE PLANTS.

The reforestation activities of 2,250 native plants were carried out from February 26 to March 30 of this year, achieving the restoration of high terrace habitat.

In order to achieve a successful reforestation, each of the spaces where the reforested plants would be placed was first located. Subsequently, the area of production of native plants located in the nurseries installed in the site was requested for the quantity and species of native trees that would be planted during the working day (Figure 10).



Figure 10: Delivery of native plants that were planted within reforestation polygons.

At the same time, the machine began with the drilling of each of the holes and placed next to the planting hole its corresponding Growboxx® (Figure 11).



Figure 11: Digging holes to reforest.

The next activity was to pour water to moisten the area and after that, the plantation was carried out (Figure 12).





Figure 12. Sowing of native plants.

At the end of the reforestation activity, we placed the anti-evaporation cover around the stem of the tree and on it the Growboxx[®] was installed.



Figure 13: Installation of Growboxx[®]

After placing the Growboxx[®], 20 liters of water were poured into the container (Figure 14). It is important to point out that by Groasis indications the water supplied to each of the boxes was treated with different nutrients to improve the process of adaptation and strengthening of each reforested native plant.



Figure 14: Filling with 20 liters of water in Growboxx[®]

Finally, the lid was placed, together with the ceramic ball and the tree protector in each of the installed Growboxx[®] (Figure 15).



Figure 15: Completion of the Growboxx® installation

Taking into consideration the restoration design; The plantation by species in the four polygons was as follows:

Polygon	Mezquite Dulce	Palo Verde	Palo Verde Amarillo	Uña de Gato	Palo Fierro	Total
1	348	174	113	44	70	749
2	483	299	34	145	90	1,051
3	49	72	0	35	24	180
4	115	86	2	31	36	270
Total	995	631	149	225	220	2,250

Finally, after completing the restoration activities in the 5 hectares, a sign with information related to this project was installed, which is in the area of the entrance to the restoration site next to the road that gives access to the polygon 1 (Figure 16).



Figure 16: Interpretive sign on the reforestation site.

WEEK 11-12
02 TO APRIL 13, 2018

MAINTENANCE AND MONITORING OF PLANTATION

In order to provide the necessary maintenance to reach the plantation survival rates as established, the water in the installed Growboxxes in each of the 4 polygons are randomly revised and after detecting the water needs. Water is poured in the containers throughout the entire plantation.

Another fundamental activity is the constant verification of the correct installation of the Growboxx®, this is derived mainly by the strong winds that occur in the area during the months March and April.

As a result of this activity, the 99% survival rate is currently registered.

As part of conservation efforts at the Miguel Aleman Restoration Site, Pronatura Noroeste, A.C. that were developed during 2017, 3 nurseries of native plants of the region were created.

For this reason, for the implementation of the reforestation activities considered in the present project, the Production team of native plants worked together during the months of September and October to produce 5,000 trees.

Although the amount mentioned is greater than that contemplated within the project, this was in order to ensure the availability of trees necessary for reforestation actions, as well as trees that allow the replacement of possible dead plant, if the case.

Next, the production of native plants by species is shown:

Species	Production
Mezquite (<i>Prosopis glandulosa</i>)	2,500
Palo verde (<i>Parkinsonia microphylla</i>)	1,000
Palo fierro (<i>Olneya tesota</i>)	500
Palo Verde Amarillo	500
Uña de Gato	500
Total	5,000



NEXT STEPS

In order to achieve a successful reforestation at the Miguel Aleman restoration site, the aforementioned maintenance activities will be carried out during the next 2 years. Approximate time for the trees to connect naturally to the water table and it is not necessary to carry out more irrigation.

Wildlife monitoring and tree survival will also be carried out within the 4 polygons to be able to evaluate the Groasis technology in this type of land, in order to be able to use it in future reforestations.

Photo gallery

















