System of Environmental Economic Accounting

The Natural Capital Accounting and Valuation of Ecosystem Services Mexico Project (NCAVES-Mexico): Mapping and assessing ecosystem condition

June, 2019

United Nations

UNEP

INEGI
INSTITUTO NACIONAL DE ESTADÍSTICA Y GEOGRAFÍA

Content

Background

General considerations on data and methods

Condition measure types

Progress

- Ecosystems integrity index
- Ecological integrity index
- Human Footprint

Learned lessons

Background

- The ecosystem condition accounts, will meet the UNSEEA EA methodology, in addition they will serve to define criteria that support national public policies included in the National Development Plan and Sectoral Programs.

National Development Plan 2019-2014

General considerations on data and methods

- Inputs: Geographic, statistical data/information from various sources
- Analysis: Maps and spatially-explicit modelling
- Wide variety of data and methods

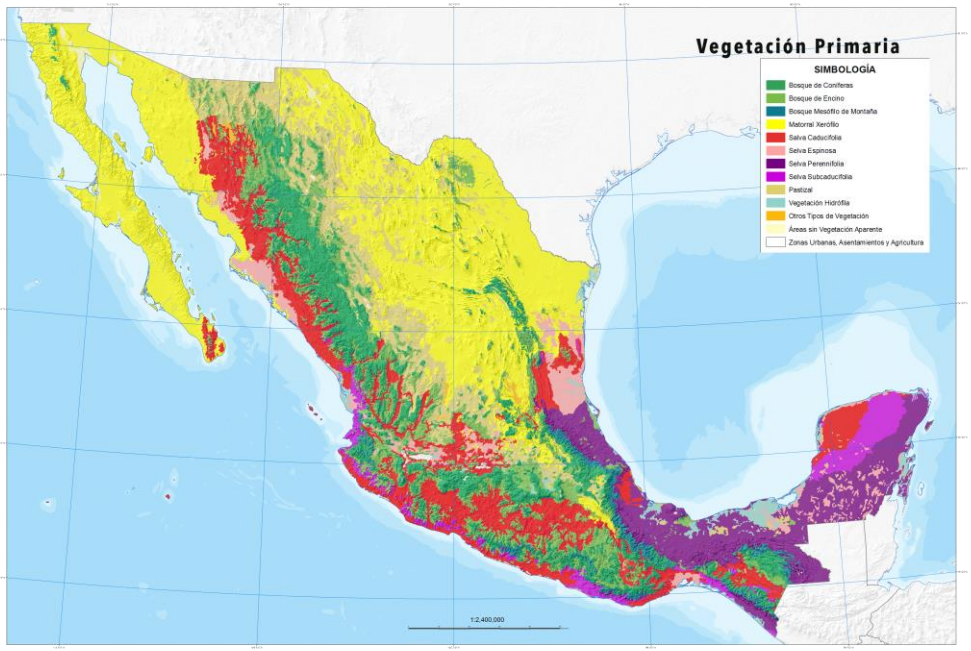
Selection principles:

- Official, domestic data/information
  - At least, data/information produced, used or accepted by official entities
- Country-wide coverage
- Spatially explicit, with suitable spatial resolution (250m or scale 1:250,000)
- Time-series or at least data available for two or more points in time
- Freely openly available data
- Explicit, transparent, replicable methods for analysis and modelling

Progress

We identified a number of **relevant data sets** that could potentially be used for describing the condition of Mexico's ecosystems:

- **Conservation status of vegetation**
- Water erosion
- Organic carbon content in soils
- Biodiversity
- **Ecosystem Integrity Index**
- Ecological Integrity Index
- **Human Footprint Index**

