



# Natural Capital Accounting and Valuation of Ecosystem Services in Mexico 2017-2019

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# Background

- Mexico's national statistical agency (INEGI) has been compiling and publishing integrated environmental-economic accounts since 1994 following the UN SEEA-CF
- 2014: Mexico, Bhutan, Chile, Indonesia, Vietnam, Mauritius and South Africa pilot countries for the *Advancing Natural Capital Accounting* (ANCA) project.
- ANCA Project in Mexico (2014-2016):
  - suppliers and users of environmental-economic information,
  - country's environmental policy priorities,
  - stakeholders and existent technical capacities.
  - interinstitutional technical working group established,
  - technical capacities developed,
  - steps necessary to advance and test the SEEA-EEA framework in Mexico outlined,
  - initial pilot study for the State of Aguascalientes:
    - ecosystem extension accounts (2002, 2011)
    - changes in ecosystem extension 2002 - 2011,
    - condition accounts: soil erosion, biodiversity, water supply and soil carbon content.

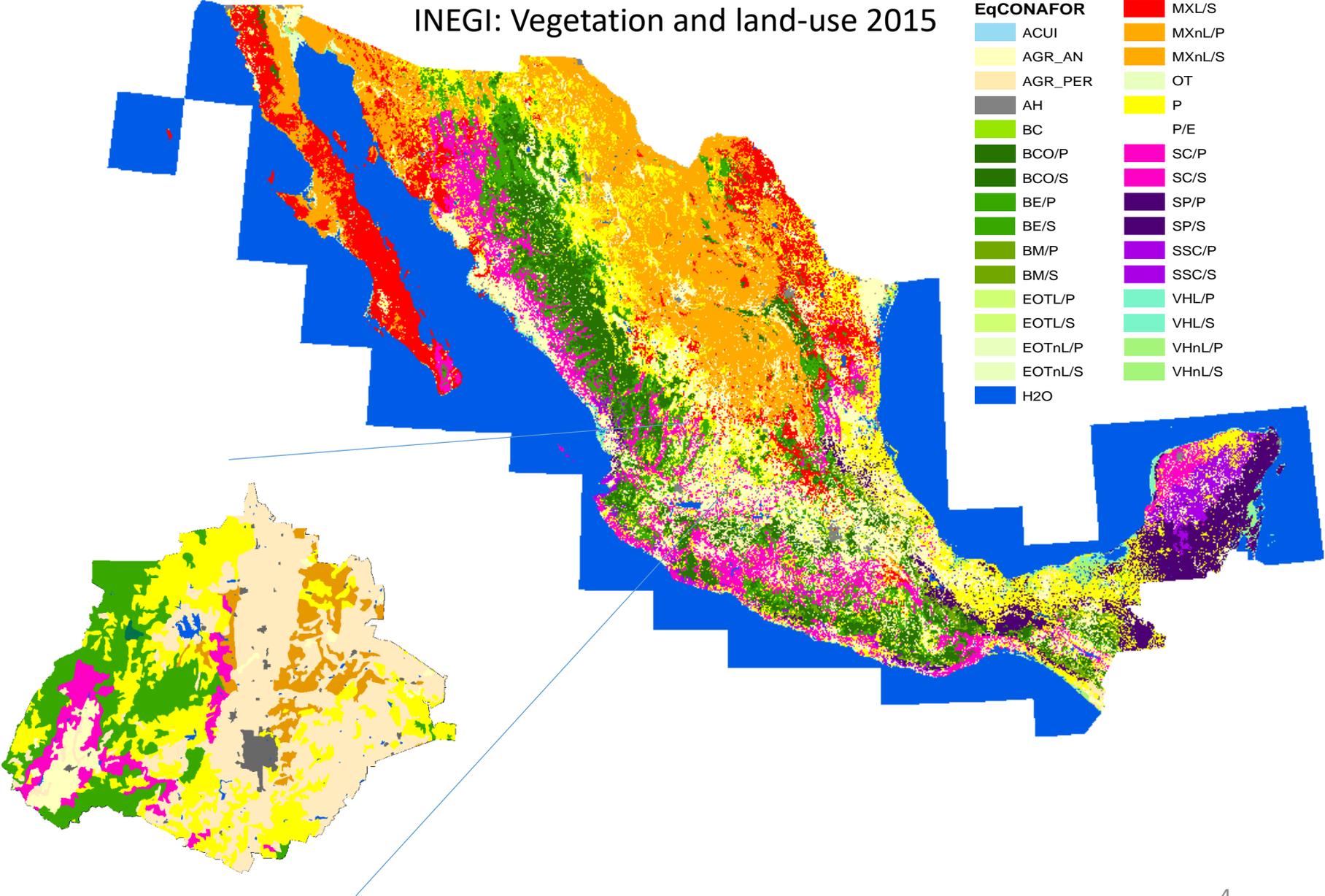


# Background

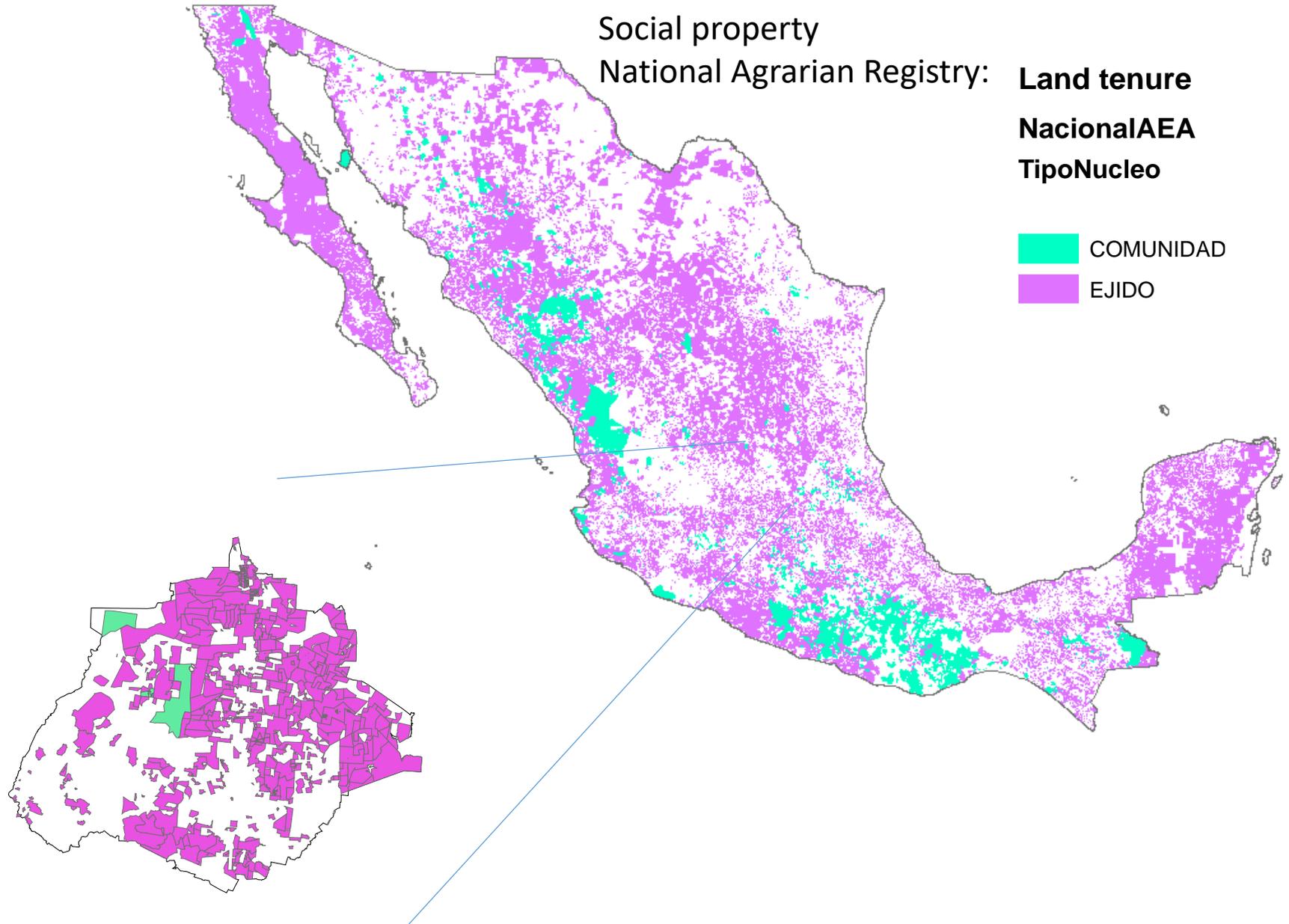
- 2017: Mexico, Brazil China, India and South Africa, pilot countries for the *Natural Capital Accounting and Valuation of Ecosystems Services* project.
- Mexico project officially launched in June 2017 in Mexico City.
- Project implementation began in September, 2017
- Initial work:
  - review data availability and modelling capacities viz a viz the country's environmental policy priorities.
  - Activities to be carried out in 2018 defined
  - List of activities endorsed by Interinstitutional Technical Group in February, 2018
- Activities for 2018
  - Complete/augment the Aguascalientes pilot study
  - Other State-level pilot studies
  - Country-wide pilot studies
  - Reach-out activities
  - Capacity building activities

