



AGRICULTURA
SECRETARÍA DE AGRICULTURA Y DESARROLLO RURAL

inifap
Instituto Nacional de Investigaciones
Forestales, Agrícolas y Pecuarias

Research, Innovation and Linkage Coordination

Annual technical and financial report 2021 Results and products of research projects		
SIGI project number: 1832935351		
Title: Restoration of 645 hectares of degraded land at the San Felipe Bacalar Experimental Site		
Responsible: MC Fernando Arellano Martin		
CIR/CENID headquarters of the Project: CIR Southeast		
Field/Experimental Site, CENID headquarters of the Project: EC Chetumal		
Date of sending the report by the researcher, to the Head of the Experimental Field, DICOVI, Head of Operation and/or Director of CENID, as appropriate:		
<p>co-responsible MC Francisco Montoya Reyes Dr. Mario S. Durán Castillo MC Xavier García Cuevas Dr. José Vidal Cob Uicab Ing. Refugio R. Rivera Leyva</p>	<p>Investigation programme Forest Restoration Honey bee Plantations and Agroforestry Systems Plantations and Agroforestry Systems Plantations and Agroforestry Systems</p>	<p>Field/Site Experimental/CENID EC Chetumal CE Edzna EC Chetumal EC Chetumal CE Mococho</p>

CRITERIA TO CONSIDER

1. FILL IN ALL THE FIELDS OF THE FORM
2. THE REPORT SHOULD BE COMPOSED WITH THE CONTRIBUTIONS OF ALL THOSE RESPONSIBLE





Research, Innovation and Linkage Coordination

A.- Annual technical report 2021

1. Executive Summary

The forest restoration of 645 degraded hectares within the San Felipe Bacalar Experimental Site will be supervised: 559 hectares were affected by forest fires that occurred in 2019 and 2020. And 86 hectares correspond to coconut plantations that were decommissioned, after fulfilling their function, due to the lack of resources for its maintenance. The restoration will be carried out in its entirety by the non-profit Foundation "Plant for the Planet Mexico, AC", in adherence to the committed surface without involving other actions other than the restoration, its related activities (opening gaps, plantation design, transfer of plants, planting, maintenance, replacement) and the research that can be linked to it. For restoration, Plant for the Planet will follow the INIFAP recommendation to use the species *Switenia macrophylla*, *bursera simaruba*, *Spondias mombin*, *Brosimum alicastrum*, *Piscidia piscipula*, *Alseis yucatanensis*, *Simira salvadorensis*, *campechian pouteria*, *Astronium graveolens*, *Sideroxylon salicifolium*, *Trichilia minutiflora* y *sabal yapa*. INIFAP and Plan for the Planet Mexico agreed on a delivery goal of 215 hectares restored annually to complete the restoration no later than December 30, 2023. The verification of compliance with the restoration goals will be carried out by INIFAP researchers through visits periodic inspections and monitoring of the work area. INIFAP researchers will train Plant for the Planet staff to monitor plant diversity and measure aerial carbon. Finally, during the project, the PAAE will be contributed through the delivery of three training courses, attention to a professional from the sector and the realization of three demonstrative days on restoration activities.

2. Objectives and goals

1) General

Supervise the forest restoration actions implemented by the non-profit foundation "Plant for the Planet México, AC" in 645 hectares of areas degraded by forest fires and abandoned areas of coconut plantations in the INIFAP San Felipe Bacalar Experimental Site.

2) Specific

- Carry out periodic visits to the hectares that will be restored by Plant for the Planet Mexico to supervise the progress of restoration through field trips and the observation of established plants.
- Monitor the structure and composition parameters of the plant community in the restored areas.
- Monitor the physical and chemical parameters of soils in the restored areas.

3) Goals

- Restore at least 215 hectares restored by reforestation annually, for a total of 645 hectares of restored degraded forest land in the San Felipe Bacalar Experimental Site by the end of the project.





- At least 30 people trained in topics related to the project during its duration.
- At least one professional from the sector served during the duration of the project.

3.Indicate the activities committed in the reported period.

1. A training course.
2. A professional from the sector served.

Four.Results and progress of the committed activities. (Insert figures, charts, graphs, etc., within this section).

As of April 2021, Plant for the Planet began work at the San Felipe Bacalar Experimental Site. The first tasks consisted of cleaning the surveys between the SE San Felipe Bacalar and the Ejido Lázaro Cárdenas «La Ceiba». Next, guardrails were made on the perimeter of the surface to be restored that year; that is, the 339 ha of semi-evergreen forest affected by a forest fire in 2019. To facilitate restoration actions, «intermediate measurements» were opened to divide the area into «blocks» (Figure 1). Subsequently, gaps were opened for the planting of individuals of native species (Figure 2).



