



Multi-institutional Project Coordinated by
CONABIO & CONANP



Introduction

It crucial to carry out an **evaluation** of the **protected areas** (PA) capacity to represent Mexico's vast **biodiversity**

The first necessary step towards this evaluation is to identify priority sites for conservation.

Previous conservation exercises:

- **World-wide Hotspots**
- **Terrestrial and Hydrological Priority Regions**
- **Alliance for Zero Extinction**

However, the large extension of most of these previously identified priority regions stresses the need of identifying precise priority sites for conservation.



GAP analysis aims COP-7

7th CONFERENCE OF THE PARTIES
CONVENTION ON BIOLOGICAL DIVERSITY
77th meeting, Kuala Lumpur,
8-20 & 27 February, 2004



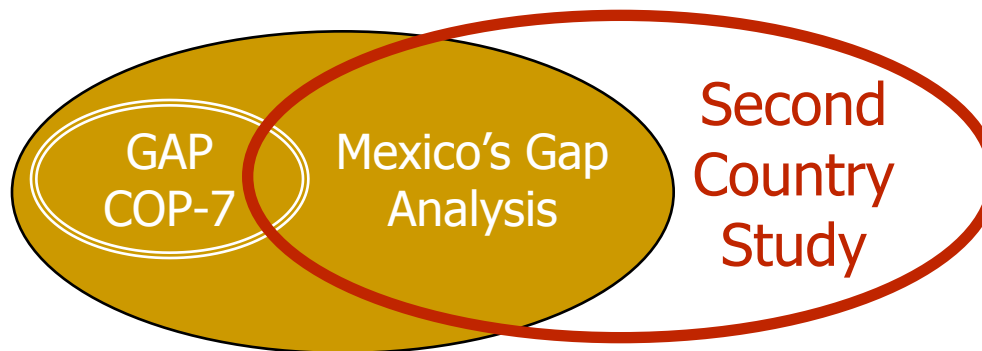
Convention on
Biological Diversity

Goal 1.1

Create and reinforce national & regional PA systems integrated in a global net

Mexico decided to expand the scope of the national GAP analysis

215 experts
participated in
the PA GAP
analysis



biodiversity's
complete
assessment

Environmental
government sector

+

International
and national
NGO's

+

Scientists

Goals

Conduct several **gap** analyses to identify *in situ* conservation **priorities**

Five-step conceptual model:

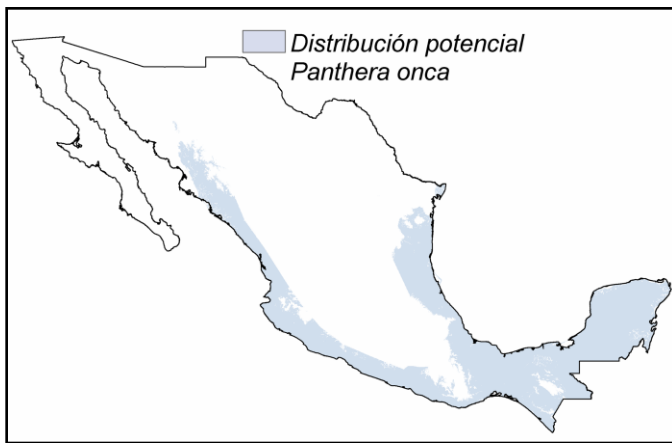
- 1) Determine critical **ecoregions** for conservation
- 2) Identify **terrestrial, fresh water and marine priority sites** for conservation
- 3) **Integrate** results of terrestrial, fresh water and marine environments and generate a **National Agenda** towards the protection of priority sites.
- 4) Protect the most important **gaps** according to the National Agenda, favoring connectivity and ecological resilience
- 5) Continue the analyses of other conservation targets at finer scales to identify important areas for **connectivity** and **ecological resilience** (considering climate change)

GIS input material generated for gap analyses

Terrestrial ecoregions map
(level 4; 1:1,000,000)



gap
Protected
areas



•Species potential distribution maps:

