

Integration of Biodiversity Data for the Management and Conservation of Wild Bee-Plant Interactions in Mexico

Programme: BID

Project ID: BID-CA2020-021-NAC

Project lead organization: National Commission for the Knowledge and Use of Biodiversity

Project implementation period: 1/7/2021 - 30/6/2023

Report approved: 25/7/2023

Final Narrative Report

Executive Summary

The main objective of the project was to develop a comprehensive data model and database to store information on interactions between native bees and their host plants in Mexico. We believe this objective was achieved. The project was developed according to the planned schedule. The team worked optimally, with excellent communication and coordination, enabling the achievement of all the products and results. The key achievements of the project were as follows: 1) the design of a sufficiently general data model to store information on interactions between native bees and their host plants, as described and inferred from three data sources: i) data available in iNaturalist observations (naturista.mx), ii) entomological collection records, and iii) scientific articles; 2) The first national (Mexico) database was created, integrating information on interactions between native bees and their host plants, using data from the three mentioned data sources; 3) All the committed datasets were assembled, including eco-morphological trait data for both bees and plants, lists of pollinator bee species, and lists of native and economically important plants; and 4) An initial network of potential users of the information was identified, representing different sectors of society. They were involved in various phases of the project to receive feedback and to adjust the data model until reaching the final model.

In terms of impact, the project has positioned itself at the local, national, and international levels. At the local level, contact has been established with representatives from various sectors of society involved in research, productive activities, or environmental education at the municipal and state levels. At the national level, the data model has been recognized as the research platforms for the implementation of the National Strategy for the Conservation and Sustainable Use of Pollinators (ENCUPS). At the international level, the data model will be linked to the Diversifying the GBIF Data Model (Biological Interactions) and contribute to the expansion of The Bee Tool North America.

The main conclusions of our project are as follows: 1) We successfully developed a highly useful data model because: a) it is sufficiently general to gather information on biological interactions from different sources of information; b) it is compatible with the data model structure being developed by GBIF; c) the information that can be integrated and mobilized using it can be easily exported to other biodiversity data exchange formats; d) can be applied to integrate information on other pollinator groups (e.g., birds, bats, beetles, flies, etc.); e) can be applied to integrate information on other types of interactions (floral resource theft, seed predation, competition, parasitism, etc.). 2) The large amount of geographic, ecological, and taxonomic data on interactions native bees - host plants in Mexico collected by the project, is already available for consultation on the GBIF platform. We expect that the mobilized datasets will drive research and management actions focused on the sustainable use and conservation of pollination and pollinators.

The main lessons learned during the project development were as follows: 1) The success of our data model lies in the fact that we identify the information needs of different potential users by mean of two workshops and by establishing a permanent communication throughout the process; 2) The formation of a multidisciplinary team, with experts in bee and plant taxonomy and bioinformatics experts allowed the efficient integration of information on native bee-plant interaction from the three sources of information; 3) The three sources of information resulted ecomplementary: while the records from bibliographic references focused on wild environments, iNaturalist records tended to focus on urban areas and to be ornamental plants. Scientific collection records, on the other hand, were more widely distributed in the territory (wild and urban environments) and covered a greater taxonomic range for both bees and plants. For this reason, to continue the efforts to integrate information from the three sources of data emerged as one of the main lessons of the project; 4) The Xicotli data project, created on the iNaturalist platform specifically for integrating data on interactions between native bees and host

plants, is a tool available to capitalize and add value to the abundant data generated within the framework of citizen science.

It was not initially considered in the project the large volume of information stored on the iNaturalist platform. To filter the useful information an artificial intelligence tool was developed to identify the presence of a floral element and a bee in the same image. On the other side, the highly time-consuming nature of mining information from scientific articles was also not initially considered. To make the work more efficient, another artificial intelligence tool was developed to help automatically identify and extract scientific names of taxa from scientific articles. These two tools were not originally contemplated.