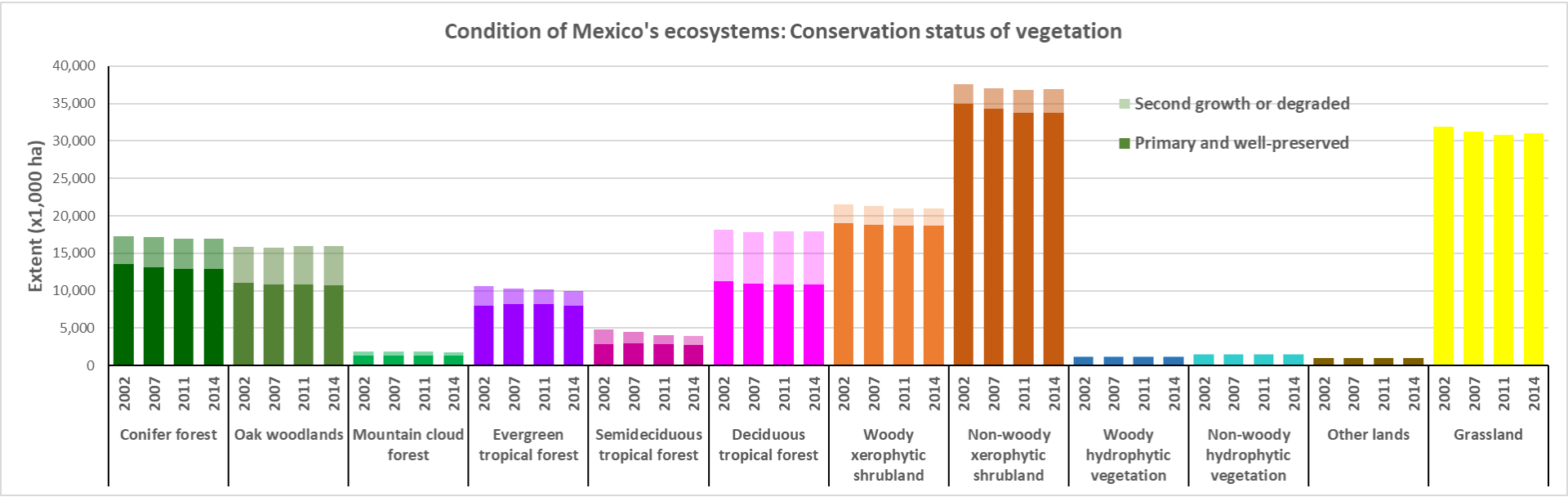


Dynamic Map Land Use and Vegetation

Assessing the condition of Mexico's Ecosystems

Conservation status of vegetation

- Well-preserved or primary vegetation vs. degraded or secondary vegetation
- Based on INEGI's vegetation and land-use charts, scale 1:250,000
- Data available for 2002, 2007, 2011 and 2014



Forum of Experts on SEEA Experimental Ecosystem Accounting 2019

Glen Cove, New York, USA

Session 3b: Ecosystem condition

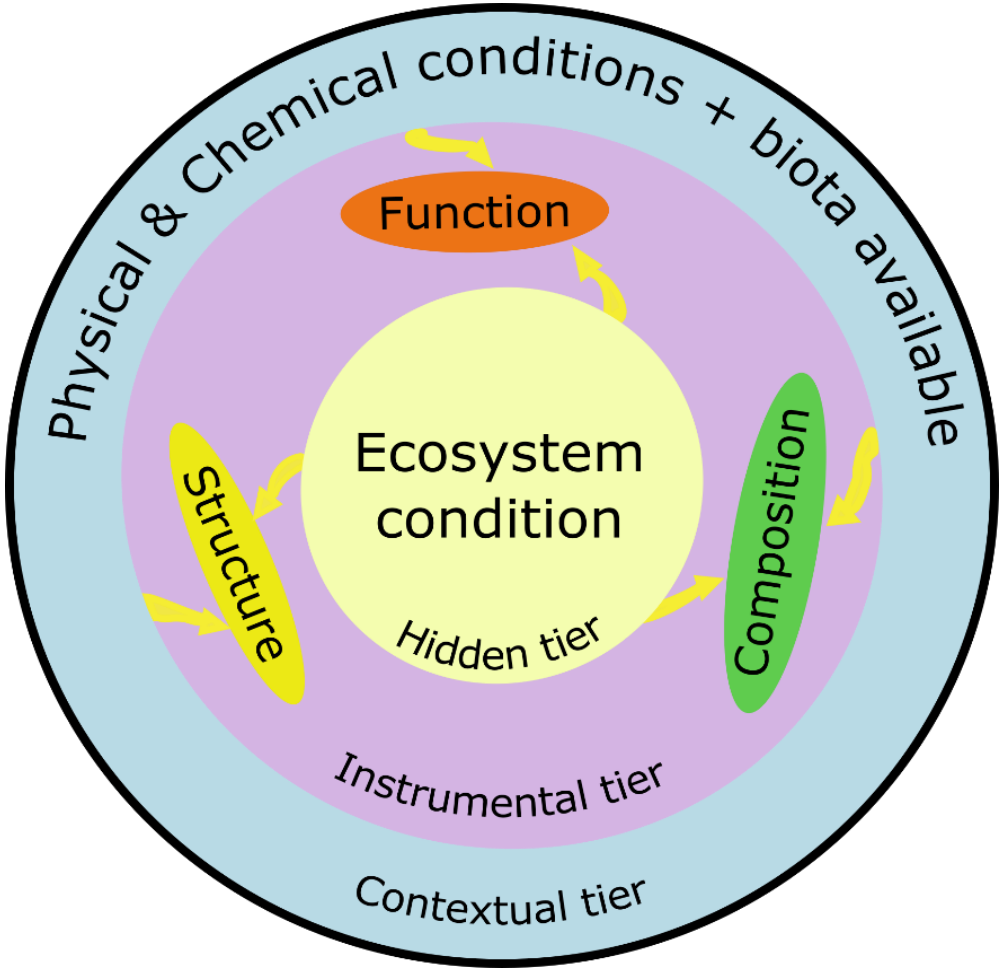
INEGI, Mexico: Condition accounts in practice: example from Mexico