Figure 1.Division of the surface restored during 2021 by Plant for the Planet, AC, within the San Felipe Bacalar Experimental Site. The first two blocks from left to right were not intervened because they were not affected by the fire and because they housed a large number of individuals of *Sabal gretherae* y *Thrinax radiata*, species protected by NOM-059.





Figure 2.Area photograph of a part of the area under restoration during 2021. The photograph shows the gaps for the planting of individuals of native species, as well as those trees that survived the ravages of the 2019 fire.

As of July 2021, Plant for the Planet, AC, began reforestation by means of individuals of native species, for the restoration of the degraded semi-evergreen forest in the «San Felipe Bacalar» Experimental Site. In total, 312,585 trees of 12 species were planted (Table 1). Of this total of individuals, 27,275 correspond to individuals used in replanting to replace those that had died. Simultaneously with planting, Plant for the Planet reported the total number of individuals planted on each surface using its TreeMapper© application.

During August, one of the researchers co-responsible for the project concluded with the attention to a professional from the Plant for the Planet, AC sector, whom he had been training since April 26 in «Vegetation sampling methods for forest monitoring» ». Additionally, researchers co-responsible for the project made a visit to the nursery that supplies Plant for the Planet in September in order to evaluate its production practices and provide technical recommendations that would help improve the quality of the plant produced. Also during September, Plant for the Planet began with periodic maintenance in the plantation gaps to favor the survival of established individuals.



Table 1. Number of planted individuals of the native species used during the reforestation carried out by Plant for the Planet during 2021 at the San Felipe Bacalar Experimental Site.

Species	Quantity
Ramon (<i>Brosimum alicastrum</i> SW.)	60594
Cedar (<i>Cedrella odorata</i> L.)	54695
Pitch (<i>Enterolobium cyclocarpum</i> (Jacq.) Griseb.)	79198
Mother Cocoa (<i>Gliricidia sepium</i> (Jacq.) Walp.)	4178
Milkweed (<i>Luehea speciosa</i> Willd.)	1009
sapodilla (<i>manilkara zapota</i> (L.) P.Royen)	2798
Jabin (<i>Piscidia piscipula</i> (L.) Sarg.)	8633
Passak (<i>Simarouba glauca</i> DC.)	1846
Mahogany (<i>Swietenia macrophylla</i> King)	49908
Maculis (<i>Tabebuia rosea</i> (Bertol.) Bertero ex A.DC.)	28844
Ciricote (<i>cordia dodecandra</i> A.D.C.)	19267
Kanasin (<i>Lonchocarpus rugosus</i> Benth.)	1615
Total	312585

Starting in November and due to the death of some of the established individuals, Plant for the Planet began replanting. In the same month, two of the researchers co-responsible for the project taught the course entitled «Determining factors in the production of quality plants in the nursery».



Figure 3. Researchers co-responsible for the project make a supervision visit to the nursery that supplies Plant for the Planet, AC



The following month, December, the demonstration event committed during this stage of the project was held. The demonstration event was attended by a total of 49 people and was attended by Plant for the Planet authorities at a national and international level. During the event, attendees were presented with a brief history of the SE San Felipe Bacalar, the evidence of the forest fire that gave rise to the project, they were told about the institutional approach for carrying out the project and finally they were shown the restoration work carried out. To the date. After this date, On December 15, two official letters were sent to the authorities of the National Forestry Commission and the Ministry of the Environment and Natural Resources to notify them of the completion of the project in the event that any requirement had to be met with these agencies within the scope of their competition. Finally, it should be mentioned that, based on evaluations carried out by counting and traversing the gaps, until the end of 2021 there was a survival of 85% of the established individuals.



Figure 4. The researcher co-responsible for the project shows those attending the demonstration day the evidence of the forest fire that occurred in the work area during 2020

5. Deviation of results.

a. experimental

b. Changes in the programming of activities and deliverables of the project.

Plant for the Planet found that 120 ha of the area committed to restoration was not actually affected by the fire and that same area is home to the species *Sabal gretherae* HJ Quero and *Thrinax radiata* Lodd. Former Schult & Schult.f., which are protected by NOM-059 (Figure 1). Therefore, it would be counterproductive to intervene in these areas. In a meeting held on October 11 between INIFAP staff and Plant for the Planet, it was agreed that the areas not affected by the fire should not be intervened, but that fire breaks be made in their





perimeters and interiors to reduce the risk of being affected by future forest fires.