# Ecosystem classification

INEGI: Vegetation and land-use 2015

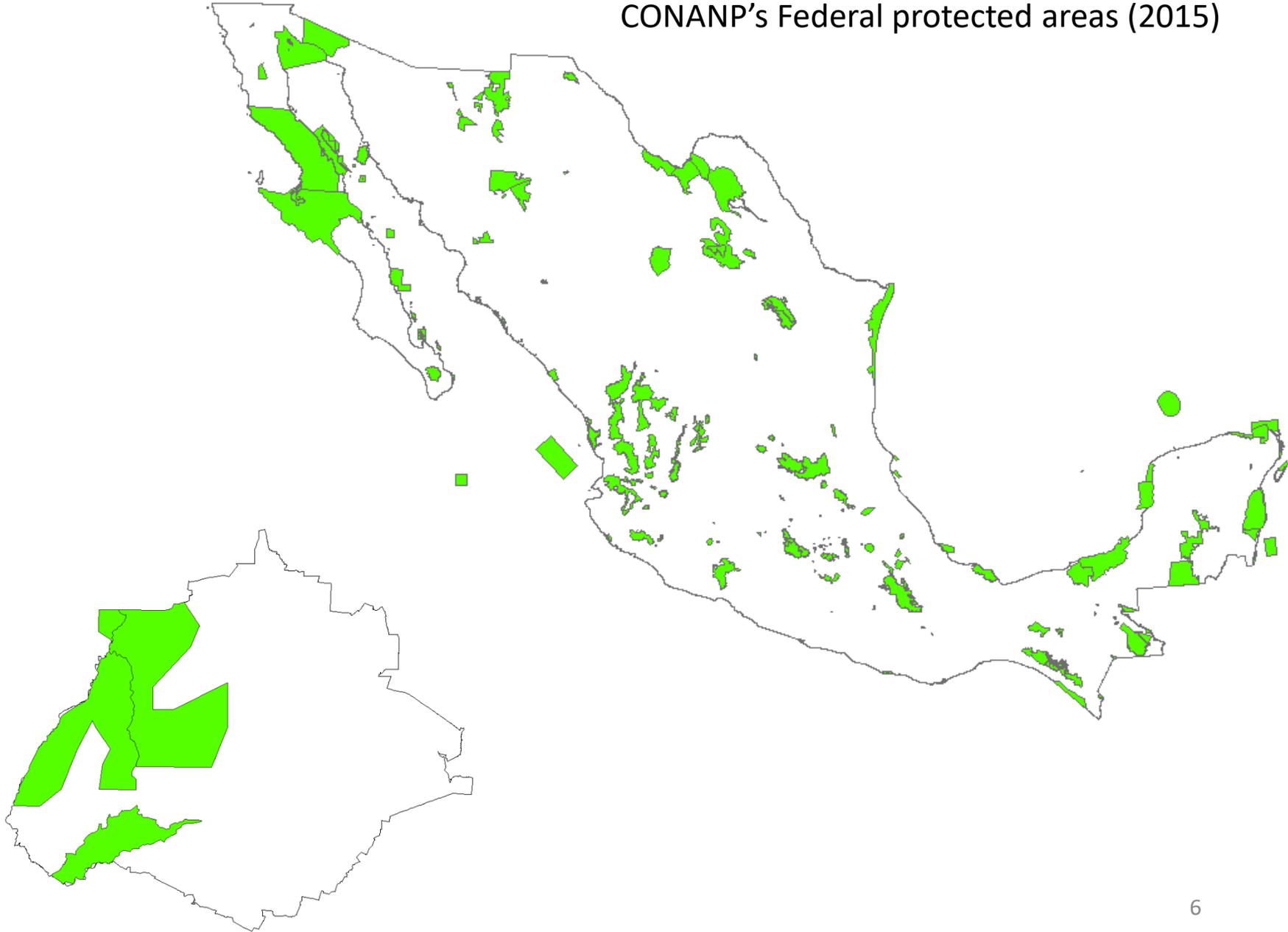


# Ecosystem classification

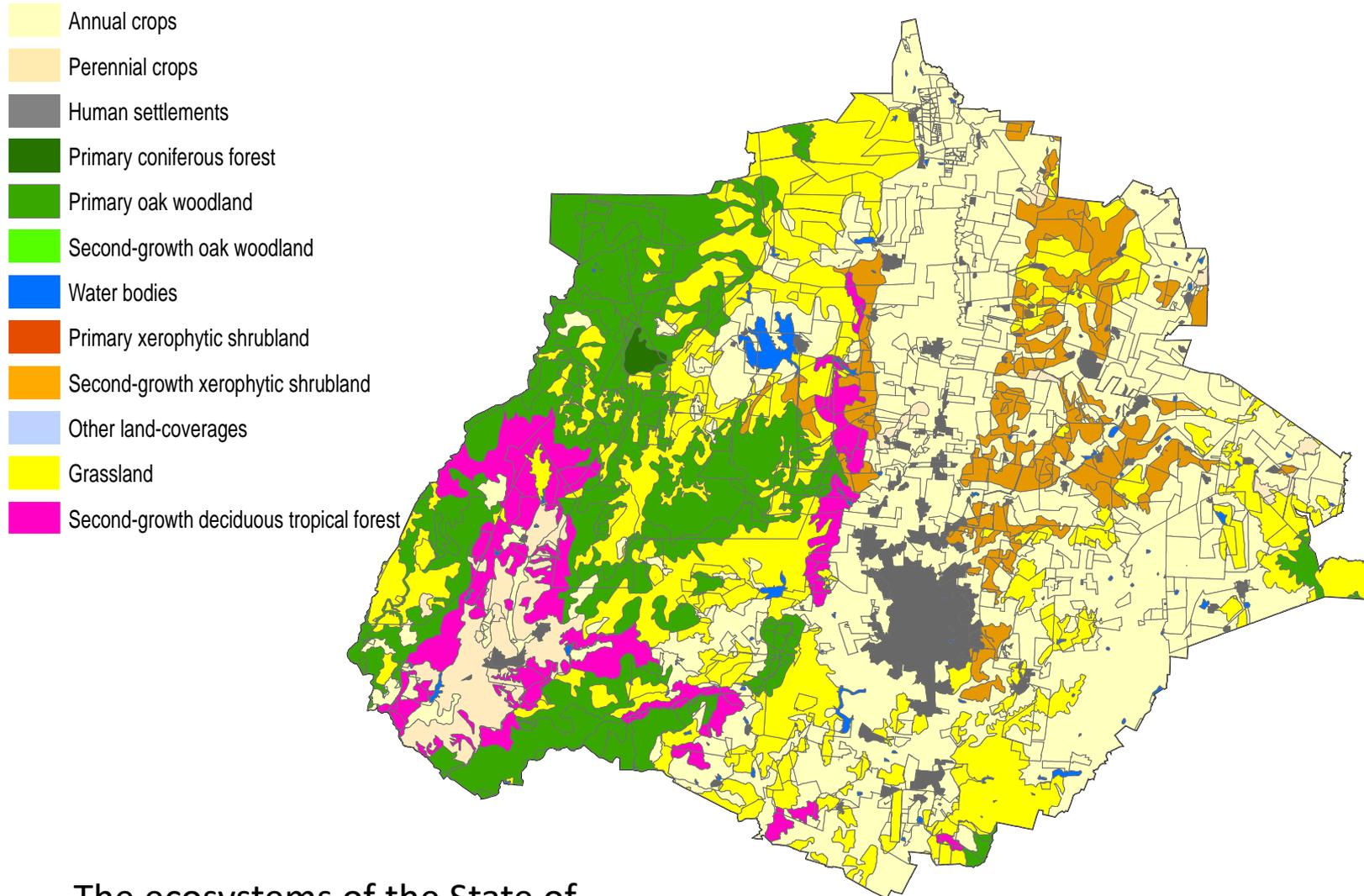


# Ecosystem classification

CONANP's Federal protected areas (2015)



# Ecosystem classification



The ecosystems of the State of  
Aguascalientes (2015)

# Ecosystem extension accounts

- INEGI's Vegetation and land-use charts: 2002, 2007, 2011 and 2015
- Protected Areas (2002, 2007, 2011 and 2015)
- Social property