Ecosystem integrity index

Octavio Pérez-Maqueo
Miguel Equihua

Ecosystem Integrity Index

Characteristics	Currently	Future
Undertaken	Inecol-Conabio	Inecol-Conabio, INEGI, IAVH
Real	Terrestrial	Inland water and marine
Scope	National (Mexico)	Colombia
Indicators	Remote sensing and field measurements (Vegetation)	Fauna
Agregated index?	Yes (0-100)	--
Reference condition?	Yes (based on hemeroby concept)	--
More than one time point?	Yes (annual periods) 2004-2014	--
Resolution	1 km^2 and 250m^2 (2014)	



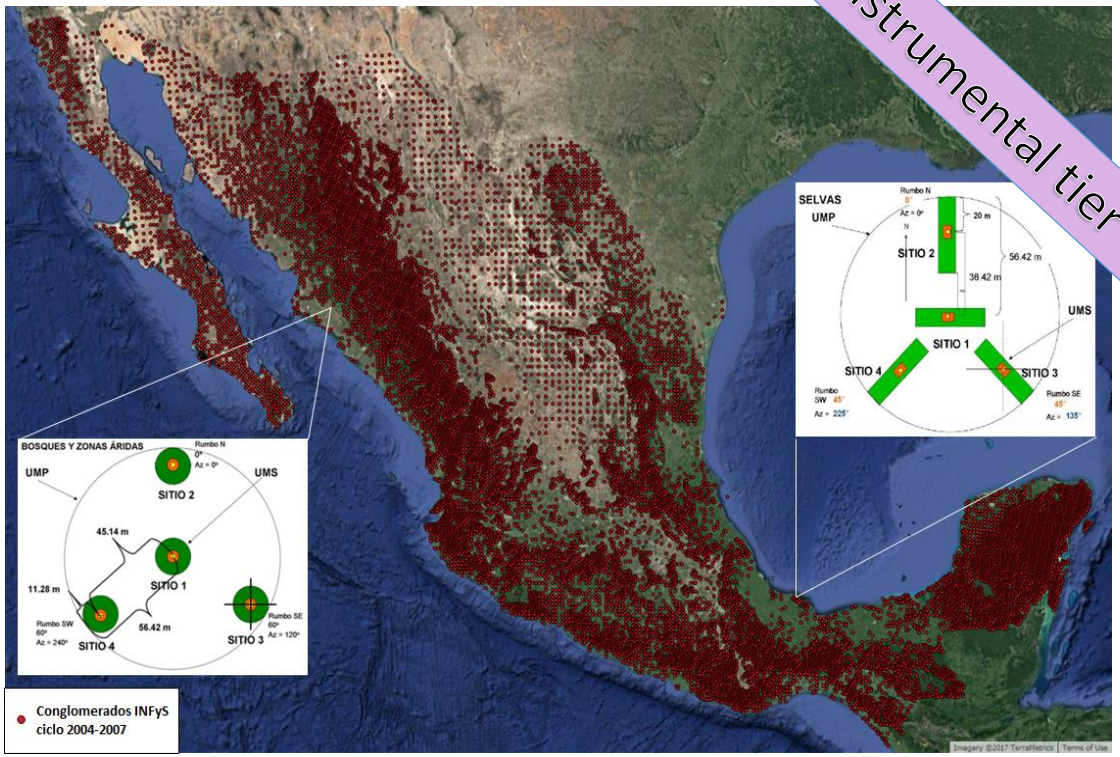
Ecosystem integrity
Three tier conceptual model