Through an official letter dated September 21, 2021, Plant for the Planet, AC, requested INIFAP to modify the plantation design for the restoration of degraded land. Originally, the Technical Annex of the project contemplated a design of 5 × 4 m for the areas of semi-evergreen forest and 3 × 3m for the areas with coconut plantations. For its part, Plant for the Planet requests that the planting arrangement be 4 × 2 m for the medium evergreen forest area. This request was due to the fact that in the lands under restoration the natural conditions and the degrees of affectation are heterogeneous. Therefore, following the same planting arrangement for the entire area to be restored may not only be unfeasible, but also counterproductive to the project's objectives. Also, Due to the fact that part of the originally stipulated area will not be intervened because it was not really affected by the fire, the modification of the plantation design is necessary so that Plant for the Planet can meet its objectives in terms of the number of established trees. Consequently, also during the meeting held on October 11, it was agreed that the plantation design be more «flexible» based on the conditions and degree of impact of the different areas. The plantation designs for each particular area will be jointly agreed upon by the institutions. Also during the meeting held on October 11, it was agreed that the plantation design be more «flexible» based on the conditions and degree of impact of the different areas. The plantation designs for each particular area will be jointly agreed upon by the institutions. also during the meeting held on October 11, it was agreed that the plantation design be more «flexible» based on the conditions and degree of impact of the different areas. The plantation designs for each particular area will be jointly agreed upon by the institutions.

In addition, due to problems in the supply of Tzalam individuals (*Lysiloma latisiliquum* (L.) Benth.) and chacáh (*bursera simaruba*(L.) Sarg.); the institutions jointly agreed that the individuals of these species would be replaced in the future, if the shortage persisted, by bojón individuals (*cordia alliodora*(Ruiz & Pav.) Oken) or ciricote (*cordia dodecandra* A. DC.), or, failing that, increase the number of individuals of cedar (*C. odorata*) and mahogany (*S. macrophylla*). It should be mentioned that these changes do not modify the objectives, goals or deliverables originally contemplated in the project.

c. Indicate if there was a change of co-responsible parties, budgetable reductions and effects on the committed products.

To strengthen the work team, particularly with regard to the production of forest plants in nurseries and at the request of Plant for the Planet, AC, Dr. José Vidal Cob Uicab, attached to CE Chetumal, and Ing. Refugio were included. Ramón Rivera Leyva, assigned to CE Mocochoá. The request for the incorporation of the researchers was made through an official letter dated September 14, 2021, and was authorized by the financial source through official communication no. 001/INIFAP/2021 and by the Southeast CIR through official communication no. JAG.YUC.800.1/273-2021.

It should also be mentioned that, in order to carry out the demonstration event committed to the project, it was necessary to request a change of items from the financial source, since, originally, all the approved resources were stipulated to be used exclusively in item 26102. Through the job no. JAG.Q.Roo.804.1.078/-2021 the financial source was requested to move \$1,000.00 to item 22301, \$5,000.00 to item 22103 and \$3,000.00 to item 33602. The financial source authorized this change of items through official letter no. 004/INIFAP/2021





6. Indicate the committed deliverables of the project and the reporting period.

Deliverables 2021

Nope.	Indicator name	Annual contribution for the fulfillment of the INIFAP goal	Date of compliance (dd/mm/yyyy)
1	Average number of professionals attended per active researcher in the year	1 professional from the sector served	12/30/2021
two	Average of courses, workshops, events, demonstrations and dissemination forums given by active researcher in year n	1 training workshop course for producers, industrial or other users 1 plot establishment or demonstrative module	12/30/2021 12/30/2021

Deliverables 2022

Nope.	Indicator name	Annual contribution for the fulfillment of the INIFAP goal	Date of compliance (dd/mm/yyyy)
1	Average of courses, workshops, events, demonstrations and dissemination forums given by active researcher in year n	1 training workshop course for producers, industrial or other users 1 plot establishment or demonstrative module	12/30/2022 12/30/2022

Deliverables 2023

Nope.	Indicator name	Annual contribution for the fulfillment of the INIFAP goal	Date of compliance (dd/mm/yyyy)
1	Average of courses, workshops, events, demonstrations and dissemination forums given by active researcher in year n	1 training workshop course for producers, industrial or other users 1 plot establishment or demonstrative module	12/30/2023 12/30/2023





7. Indicate the deliverables generated in the period. Indicate SIGI No, type of deliverable(summary, article, file, etc.)and title of the same (insert in annex A: covers or first page of the supporting documents).