Some of the challenges encountered in the project were as follows: 1) Taxonomic identification of the host plant from the photographs contained in iNaturalist is perhaps the main challenge for the team, as the photographs generally focus on the bee, and the image of the plant is less sharp. Taxonomic identification of the bees were also not straightforward since differentiating one bee species from another requires information that is not always in the photograph. However, the team's experts in both bees and plants managed to identify a large proportion of the photos, at the family, genus, or at the species level; 2) In the case of iNaturalist, there was a licensing issue with the records. Due to the difficulty of filtering the records, we were unable to identify the records with licenses compatible with those permitted in GBIF. This meant that many of the records worked on by the team could not be included in the dataset stored in GBIF; 3) Due to the heterogeneity of the data sources considered, interactions between native bees and host plants must be reported at different taxonomic levels (species-species, species-genus, genus-genus, family-species, etc.) The data model had to consider this variety of information, a point that was not originally considered.

In the short term (6 months to 1 year), the data model and the integrated information from the project will be used to: 1) drive the design of a monitoring protocol for native pollinators in Mexico within the framework of ENCUSP; 2) submit at least one data paper and two manuscripts on interaction networks between native bees and their host plants in Mexican ecosystems; 3) use the published datasets in GBIF for at least two master's theses in ecology and one doctoral thesis, co-supervised by members of the project's research team; 4) contribute to The Bee Tool North America by creating geographic layers that allow visualization of the spatial patterns of interaction between focal groups of native bee species (approximately 100 species) and focal plant groups at the North American scale, using part of the information generated by the project and adjusting the data model structure. In the medium term (1-2 years), we expect the project to 1) drive the initiatives compiled in the 2nd workshop held by the project, and 2) integrate the model into Diversifying the GBIF Data Model (Biological Interactions), and finally 3) we are very interested in continuing the project by applying the data model and the experience acquired to integrate and analyse information of other group of pollinators, as hummingbird. The possibility of compare the geographic patterns of bees vs birds pollination interactions would be of great utility.

Progress against milestones

Has your project completed all planned activities?: Yes

Has your project produced all deliverables: No

Rationale: We have received a first review of the committed data paper with some remarks we must fix. We already fix the comments given by the referee and resubmitted the data paper.

Report on Activities

Summary of the implementation of the project activities

- Model design for integrating biodiversity and ecological data

We have created a data model, called the Xicotli Data model, designed to incorporate any type of pollination interaction (<https://github.com/XicotliData/schemas>). The data model was tested successfully storing our datasets.

As participants in the pilot of the new GBIF data model (<https://github.com/gbif/model-material/tree/master/conabio-bees>), we have discovered some improvements but we also identified that our proposed model was somewhat equivalent to the new data model (<https://www.youtube.com/watch?v=3h3Bv3TU6wQ>). Therefore a mobilization between the Xicotli Data

model to the new GBIF data model will be an easy task.

We have actively socialized the Xicotli Data model so it can be used as part of the Mexican pollinator monitoring strategy. We expect this interaction of our team with the government agencies which are responsible for the implementation of the monitoring strategy to give a better digitalization of pollination interaction and it helps to mobilize data of this kind to external sources like GBIF.

- Workshop 1: What do we need to know about wild bee-plant interactions?

The final title of the workshop was "Hacia un modelo de información para el monitoreo, manejo y conservación de la polinización por abejas nativas en México". The workshop was held on January 13, 2022, in virtual mode (10:00 - 16:30 hrs) ([v=BhK_8sJ4XAc&list=PLDJg7F5BO5iDuDSNtwrkelS7-l-KAA6qe](https://docs.google.com/forms/d/1QhDX3A691ndcc29PsOOSf139fJCK66pCKyqqmT7H8/edit)). The workshop was attended by 70 persons, representing 5 sectors of society, education (52% of attendees); research (20%), agriculture, beekeeping-meliponiculture (15%), government (10%), and others (3%). Nearly 35 institutions and different regions of the country (15 states of the Mexican Republic) were represented in it. As part of the preparations for the workshop, a national survey to identify the information needs of different potential users of the datasets were designed and applied (<https://docs.google.com/forms/d/1QhDX3A691ndcc29PsOOSf139fJCK66pCKyqqmT7H8/edit>). The survey was answered by 203 people. The aim of the workshop - to identify data requirements from different stakeholders-, was successfully fulfilled and that information was used to complement our first data model version. Also, the workshop allowed the identification of key actors and potential users of the data, the first step for an Inter-institutional and multi-sectoral collaboration. Additionally, the workshop is one of the activities associated with the Mexican National Strategy for the Sustainable Use of Pollinators (ENCUSP), particularly in strengthening the monitoring and conservation of the wild bee-plant interaction

- Compilation and curation of primary ecological data.