Field Measurements

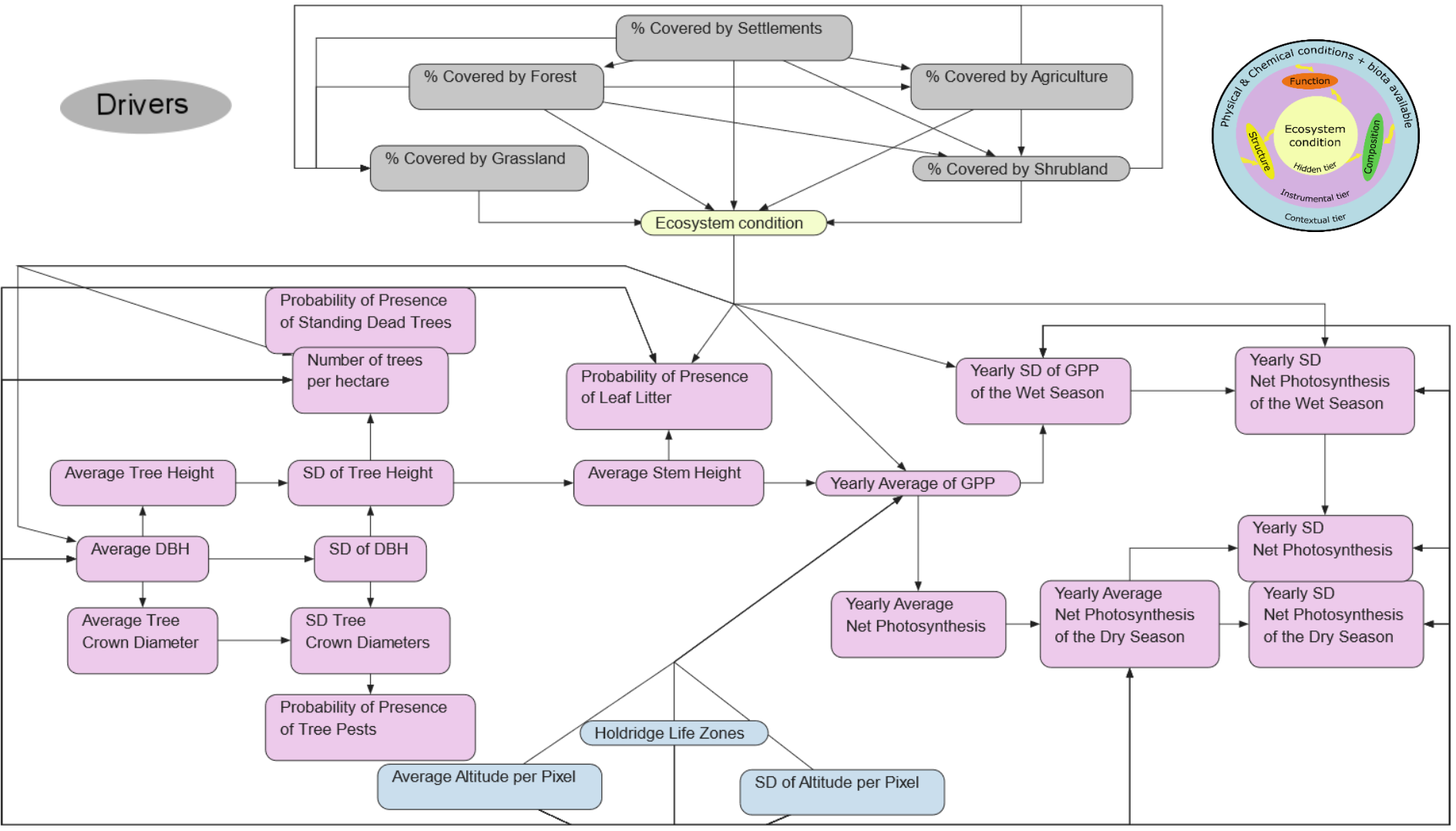
Number of trees per hectare
Tree Height
Diameter at Breast Height
Tree Crown Diameter
Stem Height
Probability of Presence of Tree Pests
Probability of Presence of Standing Dead Trees
Probability of presence of leaf litter