Amphibians

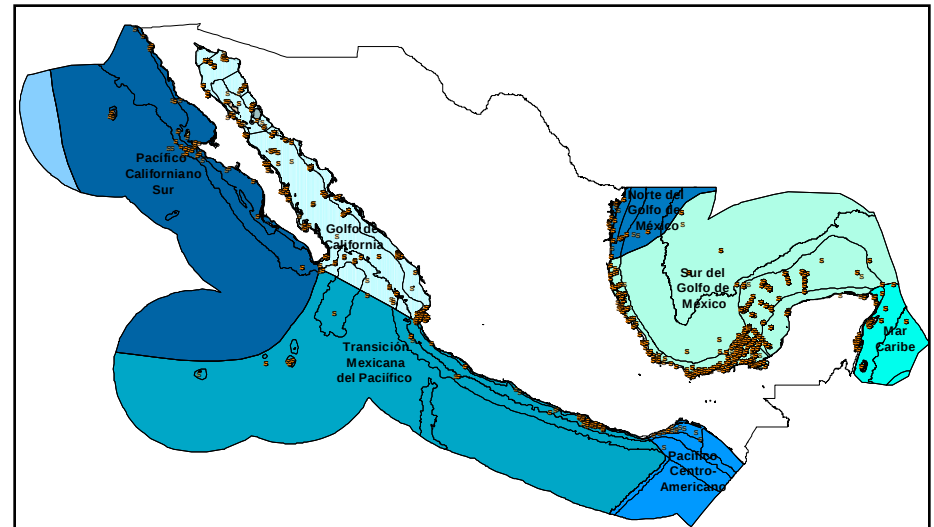
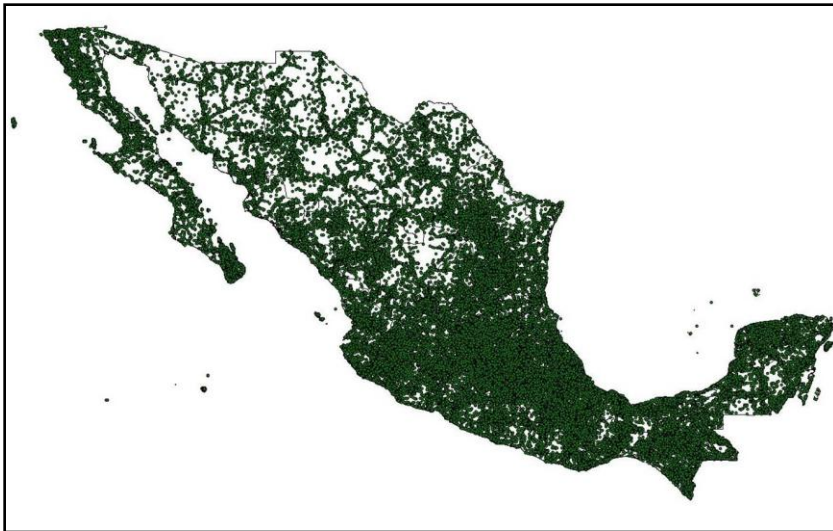
Reptiles

Birds

Mammals

Plants (Mexican Red list, NOM-059-2001)