As part of the project and its deliverables, we have compiled and published more than 22,000 occurrences with information about wild bee-plant interaction, combined on 3 datasets from different sources. We also published more than 3,500 plant and wild bee taxons with morphological traits which have been identified as important to pollination interaction. (<https://www.gbif.org/project/BID-CA2020-021-NAC/integration-of-biodiversity-data-of-wild-bee-plant-interactions-in-mexico#datasets>)

To achieve this large number of mobilized records we have developed some artificial intelligence tools which help the analyst to focus their efforts on meaningful sources (https://bitbucket.org/conabio_cmd/computer_vision-apps/src/master/apps/automatic_annotations/pollinators/).

- Preparation and submission of a data paper.

We have submitted the data paper and we have received the first round of review comments. We already resubmitted the data paper including the referee comments to a second round. We submitted the draft late as scheduled because we have had personnel movement which has delayed the project activities.

- Human resource training

We have worked closely with 4 people who have been trained to record and mobilize bee-plant interaction data. The personnel are also associated with different institutions so we expect that the training received could be replicated in their host institutions.

In Mexico, the Mexican GBIF Node has a particular way of working, on this matter with the assistance of the BID-GBIF-associated personnel, we have changed the mindset of working of the Node. Therefore we are currently helping two institutions to register as publishers on the Mexican GBIF Node, these institutions are associated with trained personnel.

- Launch of the ecological informatics tool and repository.

We are working with CONABIO to create tools to display the information compiled by the project. In this matter, we also are developing improvements in the SPECIES platform (<https://species.conabio.gob.mx/>) to explore, analyze, and display the compiled information.

Another planned collaboration in the frame of the project is the inclusion of the project findings on The Bee Tool (<https://thebeetool.com/>), we expect that at the end of 2023, the integration is going to be completed.

- Workshop 2: Better data to better serve our pollinators.

The title in Spanish of the workshop was "Hacia un Modelo de información para el monitoreo, manejo y conservación de la polinización por abejas nativas en México". The workshop was held on March 27-28, 2023 at CIIDIR-IPN, Oaxaca. On March 27, 2023, we presented the final model to project collaborators and address all their questions to implement the data model. A virtual meeting with 54

members of different social sectors (education, research, agriculture, NGO, and government) was held on the second day, March 28, with attendance from national participants and international participants (Colombia, Costa Rica, and Peru). In this virtual meeting, we presented the data model, and the results obtained from the datasets developed on the project.

- Final report and documentation

Along with the project development, we have written materials to promote the Xicotli Data iNaturalist Project, and we have documented the meaning of the different observation fields created to be used in the project (<https://xicotli-data.github.io/XD-terms-dictionary/>).

The Xicotli Data Model is publicly available on a GitHub repository (<https://github.com/XicotliData/schemas>).

Completed activities

Activity: Model design for integrating biodiversity and ecological data

Description: Definition of relevant information fields to integrate data on bee-plant interactions. These fields provide data on the type of interaction (e.g. floral visitor vs pollinator) and eco-morphological attributes of both bees and plants (e.g. body size, life form, floral traits, plant type: native, exotic, cultivated). This data model design consists of an adaptive process between structure of old and new compiled data.

Start Date - End Date: 1/7/2021 - 30/6/2023

Verification Sources: GitHub - XicotliData/schemas: <https://github.com/XicotliData/schemas>

Activity: Workshop 1: What do we need to know about wild bee-plant interactions?

Description: Organization of a workshop to identify data requirements from different stakeholders. The results from this workshop will be the guideline to the interactions data model specification and possibly the identification of new data providers that were not considered at the start of this project.

Start Date - End Date: 1/10/2021 - 30/11/2023

Verification Sources: Links: https://www.youtube.com/watch?v=BhK_8sJ4XAc&list=PLDJg7F5BO5iDuDSNtwrkeIS7-I-KAA6qe ; Documents: 1. Summary report of the workshop 1 (PDF).