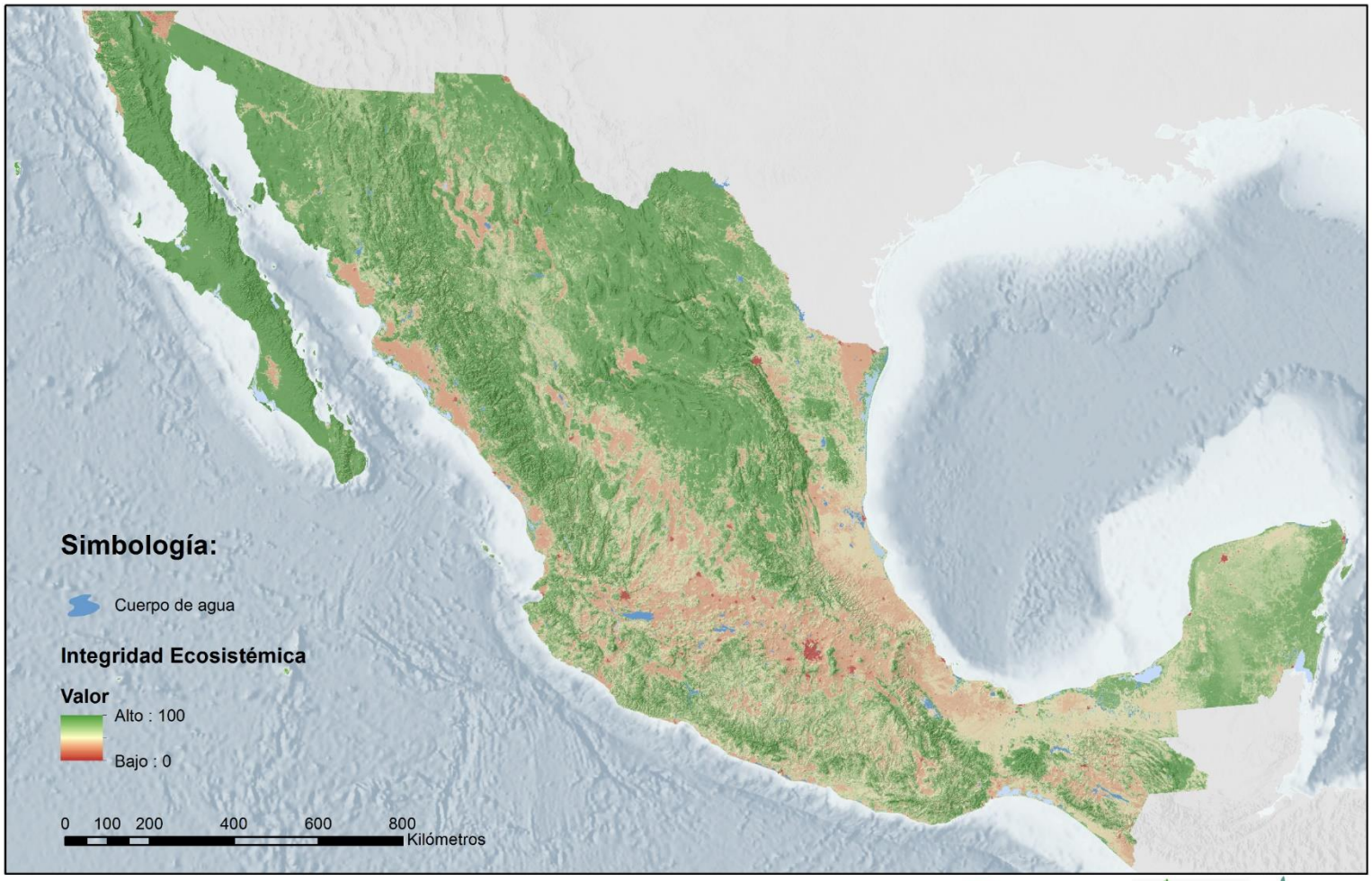
Remote sensing

Gross Primary Productivity
Net Photosynthesis



Comisión Nacional Forestal, 2012. Inventario Nacional Forestal. Informe de Resultados 2004-2009.


Drivers
% Covered by Settlements
% Covered by Forest
% Covered by Agriculture
% Covered by Grassland
% Covered by Shrubland
Ecosystem condition
Physical & Chemical conditions + biota available
Function
Ecosystem condition
Structure
Composition
Hidden tier
Instrumental tier
Contextual tier
Probability of Presence of Standing Dead Trees
Number of trees per hectare
Probability of Presence of Leaf Litter
Yearly SD of GPP of the Wet Season
Yearly SD Net Photosynthesis of the Wet Season
Average Tree Height
SD of Tree Height
Average Stem Height
Yearly Average of GPP
Average DBH
SD of DBH
Yearly SD Net Photosynthesis
Average Tree Crown Diameter
SD Tree Crown Diameters
Yearly Average Net Photosynthesis
Yearly Average Net Photosynthesis of the Dry Season
Yearly SD Net Photosynthesis of the Dry Season
Probability of Presence of Tree Pests
Holdridge Life Zones
Average Altitude per Pixel
SD of Altitude per Pixel



Integridad Ecosistémica para el año 2004

CONABIO

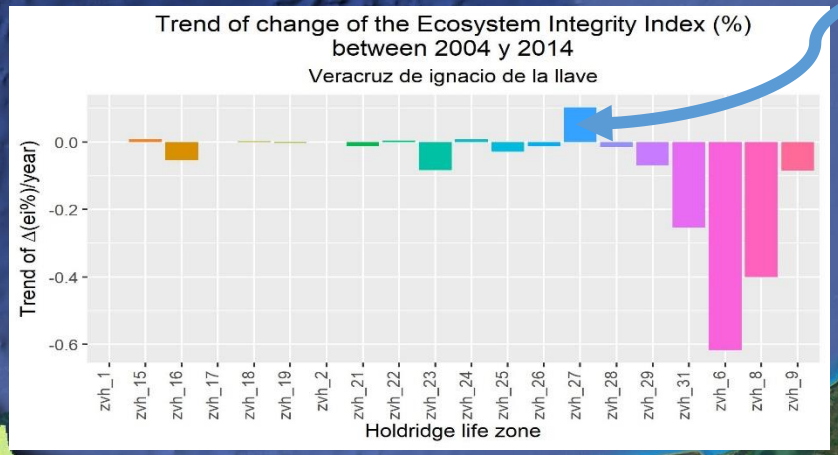
CONAFOR

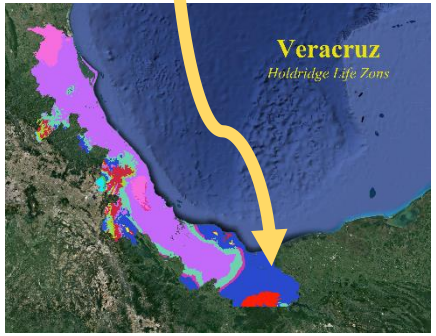
INECOL

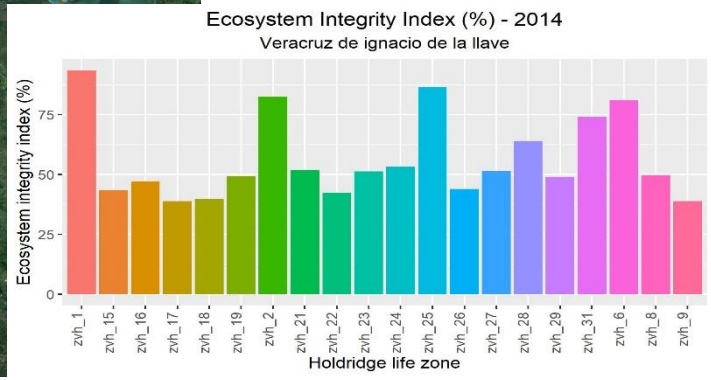
Veracruz

Ecosystem Integrity Index

27.-Premontane rain forest (South of Veracruz)







Next steps:

- Improve model resolution to 250m^2
- Dose-response functions between ecosystem integrity and degradation drivers.
- Add new variables (fauna functional groups).
- Incorporate ecosystem services (water yield, carbon, pollination).
- Keep applying our approach to public policy instruments and tools.
- Calculate the *ecosystem integrity index* for Colombia.
- Pipeline automation for ecosystem integrity time-series production.