•SNIB biological database



Gap analyses of biodiversity areas

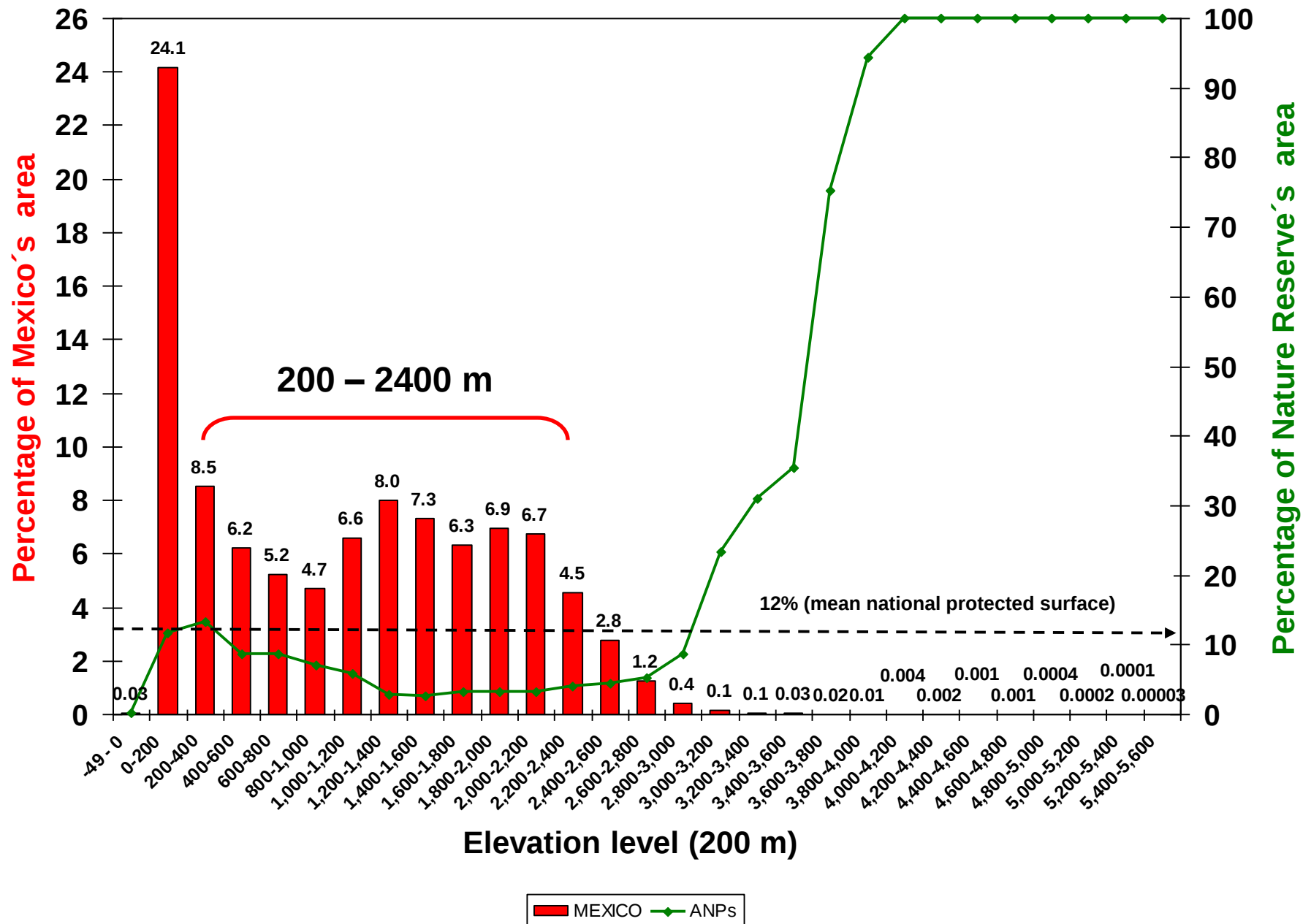
Ecological environments by altitude

Primary vegetation

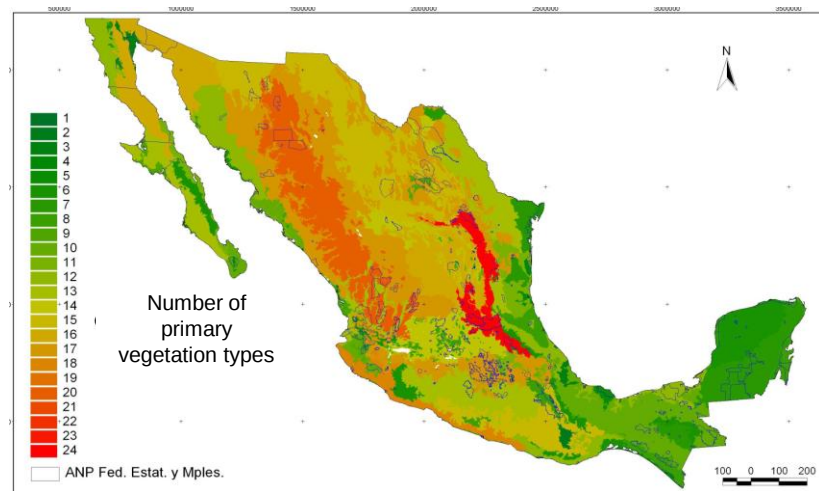
Ecoregions



Nature reserves vs. elevation levels



Primary vegetation types



Primary vegetation within ecoregions

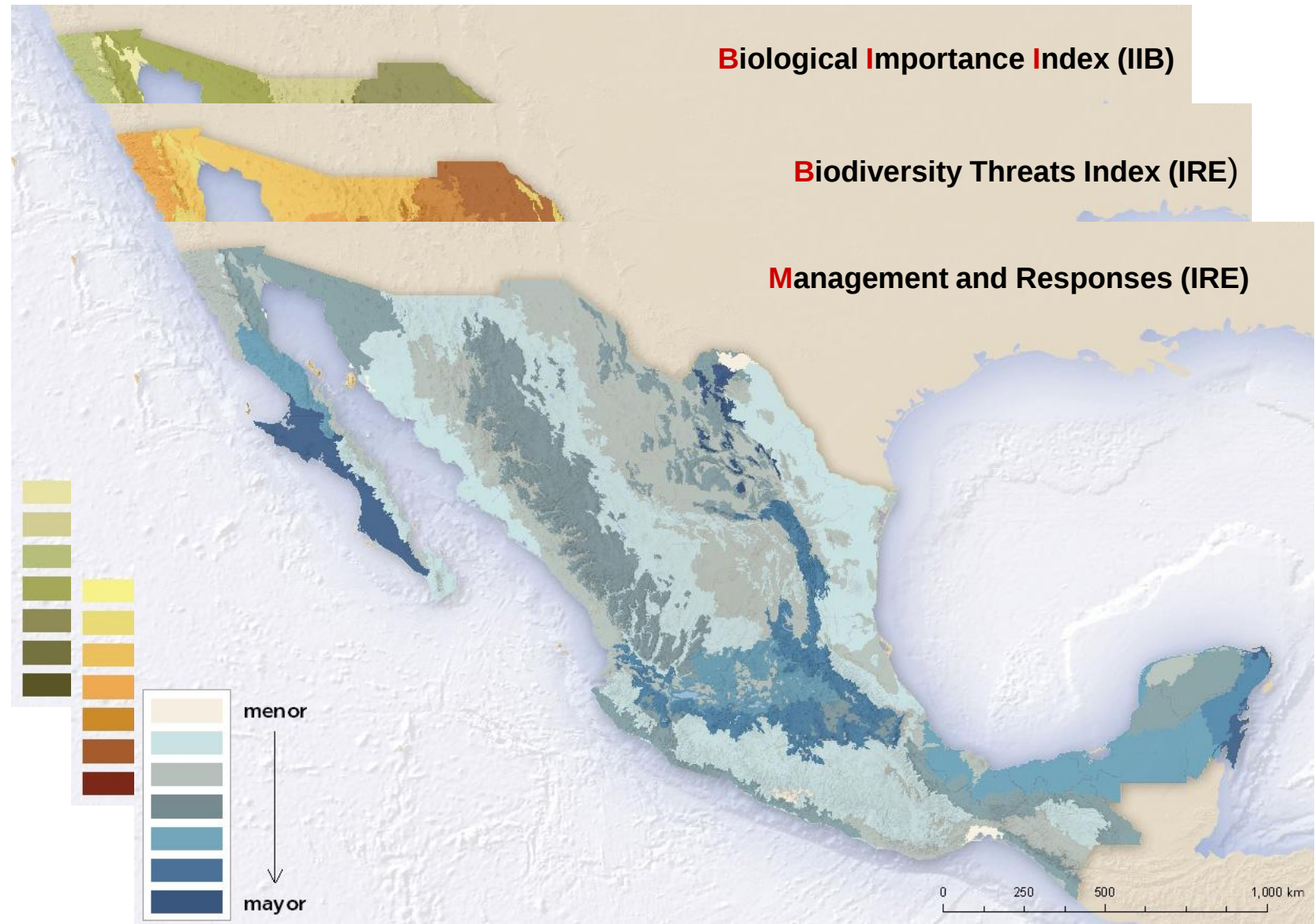


- Deserts and shrublands with higher representation in existing PA system
- Tropical dry forests highly under-represented

Dark green areas are ecoregions with the highest primary vegetation coverage

Three **indexes** were developed at the **ecoregional** level:

- **Biodiversity Threats Index (IRE)** (47 variables), **Biodiversity Threats Index (IRE)**(18 variables), **Management and Responses** (9 variables).