Activity: Compilation and curation of primary ecological data

Description: Based on the design of the data model, the interaction logs between the wild focal bee species and the plants will be compiled and curated. The compilation will be based on the list of species of the three wild bee focal groups listed in SNIB (400 spp). The primary ecological data will be compiled from different sources of scientific documents (scientific papers, thesis, technical reports) via manual revisions, data mining protocols and from other nodes associated with the SNIB (e.g. Naturalista). The information will be curated for both biological components of the interaction.

Start Date - End Date: 1/8/2023 - 1/6/2023

Verification Sources: All dataset are linked to the project website: <https://www.gbif.org/project/BID-CA2020-021-NAC/integration-of-biodiversity-data-of-wild-bee-plant-interactions-in-mexico#datasets>

Activity: Preparation and submission of a datapaper

Description: This document will synthesize the structure of the data model and the integration and use of the compiled information of focal groups of wild bees and their host plants. It will be highlighted how these interactions vary according to the type of ecosystems and the richness of wild bees associated with crops in Mexico. The data analysis will be based on eco-informatic tools available in SPECIES - CONABIO.

Start Date - End Date: 1/12/2022 - 6/6/2023

Verification Sources: 1. (PDF) Attached manuscript submitted

Activity: Human resource training

Description: The activities to carry out the proposed work will involve four interns in biology or data/computational science.

Start Date - End Date: 1/8/2021 - 7/2/2023

Verification Sources: Attached (PDF): Signed contract for four professional interns

Activity: Launch of the ecological informatics tools and repository

Description: Publication of the database, datamodel and analysis tools on a website.

Start Date - End Date: 16/1/2023 - 31/8/2023

Verification Sources: Prototype SPECIES screenshots (Attached PDF)

Datamodel and database creation script are in the repository: <https://github.com/XicotliData/schemas>

Activity: Workshop 2: Better data to better serve our pollinators

Description: Organization of a 2-day workshop to present the wild bee - plant interaction database and provide training on how to use this information and analyze it with our analytical tools. Participants from the first workshop will be important in this workshop.

Start Date - End Date: 20/3/2023 - 21/3/2023

Verification Sources: Attached narrative workshop narrative (PDF)

Link to the recorded presentations: <https://www.youtube.com/watch?v=Tc-gJX7mmpw>

Workshop materials:

<https://drive.google.com/drive/folders/1hcz5lwpgu5tngDqUGVaTcWdWFK9ZQGE6>

Attendance contact list (PDF)

Activity: Final report and documentation

Description: Work on the final report that summarizes the results of this project. Finish learning materials.

Start Date - End Date: 2/1/2023 - 30/6/2023

Verification Sources: Materials share with stakeholders:

<https://drive.google.com/drive/folders/1hcz5lwpgu5tngDqUGVaTcWdWFK9ZQGE6>

XicotliData schemas, database creation: <https://github.com/XicotliData/schemas>

Xicotlidata inat project observation fields definition: <https://xicotlidata.github.io/XD-terms-dictionary/>

Report on Deliverables

Deliverables - Summary

1) Naturalista-based wild bee-plant interactions dataset: During the project, we identified 5,865 interactions between wild bees and plants, but only 4,532 records were possible to be published on GBIF for licensing restrictions. We have also developed an AI bot that helps our team to focus its efforts on useful records, a record is useful if a bee and a plant are sufficiently well photographed to be identified (https://bitbucket.org/conabio_cmd/computer_vision-apps/src/master/apps/automatic_annotations/pollinators/).

Considering the 4,523 published records, it was possible to determine 90 families of host plants. 48% of the records could be determined only up to the plant genus, 38.1% of the records were determined up to the species level, and 13.9% could be determined only to the family level.

2) ECOSUR Mexican wild bee dataset: A huge number of records were possible to be mobilized because of two plant experts who have collaborated and visited the ECOSUR's ECOAB collection. The plant experts were part of the experts trained to mobilize interaction data.

Another important assistance was given by the ecoinformatics Department at CONABIO, its personnel provide tools that help to validate the scientific names and its higher taxonomy of the identified records. The final number of mobilized records in the dataset was 17,432. The bee records are from 5 different families. The families Apidae, Halictidae, and Megachilidae represent 97% of the bee records. There are 310 plants recorded as possible host plants for the reported bees.