Social networks and contact

- twitter.com/IGammaNet
- www.facebook.com/IGammaNet/
- www.instagram.com/igammanet/
- https://www.youtube.com/channel/UCIKMlmmjLsYOywyz5Di_8fA

- octavio.maqueo@inecol.mx; equihuam@gmail.com

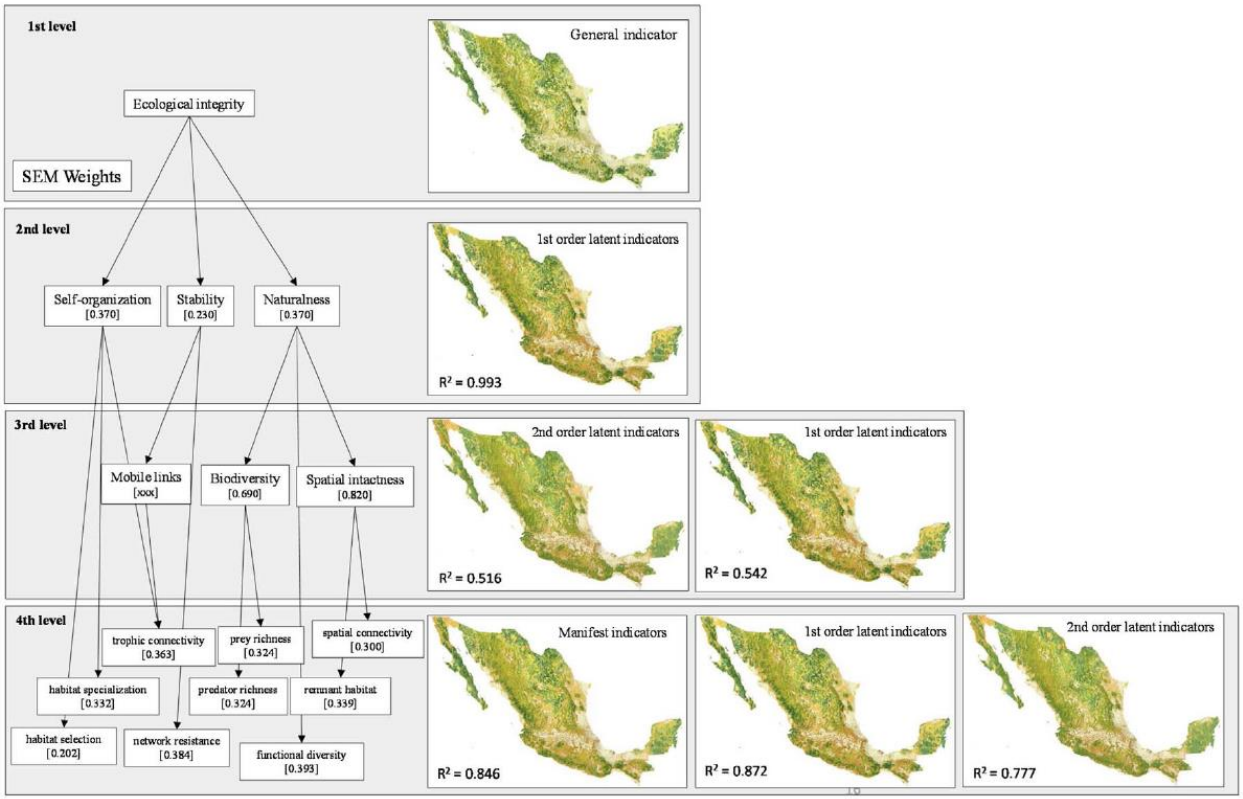
INEGI

Ecological Integrity Index

CONABIO

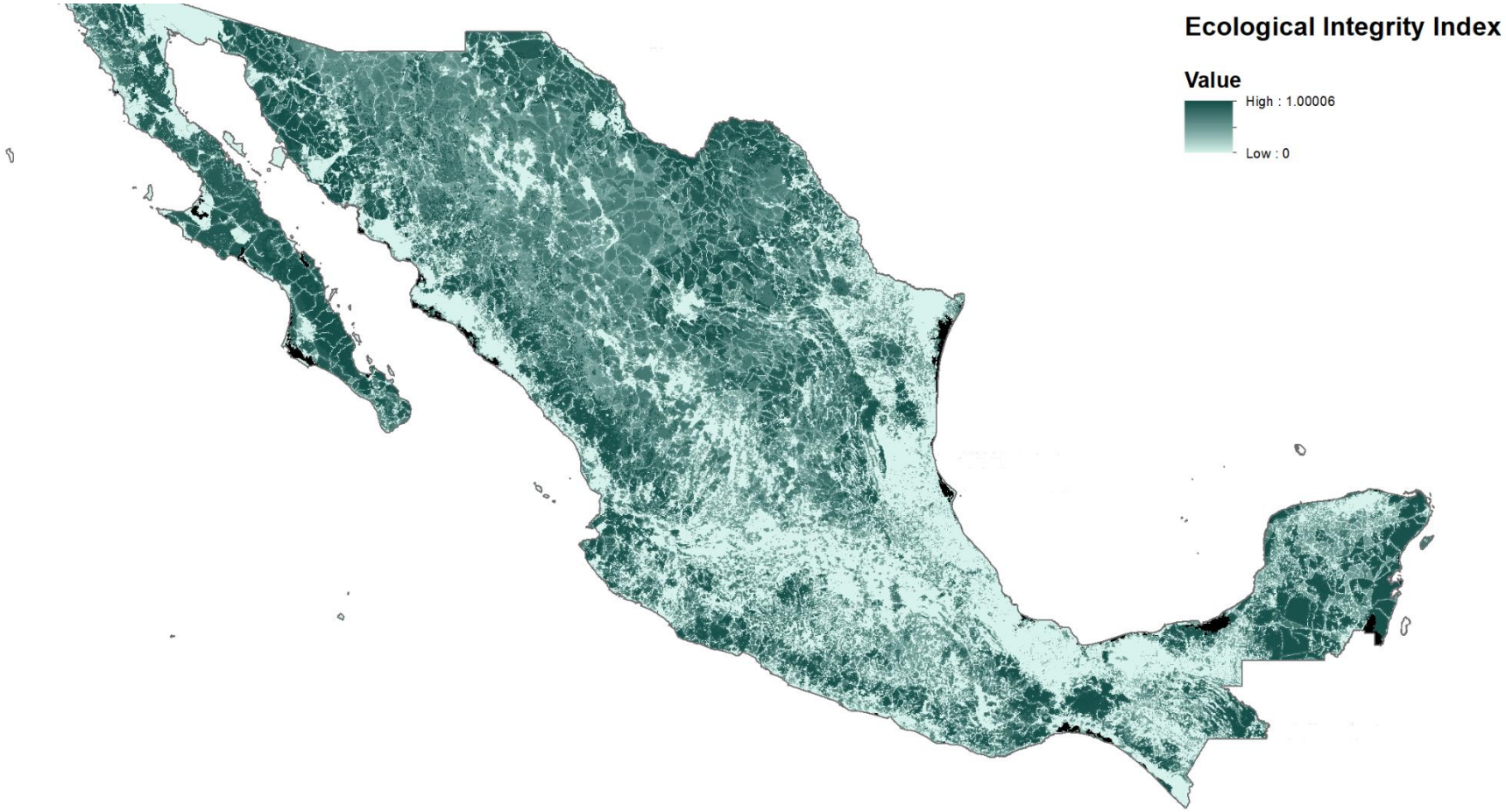
Ecological Integrity Index

- Aims to characterize "…the potential of natural landscapes to support ecological integrity in maintaining biotic and abiotic apex predators' interactions…" (Mora, 2017)
- Based on **statistical models of potential distribution for 232 mammal species and 7 top predators**, from which **indicators of functional diversity, predator/prey diversity, habitat specialization, habitat selection, remnant habitat**, **etc. are calculated**
- Indicators are then used to build spatially-explicit, Structural Equation Models for seven **abstract indicators of ecological integrity: Self-organization, Stability, Naturalness, Biodiversity, Mobile links, Spatial intactness, and Landscape heterogeneity**.
- The **latent indicators are then aggregated into an Ecological Integrity Index**



Ecological Integrity Index

- Most components are model estimates rather than actual measurements.
- Values cannot be assigned to a specific point in time and cannot be updated.
- 1km spatial resolution is relatively coarse