## Ecosystem extension accounts: State of Aguascalientes

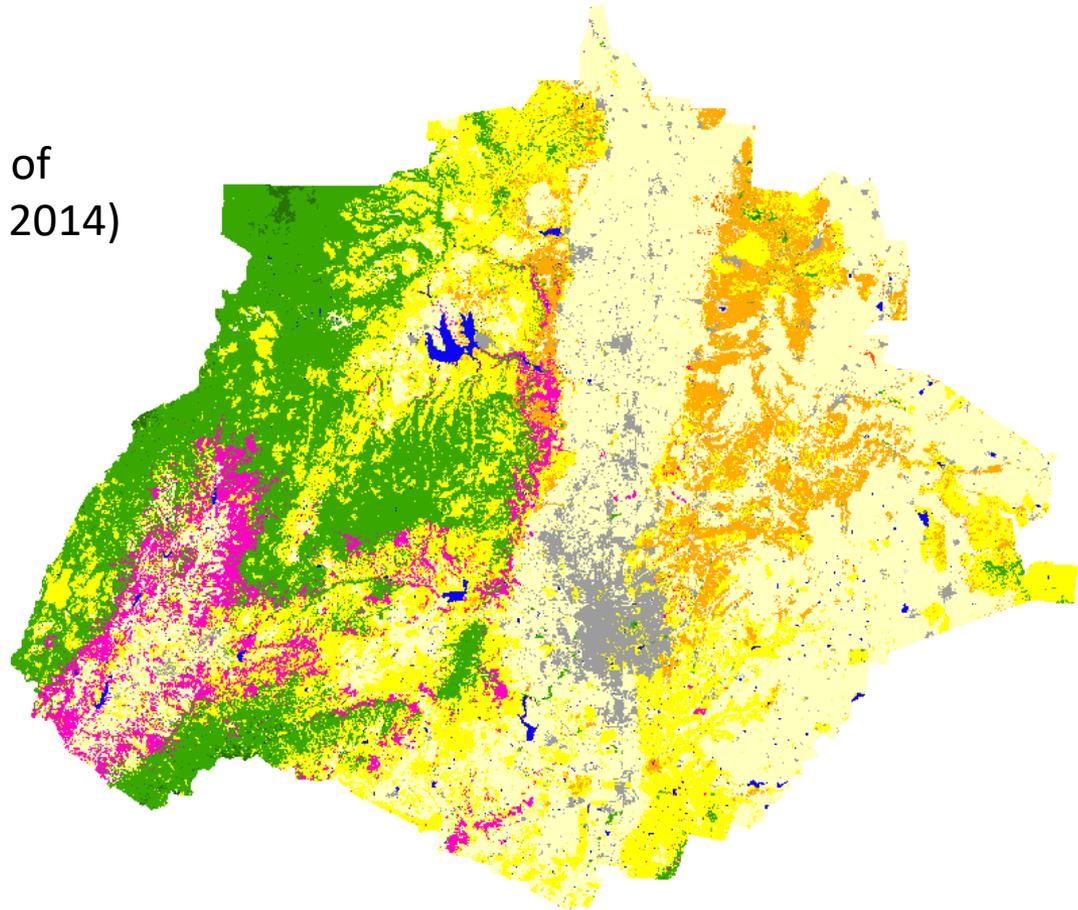
	Coniferous forest						Oak woodland						Xerophytic shrubland						Deciduous tropical forest						Grassland					
	Coms		Ejidos		Privado		Coms		Ejidos		Privado		Coms		Ejidos		Privado		Coms		Ejidos		Privado		Coms		Ejidos		Privado	
	ANP	No ANP	ANP	No ANP	ANP	No ANP	ANP	No ANP	ANP	No ANP	ANP	No ANP	ANP	No ANP	ANP	No ANP	ANP	No ANP	ANP	No ANP	ANP	No ANP	ANP	No ANP	ANP	No ANP	ANP	No ANP	ANP	No ANP
	0	0	1117.8	0	26.6	0	8636.3	27.8	10276.7	8344.5	51608.4	12868.1	486.6	0	706.8	28130.7	86.5	9952.0	0	0	3542.8	10671	7748.8	10573	1315	492	13060	57075	23537	45370
<b>2002</b>	0	0	1117.8	0	26.6	0	8636.3	27.8	10276.7	8344.5	51608.4	12868.1	486.6	0	706.8	28130.7	86.5	9952.0	0	0	3542.8	10671	7748.8	10573	1315	492	13060	57075	23537	45370
<b>2007</b>	0	0	1184.4	0	67.6	0	8436.3	27.8	10623.7	8370.9	51469.8	12877.9	486.6	0	706.8	26335.0	86.5	9964.0	0	0	3237.2	10250	6862	9763.5	1515	492	12733	52931	23161	41204
<b>2011</b>	0	0	1184.4	0	67.6	0	8941.2	11.5	13416.3	9349.9	53009.2	12614.6	486.6	0	706.8	25485.4	86.5	9870.7	0	0	3540.1	10678	9446.9	11340	1047	508	9869.7	51666	18982	40141
<b>2015</b>	0	0	1184.4	0	67.6	0	8941.2	11.5	13358.2	9349.9	52984.4	12614.6	486.6	0	706.8	25485.4	86.5	9870.7	0	0	3527.3	9996	9446.8	11165	1047	508	9940.5	52197	19006	39977

	Annual crops						Perennial crops						Water bodies						Human settlements																												
	Coms		Ejidos		Privado		Coms		Ejidos		Privado		Coms		Ejidos		Privado		Coms		Ejidos		Privado		Coms		Ejidos		Privado																		
	ANP	No ANP	ANP	No ANP	ANP	No ANP	ANP	No ANP	ANP	No ANP	ANP	No ANP	ANP	No ANP	ANP	No ANP	ANP	No ANP	ANP	No ANP	ANP	No ANP	ANP	No ANP	ANP	No ANP	ANP	No ANP	ANP	No ANP																	
	143.9	863.8	555.1	122536.5	1713.0	94459.6	0.0	0.0	3.1	4506.5	543.8	15392.3	10.5	1126.5	7.8	1161.1	37.5	2024.8	0.0	0.2	0.0	1720.7	0.0	9430.6	143.9	863.8	771.8	126640.4	2995.0	95899.4	0.0	0.0	6.3	4621.8	622.1	16096.6	10.5	1126.5	7.8	1161.2	37.5	2025.0	0.0	0.2	0.0	3774.2	0.0
<b>2002</b>	143.9	863.8	555.1	122536.5	1713.0	94459.6	0.0	0.0	3.1	4506.5	543.8	15392.3	10.5	1126.5	7.8	1161.1	37.5	2024.8	0.0	0.2	0.0	1720.7	0.0	9430.6																							
<b>2007</b>	143.9	863.8	771.8	126640.4	2995.0	95899.4	0.0	0.0	6.3	4621.8	622.1	16096.6	10.5	1126.5	7.8	1161.2	37.5	2025.0	0.0	0.2	0.0	3774.2	0.0	12240.2																							
<b>2011</b>	106.8	835.7	538.7	126559.6	3055.5	94780.0	0.0	0.0	6.3	3716.4	594.9	14303.2	10.5	1126.5	8.3	1237.7	59.6	2218.8	0.0	28.4	0.0	5327.1	0.0	14802.3																							
<b>2015</b>	106.8	835.7	538.7	126174.6	3055.5	94701.7	0.0	0.0	6.3	3716.4	595.0	14478.0	10.5	1126.5	8.3	1237.7	59.6	2218.8	0.0	28.4	0.0	5862.7	0.0	15044.0																							