We expect that the ECOAB collection will be registered as a publisher to GBIF.

3) Wild bee ecomorphological traits: The dataset includes 2,757 bee taxa from Mexico and Mesoamerica (Mexico till Panama). The compilation was made possible thanks to the collaboration of the bee department of ECOSUR-San Cristobal led by Prof. Remy Vandame. The considered taxa came from 7 families: Apidae (38%), Andrenidae (21%), Megachilidae (18%), Halictidae (16%), Colletidae (6%), Melittidae (. The data model maximizes the use of the DarwinCore fields and GBIF – Extensions and also includes tools available in Plinian Core and Audubon Core, the latter designed to represent metadata for biodiversity multimedia resources and collections. The data model fulfilled the project's main objective, which consists in providing a dynamic source of information for the study, management, and conservation of pollination, and the monitoring of the wild bee-plant interactions.

8) Workshop 1: What do we need to know about wild bee-plant interactions? Workshop. The final title of the workshop was "Hacia un modelo de información para el monitoreo, manejo y conservación de la polinización por abejas nativas en México". The workshop was held on January 13, 2022, in virtual mode (10:00 - 16:30 hrs) ([v=BhK_8sJ4XAc&list=PLDJg7F5BO5iDuDSNtwrkelS7-l-KAA6qe](https://www.youtube.com/watch?v=BhK_8sJ4XAc&list=PLDJg7F5BO5iDuDSNtwrkelS7-l-KAA6qe)). The workshop was attended by 70 persons, representing 5 sectors of society, education (52% of attendees); research (20%), agriculture, beekeeping-meliponiculture (15%), government (10%), and others (3%). Nearly 35 institutions and different regions of the country (15 states of the Mexican Republic) were represented in it. As part of the preparations for the workshop, a national survey to identify the information needs of different potential users of the datasets were designed and applied (<https://docs.google.com/forms/d/1QhDX3A691ndcc29PsOOSfI39fIJCK66pCKyqqmT7H8/edit>). The survey was answered by 203 people. The aim of the workshop - to identify data requirements from different stakeholders-, was successfully fulfilled and that information was used to complement our first data model version. Also, the workshop allowed the identification of key actors and potential users of the data, the first step for an Inter-institutional and multi-sectoral collaboration. Additionally, the workshop is one of the activities associated with the Mexican National Strategy for the Sustainable Use

of Pollinators (ENCUSP), particularly in strengthening the monitoring and conservation of the wild bee-plant interaction.

9) Workshop 2: Data to better serve our pollinators: The second workshop was at CIIDIR-Oaxaca, it was a two days workshop held on March, 27-28, 2023. On the first day we have the presentation of the data model to key stakeholders, and how can it be incorporated into their collections. On the second day, a set of public presentations was made the presentations include the presentation of the data model, how people can contribute to the Xicotli Data iNaturalist project, results obtained from the project, and its datasets. The Mexican National Strategy for the Sustainable Use of Pollinators (ENCUSP) was also a presenter because share some objectives with the project, and the project members were collaborating with them on building a monitoring network. The workshop recording is available at <https://www.youtube.com/watch?v=Tc-gjX7mmpw>. Over 50 people attended the second day in virtual form. At the workshop, we also invited the attendees to participate in a pilot program to incorporate our data model into their data capture process.

Deliverables produced by the project

Dataset deliverables

Naturalista based wild bee-plant interactions dataset

Dataset type: Occurrences

Dataset scope: Biological records of potential host plants of Mexican wild bees identified from Naturalista (Mexican iNaturalist Node) observations.

Number of records: 4,532

Data holder: Naturalista (Mexican iNat host)

Data host institution: Comisión nacional para el conocimiento y uso de la biodiversidad

% complete: 100%

Status update: The product is completed. Even we have produced more occurrence data, we could not mobilized this information to GBIF because the iNaturalist licensing rules.

DOI: 10.15468/m4r9h2

Expected date of publication:

ECOSUR Mexican wild bee dataset

Dataset type: Occurrences

Dataset scope: Specimen collected dataset with information about plant interaction. This collection is focused on Mexican native wild bees, their trait information and interactions.