INEGI

Human footprint Index

SEMARNAT

SECRETARÍA DE MEDIO AMBIENTE Y RECURSOS NATURALES

The Human Footprint Index

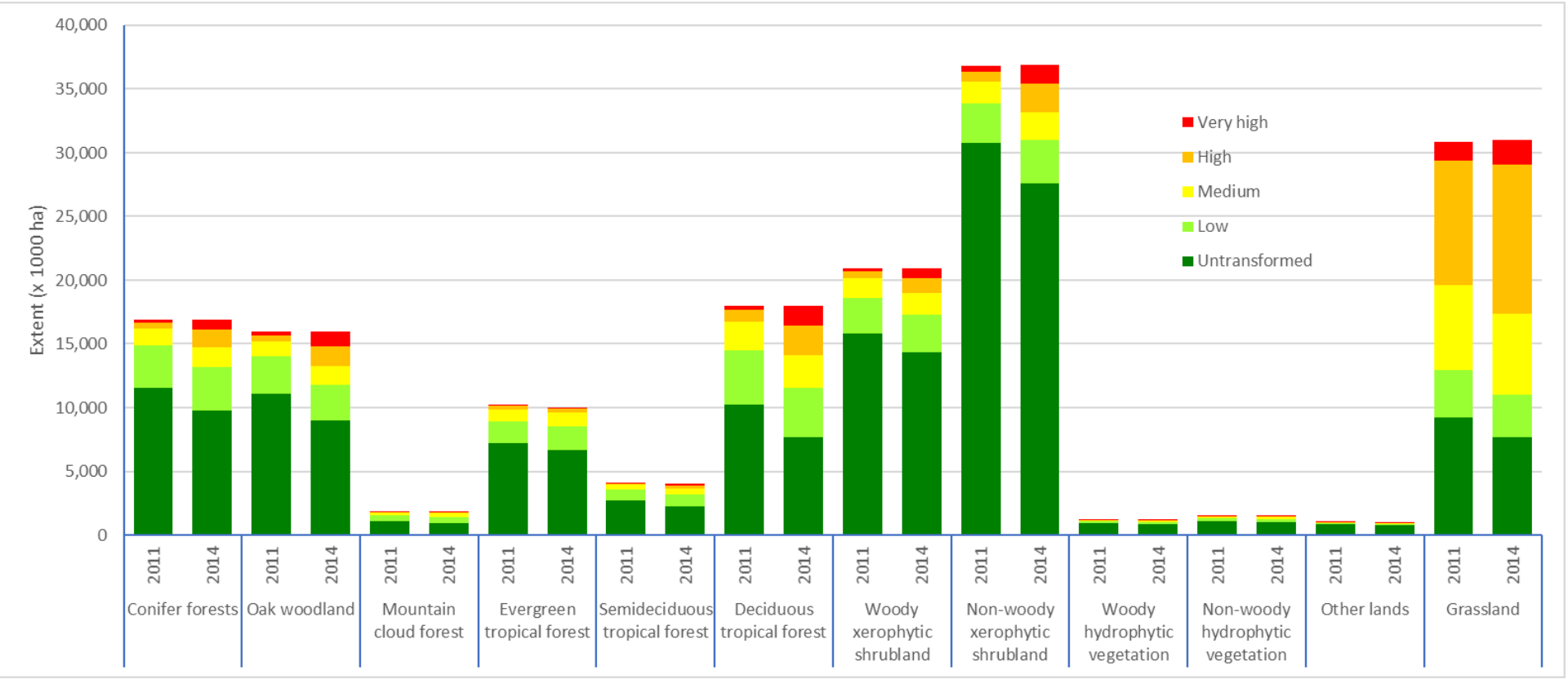
- Denotes the extent to which natural environments have been modified by human activities
- Indicator is computed by estimating/assessing the **Extent** and **Intensity** of the transformation caused by various activities (for which spatially explicit information is available):
  - Cities and towns (< 500 inhabitants, 500 - 2500 inhabitants)
  - Agriculture and aquaculture; forest plantations; cultivated pastureland
  - Roads (highway, dirt-road, carpeted road, gravel road), railways, electricity transmission lines
  - Industry
  - Wastewater treatment facilities
  - Artificial salt flats
  - Archaeological sites
  - Solid waste final disposal sites (dump sites, sanitary landfills)
  - Mines (primary, secondary, tertiary zones)

The Human Footprint Index

- Human Footprint Index calculated using data from government sources
- Human Footprint Index maps produced for 2011 and 2014-2015
- Spatial resolution: 250m

The Human Footprint Index

- Extent and intensity of the impact of human activities in Mexico's ecosystems
- 2011 and 2014



Learned lessons

Conclusions and lessons learned on Indicators of Ecosystem Characteristics:

- Measures of biophysical variables, **not easily interpreted by non-specialists; b**ut **can be readily related to ecosystem services** and to the ecosystem's capacity to supply them

- **Vast amount of relevant data** available in Mexico (soil surveys, forest inventory, biodiversity, etc.) **but not all of those meet the requirements to be used for examining ecosystem condition**

- More efforts needed to collect/compile **country-wide, spatially explicit, moderate resolution, multi-date data** on biophysical variables indicators of ecosystem condition, using existing data, data from other sources (e.g., remote sensing), and suitable modeling tools (e.g. S-World)

Conclusions and lessons learned on Composite Indicators of Ecosystem characteristics:

- Attractive, useful communication tools. Easy communication and interpretation by non-specialized audiences

- The meaning of changes is not immediately clear. Need to be traced back to component variables in order to relate and interpret values in relation to ecosystem services

- Different indices include different variables, e.g. forest structure and function vs. predator-prey interactions, etc.

- 1 km resolution relatively coarse. Recent 250m-resolution version of the Ecosystem Integrity Index to be incorporated into project once data for at least one extra date are produced and made available.

Conclusions and lessons learned on Composite Indicators of Pressures on Ecosystems:

- Easy communication and interpretation by non-specialized audiences
- Lumps together various variables denoting the human influence or activity that impact natural landscapes
- Calculated from actually measured, spatially explicit, regularly updated data compiled by government agencies
- Changes in its values are hard to interpret, as they might be the result of changes in one or several of its component variables.