Ecoregional gap analysis

Niveles de protección de las ecoregiones terrestres por áreas naturales protegidas



11 of 96 **Ecoregions** with no formal protection

Marine **p**riority **s**ites for biodiversity conservation

105 priority sites
79 coastal and oceanic sites
26 deep sea sites

National Survey: 67 of
239 priority sites; **22** are
unprotected

Until 2006, 63 **AZE** sites
in Mexico, 14 are islands
(birds and mammals):
40% unprotected



Coincidence of Marine Priority Sites and Marine Priority Regions

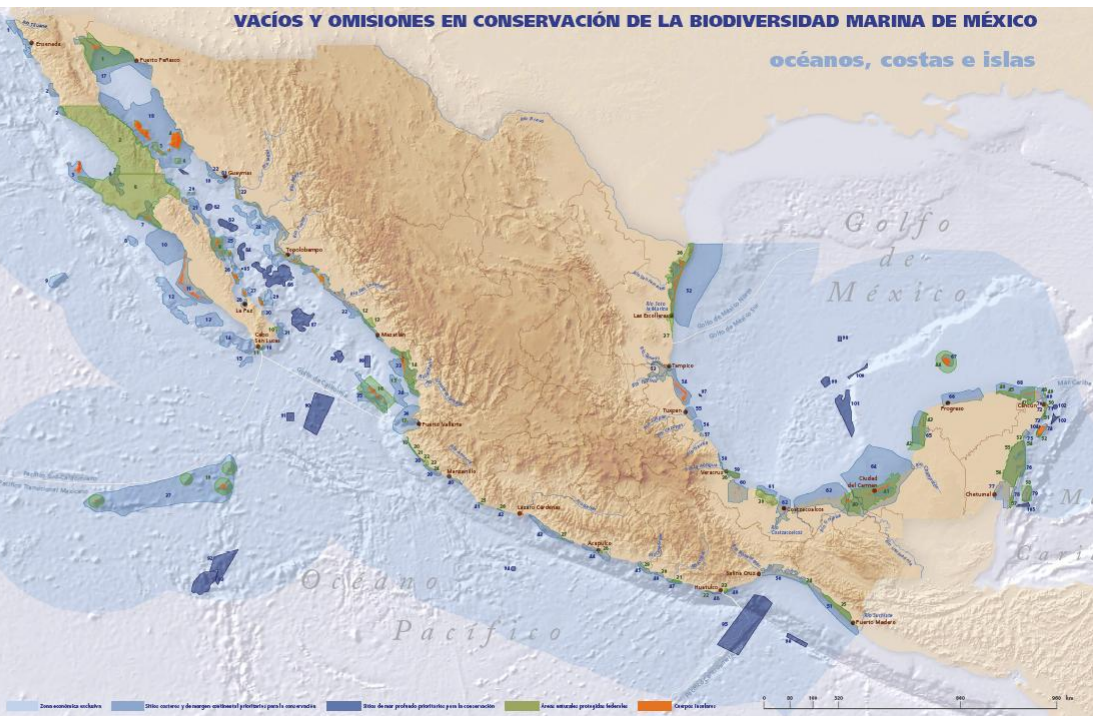
<i>Sites</i>	<i>Total area (ha)</i>	<i>No. of sites</i>	<i>% Overlapped area</i>
SCMC + SMP	34 230 504.84	105	70
RMP	137 862 023.82	70	17