# Ecosystem extension accounts

- CONABIO's Monitoring Activity Data for Mexico System (MAD-Mex)
- Land cover monitoring
- High spatial resolution: Sentinel 5m data
- High-frequency: Automated digital processing -> yearly updates
- Lower semantic resolution

Land cover in the State of  
Aguascalientes (MAD-Mex 2014)



# Ecosystem condition accounts

## 1.- Conservation status of vegetation (primary vs. second-growth)

- Based on INEGI's vegetation and land-use charts

		Coniferous forest						Oak woodland						Xerophytic shrubland						Deciduous tropical forest						Grassland					
		Coms		Ejidos		Privado		Coms		Ejidos		Privado		Coms		Ejidos		Privado		Coms		Ejidos		Privado		Coms		Ejidos		Privado	
		ANP	No ANP	ANP	No ANP	ANP	No ANP	ANP	No ANP	ANP	No ANP	ANP	No ANP	ANP	No ANP	ANP	No ANP	ANP	No ANP	ANP	No ANP	ANP	No ANP	ANP	No ANP	ANP	No ANP	ANP	No ANP	ANP	No ANP
		ANP	No ANP	ANP	No ANP	ANP	No ANP	ANP	No ANP	ANP	No ANP	ANP	No ANP	ANP	No ANP	ANP	No ANP	ANP	No ANP	ANP	No ANP	ANP	No ANP	ANP	No ANP	ANP	No ANP	ANP	No ANP	ANP	No ANP
2002	Primario	0	0	1117.8	0	26.6	0	5833.7	27.8	4737.3	2608.4	27959.5	2258.0	486.6	0.0	706.8	22455.1	86.5	6679.9	0	0	0	0	0	0	1315.1	491.6	13060.4	57075.4	23537.2	45369.9
	Secundario	0	0	0	0	0	2802.6	0.0	5539.4	5736.1	23648.9	10610.1	0.0	0.0	0.0	5675.6	0.0	3272.0	0.0	0.0	0.0	0.0	3542.8	10670.8	7748.8	10573.5	NA	NA	NA	NA	NA
2007	Primario	0	0	1184.4	0	67.6	0	3290.5	27.8	4618.5	2157.5	27379.5	2376.2	486.6	0	706.8	13301.3	86.5	4658.2	0	0	0	0	0	0	1515	492	12733	52931	23161	41204
	Secundario	0	0	0	0	0	5145.8	0	6005.2	6213.4	24090.3	10501.7	0.0	0	0.0	13033.7	0.0	5305.9	0	0	0	0	3237.2	10249.8	6862	9763.5	NA	NA	NA	NA	NA
2011	Primario	0	0	1184.4	0	67.6	0	3290.5	11.5	4350.6	2739.8	25856.5	2192.7	486.6	0	706.8	12757.6	86.5	4774.7	0	0	0	0	0	0	1047	508	9869.7	51666	18982	40141
	Secundario	0	0	0	0	0	5650.7	0	9065.7	6610.1	27152.7	10421.9	0.0	0	0.0	12727.8	0.0	5096.0	0	0	0	0	3540.1	10678.1	9446.9	11340	NA	NA	NA	NA	NA
2015	Primario	0	0	1184.4	0	67.6	0	3290.5	11.5	4328.3	2739.8	25819.7	2192.7	486.6	0	706.8	12757.6	86.5	4774.7	0	0	0	0	0	0	1047	508	9940.5	52197	19006	39977
	Secundario	0	0	0	0	0	5650.7	0	9029.9	6610.1	27164.7	10421.9	0.0	0	0.0	12727.8	0.0	5096.0	0	0	0	0	3527.3	9996.0	9446.8	11165	NA	NA	NA	NA	NA

