

North America Blue Carbon Maps

Cartographic Integration Process

Commission for Environmental Cooperation

North America Mangroves Map update process

This document describes the processes conducted to update the North America Mangroves distribution map published by the Commission for Environmental Cooperation (CEC) in 2015. The overall process comprises data search of new or updated mapping sources describing the spatial distribution of Mangroves across North America, data review, data selection and cartographic integration of the selected data.

An initial review of the datasets used in the 2015 North America Mangroves distribution map and an exhaustive search for data updates or new datasets available was conducted by the Mexican Carbon Program, that reviewed 13 mangroves datasets ranging from global to regional scale (Table 1).

Table 6. Initial mangroves datasets collected and reviewed.

| | Dataset | Geometry | Source |
|----|---|----------|--|
| 1 | Global Mangrove Watch (1996 - 2016) | Polygon | World Conservation Monitoring Center-United Nations Environment Programme |
| 2 | Mexico mangroves distribution (2015) | Polygon | National Commission for the Knowledge and Use of Biodiversity |
| 3 | Mangroves in Ahome, Sinaloa (1) | Polygon | Costa Salvaje Mexico |
| 4 | Mangroves in Ahome, Sinaloa (2) | Polygon | Costa Salvaje Mexico |
| 5 | Mangroves in Bahía Magdalena | Polygon | Costa Salvaje Mexico |
| 6 | Mangroves in La Paz, Baja California Sur | Polygon | Costa Salvaje Mexico |
| 7 | Mangrove distribution in the coast of Chiapas | Polygon | Pronatura-Chiapas, Ecosur |
| 8 | Mangrove distribution in Laguna de Terminos, Campeche | Polygon | Instituto Nacional de Ecología y Cambio Climático - United Nations Development Programme |
| 9 | Mangrove distribution in La Encrucijada, Chiapas | Polygon | Instituto Nacional de Ecología y Cambio Climático - United Nations Development Programme |
| 10 | Mangrove distribution in Pantanos de Centla | Polygon | Cecropia - Sustentabilidad y Acción Climática |
| 11 | USA Mangroves distribution from the National Greenhouse Gases Inventory | Point | USA Environmental Protection Agency |

| | | | |
|----|--|-------|--|
| 12 | Mangrove locations in Tuxpan, Veracruz | Point | Agustín de Jesús Muñoz Basañez (Universidad Veracruzana) |
|----|--|-------|--|

| | | | |
|----|---|-------|--|
| 13 | Mangrove locations in estero El Soldado | Point | |
|----|---|-------|--|

In a second review of the mangrove datasets, each of them was evaluated and identified for suitability in the update process. Based on this second review, a final list of mangrove datasets was defined to be used in the mapping integration process representing the spatial distribution of mangrove ecosystems across North America. The following list offers a summary of the second review of mangroves datasets.

1. Global Mangrove Watch (1996 - 2016)

This layer was not used as this one corresponds to "Global Mangrove Watch" layer and not to the Global Mangrove Distribution

2. Mexico mangroves distribution (2015)

The National Commission for the Knowledge and Use of Biodiversity (CONABIO) has already released an updated version of this datasets in the 2020 Mangrove distribution map of Mexico.

3. Mangroves in Ahome, Sinaloa (1)

The area represented in this layer is already mapped in the new Mexican Mangrove Map 2020 published by CONABIO.

4. Mangroves in Ahome, Sinaloa (2)

The area represented in this layer is already mapped in the new Mexican Mangrove Map 2020 published by CONABIO.

5. Mangroves in Bahía Magdalena

The area represented in this layer is already mapped in the new Mexican Mangrove Map 2020 published by CONABIO.

6. Mangroves in La Paz, Baja California Sur

The area represented in this layer is already mapped in the new Mexican Mangrove Map 2020 published by CONABIO.

7. Mangrove distribution in the coast of Chiapas

The area represented in this layer is already mapped in the new Mexican Mangrove Map 2020 published by CONABIO.

8. Mangrove distribution in Laguna de Terminos, Campeche

The area represented in this layer is already mapped in the new Mexican Mangrove Map 2020 published by CONABIO.

9. Mangrove distribution in La Encrucijada, Chiapas

The area represented in this layer is already mapped in the new Mexican Mangrove Map 2020 published by CONABIO.

10. Mangrove distribution in Pantanos de Centla

The area represented in this layer is already mapped in the new Mexican Mangrove Map 2020 published by CONABIO.

11. USA Mangroves distribution from the National Greenhouse Gases Inventory

This dataset contains updated point locations of mangrove distribution across the United States.

12. Mangrove locations in Tuxpan, Veracruz

This dataset contains sample point locations in the Tumilco mangrove area in Tuxpan Veracruz and it has been derived from a master's thesis field work.

13. Mangrove locations in estero El Soldado

There is no metadata information, the sources of this dataset are unknown.