Number of records: 17,432

Data holder: ECOSUR-San Cristobal

Data host institution: Comisión nacional para el conocimiento y uso de la biodiversidad

% complete: 100%

Status update: We have proposed to mobilize around 3,000 records but we could exceed that target by a big margin. This dataset has also been transformed and ingested in the new GBIF data model

DOI: 10.15468/xdzgbt

Expected date of publication:

Wild bee ecomorphological traits

Dataset type: Checklist

Dataset scope: Mexican wild bee checklist. Describe wild bee ecomorphological traits useful for the identification of their type of interaction with plant species. Record finding of bee-plant interaction

Number of records: 2,757

Data holder: ECOSUR-San Cristobal

Data host institution: Comisión nacional para el conocimiento y uso de la biodiversidad

% complete: 100%

Status update: The checklist was mainly compiled from a thorough compilation and review of different bee collections. The compilation was always accompanying with the bee lab of ECOSUR, which held the most complete bee biological collection.

DOI: 10.15468/m78tu9

Expected date of publication:

Wild bee host plants ecomorphological traits

Dataset type: Checklist

Dataset scope: Describe ecomorphological traits of plants for the identification of syndromes which favor the interaction from a wild bee and plant. Characteristics of the plants flowers are included.

Number of records: 983

Data holder: ECOSUR-San Cristobal

Data host institution: Comisión nacional para el conocimiento y uso de la biodiversidad

% complete: 100%

Status update: As a result of the compilation of different occurrences with associated plant taxa, the bee lab from ECOSUR create the initial checklist. With the initial checklist a group of taxonomy experts from INECOL-Bajo validate the taxonomic name, and assign its higher taxa, and relevant plant traits (flower shape, flower color, and life form)

DOI: 10.15468/2u8hyh

Expected date of publication:

Mexican wild bees-plant interactions from literature

Dataset type: Occurrences

Dataset scope: From each bibliographic source, the scientific names of the wild bees and host plants were extracted together with the geographic data and the type of the interaction

Number of records: 346

Data holder: Comisión nacional para el conocimiento y uso de la biodiversidad

Data host institution: Comisión nacional para el conocimiento y uso de la biodiversidad

% complete: 100%

Status update: The committed records were published. Currently we have a backlog of more records that should be processed and we have planned to mobilized in a latter time

DOI: 10.15468/pev9m2

Expected date of publication:

Other deliverables

Wild bee-Plant interaction data model

Description: Data model that defines wild bee's features relevant for identifying type of interactions with host plants (mainly morphological features). Data model for wild bees' host plants that helps identify syndromes and relations with each species of wild bee. Data model for wild bee - plant interactions, this model defines all the features intrinsic to an interaction.

% complete: 100%

Status update: The data model and its database creation script was publicly available

Sources of verification: <https://github.com/XicotliData/schemas>

Workshop 1: What do we need to know about wild-bee plants interactions?

Description: Workshop to identify data requirements from different stakeholders. The result from this workshop should be a guideline to the interactions data model specification.

% complete: 100%

Status update: The workshop was held on January 13, 2022

Sources of verification: https://www.youtube.com/watch?v=BhK_8sJ4XAc&list=PLDJg7F5BO5iDuDSNtrkelS7-l-KAA6qe

Workshop 2: Data to better serve our pollinators.

Description: Presentation of the wild bee - plant interactions database and training on how to use this information and tools to further analyze it.

% complete: 100%

Status update: The workshop was held from March 27 to March 28.

Sources of verification: <https://www.youtube.com/watch?v=Tc-gJX7mmpw>

Events

Open-House

Dates: 2023-09-30 - 2021-09-30

Organizing institution: Instituto de Ecología (INECOL)

Country: Mexico

Number of participants: 300

Comments: Open House is an annual scientific divulgation event aimed at the general public. In 2021 it was held virtually. Our participation was carried out with an interactive talk entitled: "Xicotli Data abejas silvestres y sus plantas" (Xicotli Data: Wild Bees and their plants).