Deliverables generated 2021

Nope.	SIGI No.	Kind of deliverable	Deliverable Title
1	010205398900162609	Attention to professional of sector	Vegetation sampling methods for forest monitoring
two	010201236900165352	course instructor or workshop training for professionals, producers, industrial or other industry users productive	Training course "determining factors in the production of quality plants in nurseries"
3	010203398400169070	Establishment of plots or modules demonstrative of transfer of technology	Restoration by reforestation of areas of semi-evergreen forest affected by forest fires

8. Activities scheduled for the next period.

It is planned that during 2022 the supervision visits by INIFAP will continue to the activities that Plant for the Planet, AC will carry out during that year. In 2022, Plant for the Planet, AC will start with the restoration by reforestation in the 220 ha affected by forest fires that occurred in 2020. The activities that Plant for the Planet will carry out will consist of establishing firebreak gaps, opening plantation gaps, cleaning and weeding in the field, collection and processing of seeds, production of forest plants, transfer to plantation sites, drilling, planting, maintenance of the plantation through weeding and cleaning. INIFAP will verify and endorse these activities through technical advice provided during visits to the work site. Also,





Annexes:

- A. Deliverables, covers or first page of the supporting document**
- B. Letter of guarantee that they have the field book and/or log, which may be required in the event of any inspection.**
- C. In the case of co-responsible persons from other centers that handled financial resources, the financial report endorsed by the corresponding administrator must be included.**

B.- Annual financial report in 2021 (thousands of pesos)

Field/Site/CENID Headquarters and branch*	Means approved	means ministered	Means exercised	Balance
EC Chetumal	\$99,600.00	\$99,600.00	\$35,814.59	\$63,785.41
CE Mocochoa	\$5,000.00	\$5,000.00	\$5,000.00	0.00

* Add the data by Field/Site/CENID where resources were dispersed in 2021.

Firms

**MC Ferdinand
Arellano Martin
Investigator
Responsible**

**CP Blanca Alejandra
Rosado Nic
Responsible
Administrative**

**Dr. Ruben Dario Gongora
Perez
DICOVI of INIFAP in
Quintana Roo**





ACHIEVEMENT FORMAT

Research, Innovation and Linkage Coordination

1.achievement title

a. REFERS TO AN ACHIEVEMENT THAT HAS BEEN GENERATED THROUGH RESEARCH DURING 2021

two.brief description

An area of X ha that had been degraded by a forest fire that occurred during 2019 within the «San Felipe Bacalar» Experimental Site was restored through reforestation with native species.

3.Problem:During 2019, 339 ha within the «San Felipe Bacalar» Experimental Site were affected by a forest fire. Consequently, and in accordance with article 121 of the General Law on Sustainable Forestry Development, INIFAP was obliged to restore this area no later than 2021, since said law in the aforementioned article establishes that «the owners and legitimate possessors of forest land they are obliged to carry out, in case of fire, the restoration of the affected surface; when natural regeneration is not possible, restoration will be done through reforestation, paying special attention to the prevention, control and combat of pests and diseases».

Four.describe impacts, Within the project, temporary employment was created for 32 people in localities surrounding the Experimental Site «San Felipe Bacalar», where the project is being carried out, specifically in the ejidos Lázaro Cárdenas «La Ceiba» and Reforma. In this way, the project contributed to mitigating the economic impacts of the COVID-19 pandemic in those localities.

On the other hand, reforestation activities contribute to combating the degradation suffered by the semi-evergreen forest in SE San Felipe Bacalar. In this way, the recovery of the C stocks of the forest vegetation of SE San Felipe Bacalar is promoted and the provision of regulating ecosystem services is promoted, such as the capture of C by the establishment of growing seedlings, support and culture in SE San Felipe Bacalar.

5.Mention availability.X ha of medium evergreen forest under restoration by reforestation in zone IV of the SE «San Felipe Bacalar» in the Ejido Lázaro Cárdenas «La Ceiba», Bacalar, Quintana Roo, Mexico.





6. Area of application, the benefits derived from the project such as temporary employment and ecosystem services are locally applicable to the populations surrounding the SE «San Felipe Bacalar», but the practices and restoration processes carried out can be applied in other areas with medium semi-evergreen forest degraded by forest fires .

7. Allusive photographs of the achievement, with high resolution (of good quality)



Figure 5. Area of the Experimental Site «San Felipe Bacalar» occupied by medium evergreen forest and affected by a forest fire that occurred during 2020.





Figure 6.Opening of gaps in the area affected by a forest fire during 2019 for enrichment with native species for restoration purposes.



Figure 7. Drone photo of the area under restoration during 2021. It is possible to appreciate the enrichment gaps opened in the area, as well as the trees that withstood the onslaught of the fire.





Figure 8.Individuals of native species produced in tubes for use by Plant for the Planet during the restoration of degraded areas in the «San Felipe Bacalar» Experimental Site.



Figure 9.Staff from Plant for the Planet, AC, establishing seedlings of native species for the restoration of degraded areas at the San Felipe Bacalar Experimental Site.





Figure 10. individual of *Cedrela odorata* L. (red cedar) established in one of the enrichment gaps opened during the project.