Derived from the second review of the initially identified and reviewed mangroves datasets covering the North American region. A final list of datasets was defined to be used as main inputs in the new North America Mangrove distribution map. Some of the datasets were acquired later than the initial data collection, Table 2.

Table 7. Final datasets for the North America Mangroves Map update.

| | CODE | Name | Version | Resolution/ Scale | Spatial Reference | Year of Origin | Year of Publication | Coverage | Source |
|----------|-------|--|---------|----------------------|----------------------|-------------------|------------------------|----------|---|
| Polygons | MG_01 | Global Distribution of Mangroves USGS (2011) | 1.3 | 30 meters | WGS 1984 | 2011 | 2015 | Global | UN World Conservation Monitoring Centre |
| | MG_02 | Distribución de los manglares en México en 2020 | 1 | 1:50,000 | WGS 1984 | 2020 | 2021 | Mexico | National Commission for the Knowledge and Use of Biodiversity |
| | MG_03 | Distribución de manglar perturbado de México en 2020 | 1 | 1:50,000 | WGS 1984 | 2020 | 2021 | Mexico | National Commission for the Knowledge and Use of Biodiversity |

Preprocessing by dataset

MG_01. Global Distribution of Mangroves USGS (2011)

A “selection by attributes process” was performed to isolate all mangrove polygons within the United States and Mexico territories. All polygons located in the USA territories over the Pacific Ocean as well as Puerto Rico were deselected. A final saltmarshes layer was exported from the remaining polygons selection.

MG_02. Distribución de los manglares en México en 2020

No preprocessing was needed for this dataset.

MG_03. Distribución de manglar perturbado de México en 2020

No preprocessing was needed for this dataset.

2021 North America Mangroves Distribution Map, Cartographic Integration Process

1. All preprocessed polygon spatial layers (MG_01 - MG_03) were reprojected from their original Coordinate Reference System (CRS) to the standard North American Atlas CRS (Table 3).

Table 8. North American Atlas, Coordinate reference System

| | |
|---------------------------|-------------------------------------|
| Projection | Lambert Azimuthal Equal Area |
| Linear Unit | Meters (1.0) |
| False Easting | 0.0 |
| False Northing | 0.0 |
| Central Meridian | -100.0 |
| Latitude of Origin | 45.0 |
| Datum | D Sphere ARC INFO |
| Spheroid | Sphere ARC INFO |
| Semimajor Axis | 6370997.0 |
| Semiminor Axis | 6370997.0 |
| Inverse Flattening | 0.0 |

2. Definition of standard attribute fields that describe common information recorded in most of the input datasets (Table 4).

Table 9. Standard attribute fields defined for the North America Mangroves polygons Map update.

| Field Name | Definition | Data Type | Description |
|-------------------|---------------------|-----------|--|
| COUNTRY | Country | Text | Country of location of each polygon (CAN: Canada, USA: United States of America, MEX: Mexico) |
| STATEABB | State or Province | Text | State or province code defining the location of each polygon (two letters country code + two letters state/province code) |
| NAME | Reported Name | Text | Name of the features described by each polygon, as reported by the source of each dataset |
| INPT_SRCE | Input Source | Text | Description of the original dataset used to acquire each polygon |
| YEAR_PUB | Year of Publication | Long | Year of the publication of the last update of the dataset used as input |
| RESP_PARTY | Responsible Party | Text | Name of the entity responsible on providing each dataset |
| YEAR_ORGN | Year of Origin | Text | Year of origin of data reported by the source of each dataset (this can be year when data was taken or when the data was originally published by the source) |
| SURVEY_MET | Survey Method | Text | Reported method of data acquisition as reported by the source of each dataset |
| SCAL_RPRTD | Scale Reported | Text | Scale of the input data used in each polygon or general dataset as reported by the source |
| RESL_RPRTD | Resolution Reported | Text | Resolution of the input data used in each polygon or general dataset as reported by the source |
| SOURCE_DES | Source Description | Text | General description of the source dataset used to derive each polygon |
| CITATION | Citation | Text | Full citation of the used data source |
| SOURCE_ID | Source ID | Text | Identification code of the datasets reported in the data sources full description document |

3. GIS steps to integrate selected and preprocessed Mangroves datasets.

As some of the datasets show spatial overlaps, some criteria were defined to deal with overlapping polygons from different data sources and keep as much spatial information as possible.

In order to define the criteria to prioritize sources datasets on areas where information overlaps, the Mexican Carbon Program conducted a series of three national workshops with experts from Canada, the United States and Mexico.

Experts were asked to rank the sources datasets features that should be considered when selecting the sources of information that must prevail over areas with overlapping polygons. Six quality features were evaluated by the experts, comprising:

- Most updated datasets
- Fine spatial resolution over coarse spatial resolution
- Datasets reporting accuracy
- National or regional datasets over global datasets
- Independent research studies over institutional datasets
- Most complete metadata

A group of eleven experts participated in a survey to rank the criteria (Table 5).