Website or sources of verification: <https://youtu.be/lzw5WbKXV1Q?t=1780>

Events

Workshop "Toward a data model for monitoring, management, and conservation of the pollination by wild bees in Mexico"

Dates: 2022-01-13 - 2022-01-13

Organizing institution: CONABIO, INECOL, ECOSUR, and CIIDIR-IPN Oaxaca

Country: Mexico

Number of participants: 70

Comments: he workshop was attended by 70 assistants, representing 5 sectors of society: education (52% of attendees), research (20%), agriculture, beekeeping-meliponiculture (15%), government (10%), and others (3%). Nearly 35 institutions and different regions of the country (15

states of the Mexican Republic) were represented in it.

Website or sources of verification: https://www.youtube.com/watch?v=BhK_8sJ4XAc&list=PLDJg7F5BO5iDuDSNtwrkelS7-I-KAA6qe

Events

Survey: Wild Bees and their flowers

Dates: 2022-01-01 - 2022-06-30

Organizing institution: INECOL, CONABIO, ECOSUR, CIIDIR-IPN Oaxaca

Country: Mexico

Number of participants: 204

Comments: The survey was answered by 203 people. The aim of the workshop - to identify data requirements from different stakeholders-, was successfully fulfilled and that information was used to The survey was answered by 203 people. The aim of the workshop - to identify data requirements from different stakeholders-, was successfully fulfilled and that information was used to complement our first data model version. Also, the survey allowed the identification of key actors and potential users of the data, the first step for an Inter-institutional and multi-sectoral collaboration

Website or sources of verification:

(<https://docs.google.com/forms/d/1QhDX3A691ndcc29PsOOSfI39fIJCK66pCKyqqmT7H8/edit>) and (https://docs.google.com/forms/d/1_rNDY_iuI0AH0LjelYiVRjv4xJ5Aw3XD0RaOz92Hbi8/edit)

Events

Mexico-Mesoamerica Bee Biodiversity Initiative Meeting

Dates: 2021-09-13 - 2022-05-22

Organizing institution: Scientists and citizen initiative

Country: USA

Number of participants: 27

Comments: This initiative brought together a large group of specialists in studying bees native to North America. Our participation focused on highlighting the use of the DwC standard to integrate and mobilise ecological data from bee-plant interactions. Thus, we managed to provide further visibility to our project.

Website or sources of verification: <https://youtu.be/DWxMe8wtUyM?t=3321>

Events

Towards an information model for the monitoring, management and conservation of pollination by native bees in Mexico. Second workshop

Dates: 2023-03-27 - 2023-03-28

Organizing institution: CONABIO, INECOL, ECOSUR, and CIIDIR-IPN Oaxaca

Country: Mexico

Number of participants: 63

Comments: The first day we have the presentation of the data model to project stakeholders, and how can it be incorporated into their collections. On the second day, a set of public presentations was made the presentations include the presentation of the data model, how people can contribute to the Xicotli Data iNaturalist project, results obtained from the project, and its datasets.

Website or sources of verification: <https://www.youtube.com/watch?v=Tc-gJX7mmpw> (recording)

Communications and visibility

The results of the project are being communicated through different activities: First of all, the workshop “Towards to a data model for monitoring, management, and conservation of the pollination by wild bees in Mexico” (Spanish name: “Hacia un modelo de información para el monitoreo, manejo y conservación de la polinización por abejas nativas en México”) brought together key potential users, which strategically made it possible to publicize the existence of this project, socialize its objectives, publicize the Naturalista project, Xicotli data: las abejas mexicanas y sus flores.

The second workshop first reviews the options of the data model implementation with project stakeholders and also presents in a friendly way the main considerations for the data model to workshop participants. In the workshop, we also invite the audience to participate in the Xicotli Data iNaturalist project to contribute to expanding the number of identifications of bees, plants, and better photos to facilitate plant identification. Preliminary results in the published dataset were shown. We also publicize some of the project datasets by email (find PDF attached), and social media (<https://twitter.com/XicotliData>).

We have attended forums to share our results like the one organized by the Commission for

Environmental Cooperation (https://twitter.com/CCA_Espanol/status/1650513356468396032?s=20 and attached PDF poster).

We are working on the publication of a data paper, and some other publications to share the lesson learned in the project.