# Ecosystem condition accounts

## 2. Soil erosion (INEGI's hydric soil erosion chart, 2015)

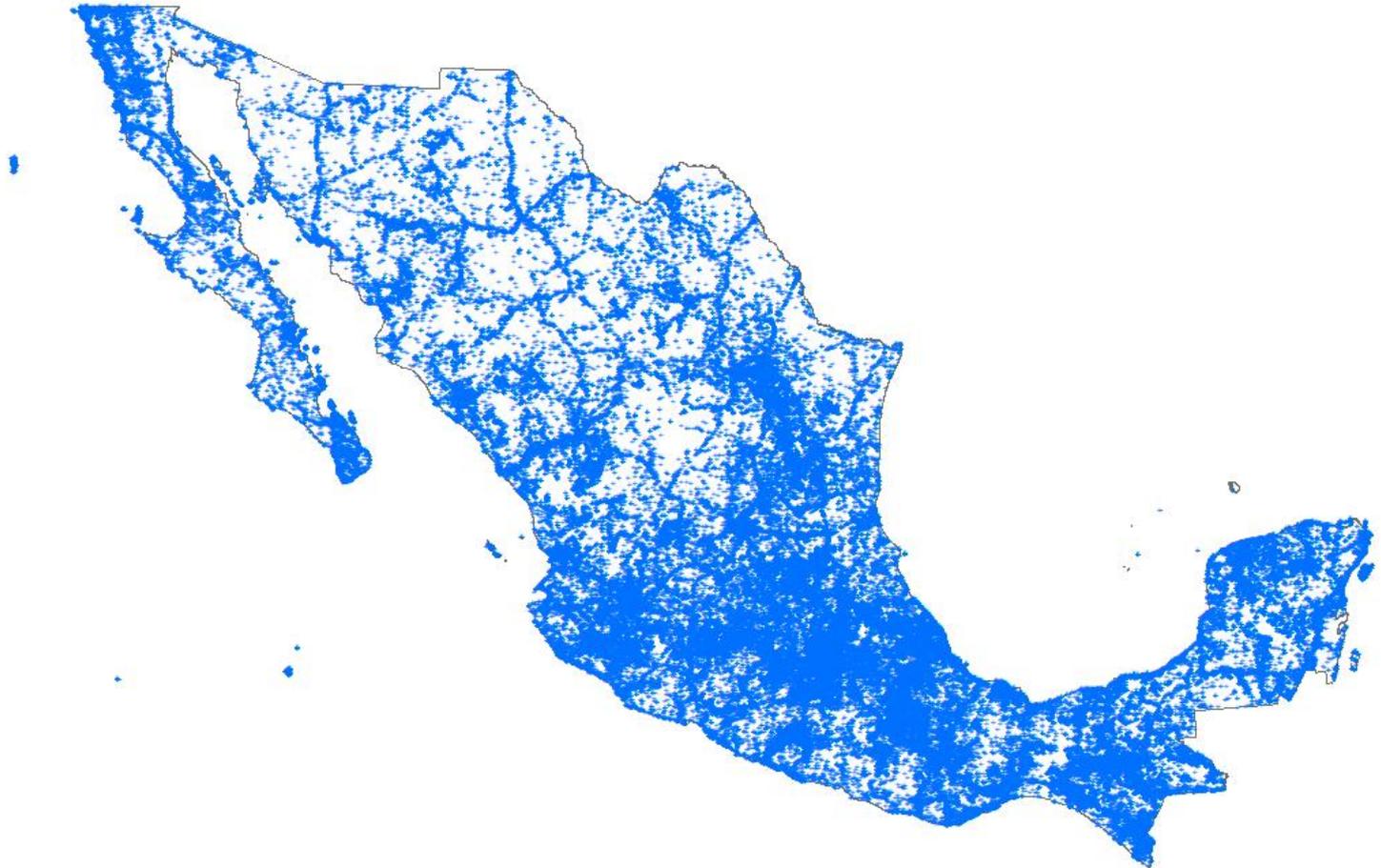
### GRADO



# Ecosystem condition accounts

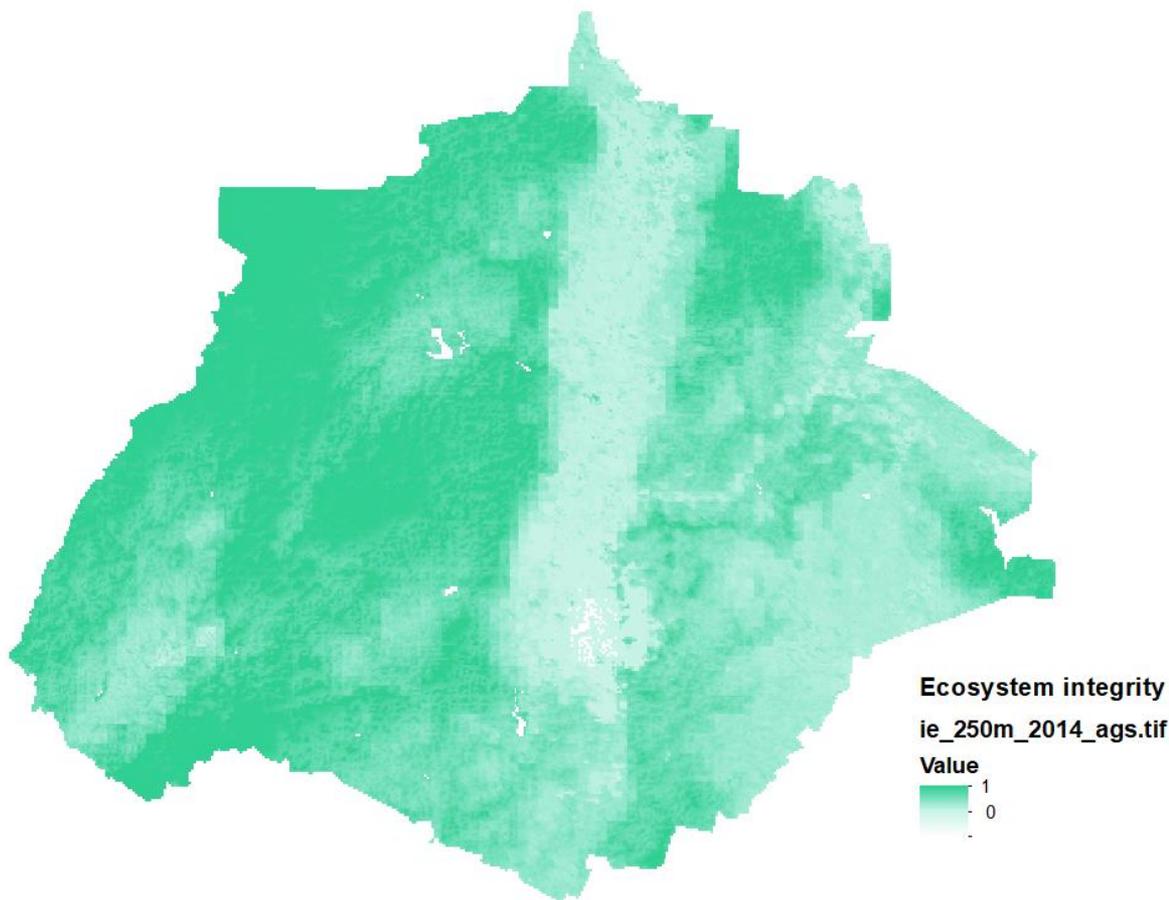
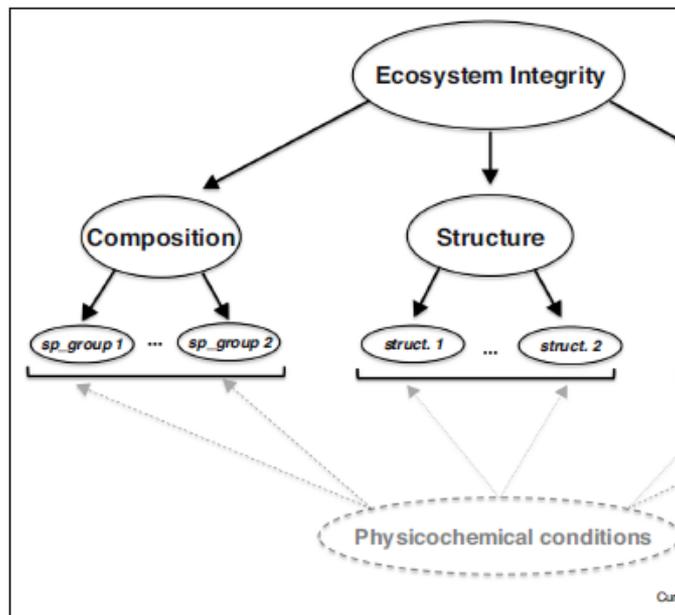
## 3. Biodiversity: Collection records for 14,424 plant species (CONABIO):