Table 10. Group of Blue Carbon experts from Canada, the United States and Mexico.

| | Name | Country | Institution | Email |
|----|-------------------------------|---------------|---------------------------------|--------------------------|
| 1 | Nate Herold | United States | NOAA | nate.herold@noaa.gov |
| 2 | Margot Hessing-Lewis | Canada | Hakai Institute | margot@hakai.org |
| 3 | Gail Chmura | Canada | McGill University | gail.chmura@mcgill.ca |
| 4 | Dan Mulrooney | Canada | Parks Canada | dan.mulrooney@canada.ca |
| 5 | Anna Hilting | United States | NOAA | anna.hilting@noaa.gov |
| 6 | María Teresa Rodríguez Zúñiga | Mexico | CONABIO | mrodrig@conabio.gob.mx |
| 7 | Joanna Acosta Velázquez | Mexico | Aura: manglares y costas, S. C. | joanna.acosta@gmail.com |
| 8 | Iliana Pérez Espinosa | Mexico | COANBIO | iperez@conabio.gob.mx |
| 9 | Carlos Troche | Mexico | CONABIO | ctroche@conabio.gob.mx |
| 10 | Beatriz Carolina Corral Osuna | Mexico | INECC | beatriz.corral@gmail.com |
| 11 | Zulia Mayari Sánchez Mejía | Mexico | Instituto Tecnológico de Sonora | zulia.sanchez@itson.edu |

Based on the survey results, data features were ranked by the experts from the three countries as shown in the figure below (Figure 1).

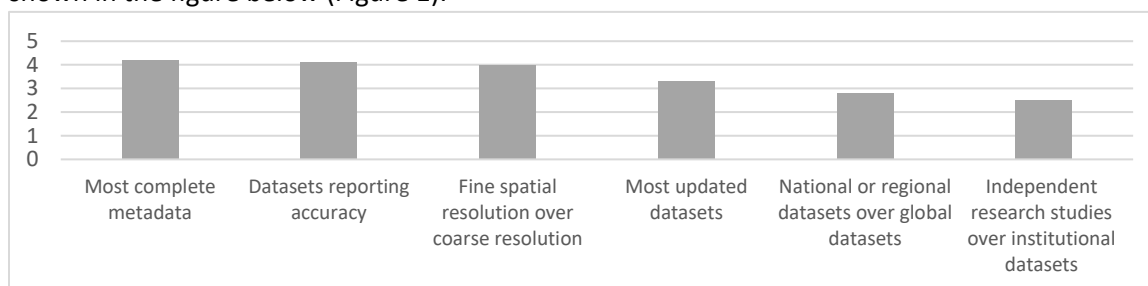


Figure 2. Criteria for spatial layers prioritization defined by the Blue Carbon group of experts.

As a result of the experts-defined criteria and the characteristics of the information provided by each source dataset, we defined each dataset as authoritative over its corresponding region.

The Mexico Mangrove Distribution map and the Disturbed Mangrove distribution map produced by the National Commission for the Knowledge and Use of Biodiversity (CONABIO) were defined as the only authoritative sources over Mexico. Thus, mangrove distribution data provided by the WCMC map was not used as input layer over Mexico.

Mangrove polygons from both mangrove distribution and disturbed mangrove distribution over Mexico spatially complement each other without any overlapping, thus, no further processes were required prior the use of these layers for the North America Mangrove distribution map.

Step 01

All polygons from the WCMC Global Distribution of Mangroves corresponding to USA territory were selected and exported to a new spatial layer.

Output = WCMC_mangroves_laea_final.shp

Step 02

All the layers previously prepared and preprocessed with no overlapping areas between source data sets were merged in a new spatial layer.

- WCMC_mangroves_laea_final.shp
- MEX_mangroves_laea_final.shp
- MEX_disturbed_mangroves_laea_final.shp

Output = NorthAmerica_mangrove_layers_merge.shp

Step 03

A process of “Multipart to Single part” was applied to the output layer from the previous step. This way, all polygons are individually accounted as single polygons, which will allow to dissolve spatially connected polygons that share the same values in all the attribute fields.

Output = NorthAmerica_mangrove_layers_singlepart.shp

Step 04

A “Dissolve” process was applied to the output layer from the previous step. All individual polygons that are spatially connected and share the same values across the thirteen common attributed fields (except area) will break down into new polygons. This way, the number of polygons and the size of the final spatial layer file is reduced. No multipart features creation is allowed in this step.

Output = NorthAmerica_mangrove_polygons_dissolve.shp

Step 05

A new field "AREA_SQMT" is created and the area in squared meters is calculated for this field. The area is calculated based on the map coordinate reference system.

Step 06

After a final check of attribute table consistency and data display on different GIS platforms, a spatial data file in ESRI "shp" format is generated to provide the final CEC North America mangroves distribution map.