Monitoring and evaluation

Final Evaluation

Throughout the project, we recognized the need to systematically compile biological interactions. In the initial phase, we faced the challenge of developing a unified approach to store information about the interactions between biological entities as pollinators. Our task was complicated by the diverse range of information available from different sources such as citizen science portals, research publications, and biological collections. Abstracting this variety of information into a single repository proved to be a daunting task.

To overcome this challenge, we engaged in extensive discussions with team members and key stakeholders. These deliberations led us to devise a satisfactory data model that would enable us to consolidate data from various sources. During the pilot of the new GBIF data model, we discovered striking similarities between their proposed model and ours. However, we also identified a few deficiencies in our data model. For instance, we initially overlooked how to store sampling events, but we intend to address this in future iterations. Additionally, through the pilot program, we realized that the resourceRelationship field could have multiple contexts, which presented a potential problem. To tackle this issue, we decided to employ an ontology to restrict the possible storage values to terms indicative of biological interactions.

One of the aspects we take pride in is our decision to gather information from diverse sources. This approach enabled us to create distinct datasets that revealed complementary information both spatially and biologically. We firmly believe that the compilation we have accomplished will prove beneficial to stakeholders across various sectors, including agriculture, beekeeping, government, and academia. By utilizing a data-driven approach with more comprehensive data, these actors can enhance their decision-making processes.

We were pleasantly surprised by the number of records mobilized during the project. However, we attribute this success to the implementation of AI-assisted tools, which aided us in focusing our curation process on more relevant information. The use of AI tools has opened up new possibilities for improving future mobilization projects.

We also found the presentation on GBIF and the use of IPT for data mobilization to be highly informative and constructive. Throughout the project, Leonardo Buitrago provided invaluable support, promptly answering all our inquiries and offering supervision. His feedback on the quality of our published datasets proved instrumental in ensuring the high standards we aimed to achieve.

Best Practices and Lessons learned

When we worked with the iNaturalist dataset we took advantage of the taxonomic backbone and it was beneficial to have this aid when creating the records for the dataset. We have found that a taxonomic backbone is always necessary, even if there is not 100% coverage of taxon names.

Reviewing data licensing options is also important because in iNaturalist the licensing options don't only cover the image and the record it also covers the attached data from other users, and there is an implicit translation of the property of the new information like the one we produced.

Post Project activities

We will continue promoting the Xicotli Data iNaturalist project so that more people could create a set of new plant identifications for the bee records. In this matter, we also want to review how to add the information we have created to be shared with the Globi platform.

We have created a collaboration with the Mexican National Strategy for the Sustainable Use of Pollinators and we expect to provide our experience in creating the data model to include its use in the monitoring efforts of the strategy.

We also going to work with the Commission for Environmental Cooperation to include our findings in wild bee-plant interaction to be included in the BeeTool platform.

Sustainability

Sustainability Plans

We have engaged with the Mexican National Strategy for the Sustainable Use of Pollinators in the pollinator monitoring track. We proposed to use the developed data model to capture the monitoring events within the Strategy. We expect that the information compiled by the monitoring events can be included in the Mexican National Biodiversity Information System and later be published in the GBIF portal.

We also published some material to give guidelines to contribute to the Xicotli Data iNaturalist project. We have invited botanist associations to contribute to plant identification in the project.

ECOAB collection from ECOSUR has already adopted our ideas to include information about interactions between wild bees and plants. This is a very important result of the project because the ECOAB collection is one of the largest and most complete bee collection in Mexico, and its personnel also advise other smaller collections along Mexico and Central America.

These collaborative efforts and the integration of our project's outcomes into existing systems and collections are key elements in ensuring the sustainability and long-term impact of our work. By establishing connections with national strategies, inviting participation from relevant associations, and influencing established collections, we have laid the foundation for continued progress and future developments in the field of pollinator monitoring and biodiversity research.

Impact of COVID-19 pandemic on project implementation

The pandemic has not had adverse effects on the project. The personnel who travel to different biological collections don't suffer from lockdown or travel restrictions. In the second workshop, we can have it in person with some participants and we take advantage of the new ways of communication with a hybrid meeting.

GBIF leads the Biodiversity Information for Development (BID), a programme funded by the European Union. The programme provides supplementary support for activities addressing the needs of regional researchers and policymakers through mobilization and use of biodiversity data.