- No. species of higher plants,
- No. of species at risk,
- Presence/No. of exotic invasive species



# Ecosystem condition accounts

4. Soil organic carbon (being processed, based on INEGI-CONAFOR's data)
5. Ecosystem Integrity Index (CONABIO): An index denoting the structural integrity of ecosystems, based on 39 tree variables measured on-the-ground as part of Mexico's National Forest Inventory. The variables are rated in relation to the values expected under relatively unimpaired conditions, and the ratings are aggregated into a single score 0-1



# Ecosystem condition accounts

## Aggregation of ecosystem condition variables:

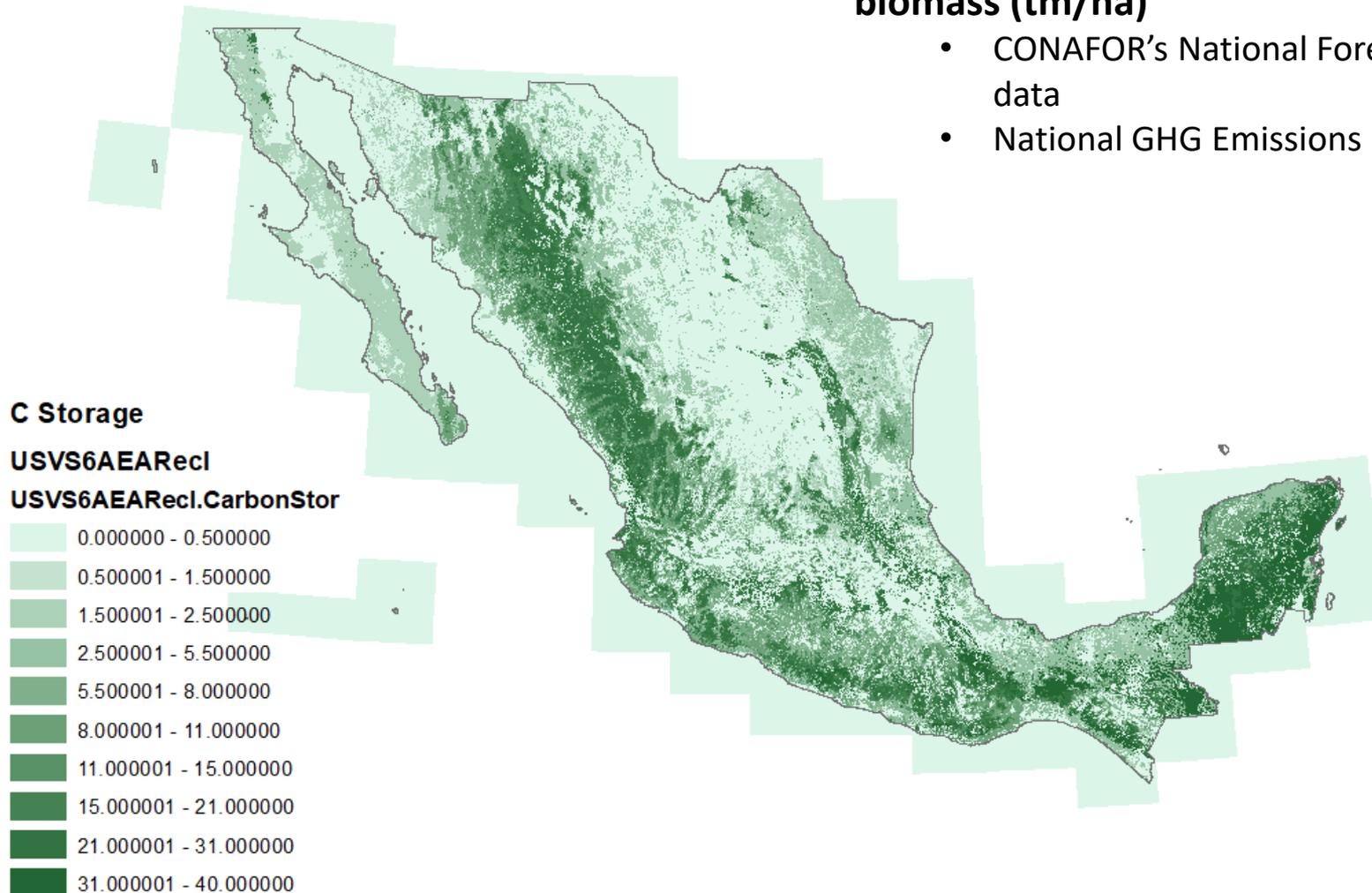
### Multi-purpose/multi-criteria approach:

- $EC_1 = w_{11}X_1 + w_{12}X_2 + \dots + w_{1n}X_n$
- $EC_2 = w_{21}X_1 + w_{22}X_2 + \dots + w_{2n}X_n$
- $\dots$
- $EC_p = w_{p1}X_1 + w_{p2}X_2 + \dots + w_{pn}X_n$

# Mapping and valuation (physical terms) of ecosystem services

## Carbon storage in above- and below-ground biomass (tm/ha)

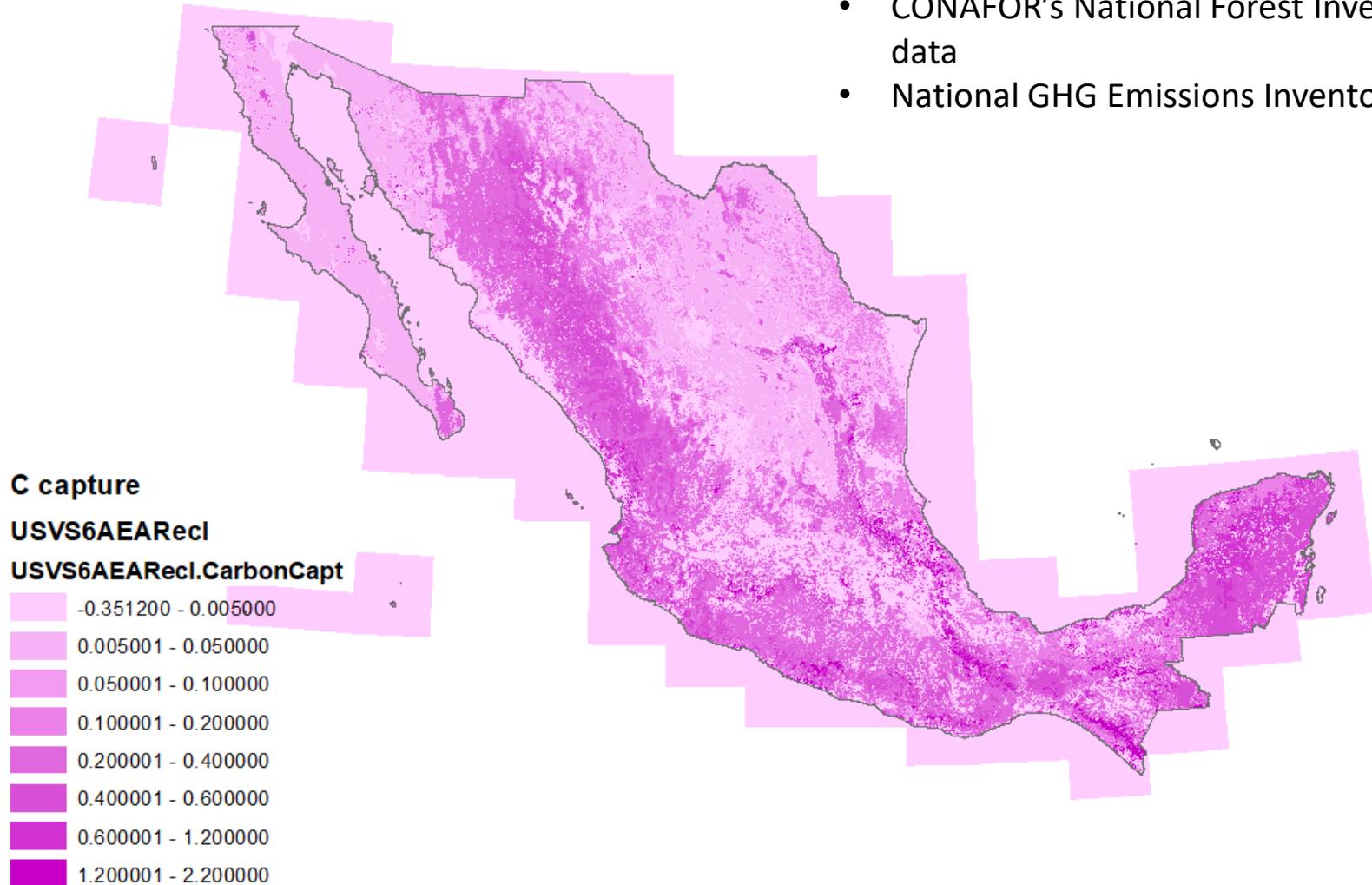
- CONAFOR's National Forest Inventory data
- National GHG Emissions Inventory



# Mapping and valuation (physical terms) of ecosystem services

## Carbon capture by vegetation (tm/ha/yr)

- CONAFOR's National Forest Inventory data
- National GHG Emissions Inventory



# Mapping and valuation (physical terms) of ecosystem services

- **Food crop production** (being processed):
  - Based on Ministry of Agriculture's yearly production data
- **Water capture and supply** (being processed):
  - Hydrologic balance model
  - SWAT, Arc-Hydro
- **Coastal protection by mangrove ecosystems** (**pending**)
  - CONABIO's Mangrove monitoring system

# Next steps

- Demand for and beneficiaries of ecosystem services
- Monetary valuation
  
- Dissemination of results to stakeholders
- Conduct 2-3 other State-level studies

# Issues

- Data availability vs. Access to data
- Information update:
  - Legacy data (e.g. biodiversity, soil carbon content)
  - Soil erosion



# Ecosystem classification

- Basis: INEGI's Vegetation and Land-use classification:
  - Highly detailed classification system: 57 vegetation types, 24 land-use classes
  - describes the main types of natural vegetation and land-use occurring in the country
  - most comprehensive framework for describing/making reference to Mexican terrestrial ecosystems
  - Major international/domestic reports and indicators (OECD, FRA, UNFCCC, the State of the Environment report, etc.) produced in Mexico framed in terms of INEGI's classification (or simplified version).
- Aggregated version of INEGI's classification, including:
  - 14 vegetation classes
  - 4 land use classes (agriculture [annual or permanent crops], forest plantations, human settlements)
  - ancillary classes (water bodies, ocean, foreign country)
- Land tenure and management:
  - Private property vs. communal property (ejido and indigenous communities)
  - Federal Protected Natural Areas