SMP = Deep sea priority sites
SCMC = Coastal priority sites

105 priority sites
79 coastal and oceanic sites
26 deep sea sites

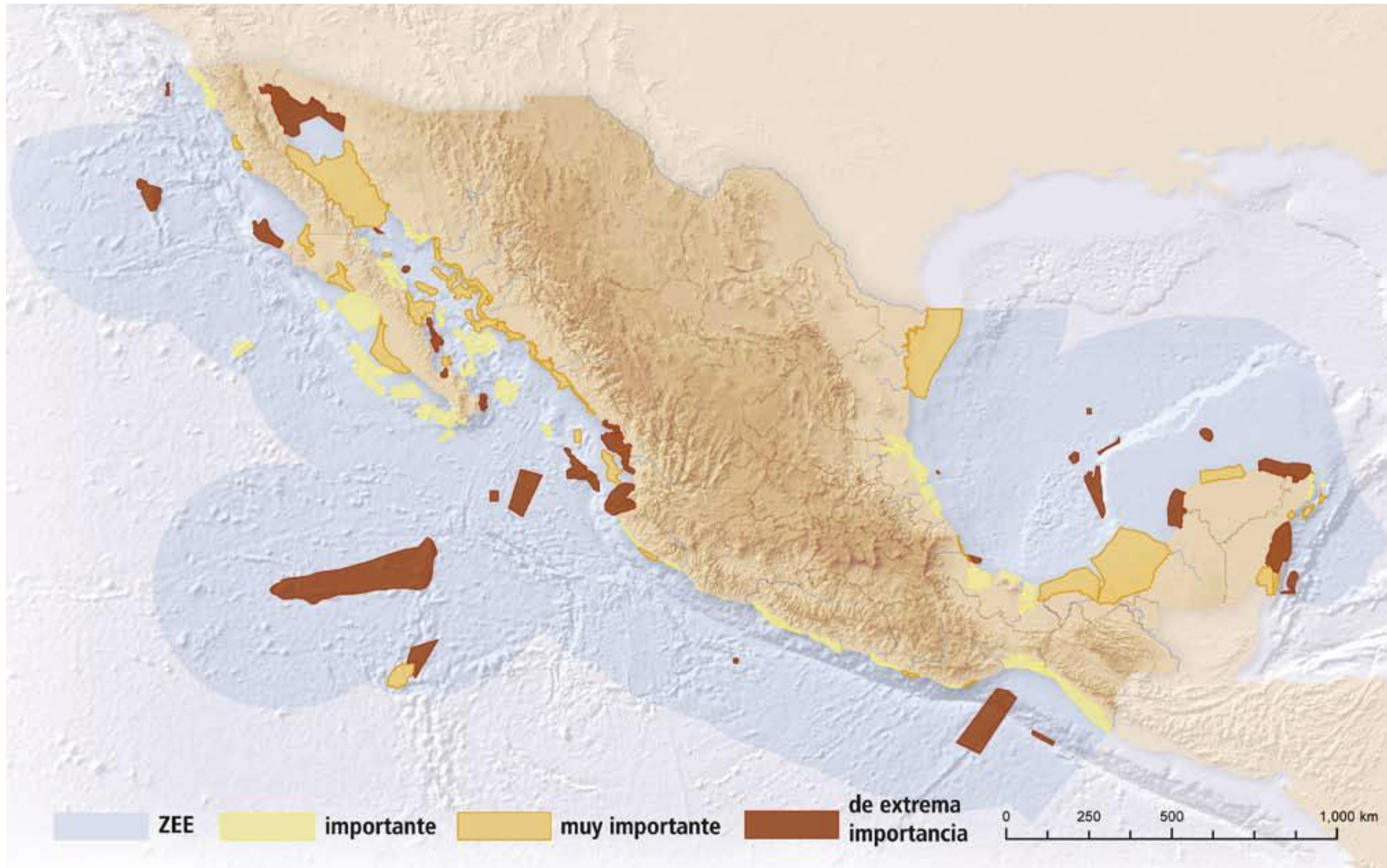
Marine priority sites by ecoregion

coasts, islands and oceans



<i>Marine Ecoregions</i>	<i>no. SCMC+SMP</i>	<i>% de no. SCMC+SMP</i>
Northern Gulf of Mexico	2	1.90
Centroamerican Pacific	5	4.76
Mexican Pacific Transition	19	16.19
Caribbean Sea	15	14.29
Southern Gulf of Mexico	21	20.00
Gulf of California	30	28.57
Total	105	100

Coastal and marine gap analysis



Coastal and marine gap analysis

Classification of marine priority sites

Sites	Important		Very important		Extremely important	
	no. of sites	% sites	no. of sites	% sites	no. of sites	% sites
Coastal	36	46	27	34	16	20
Deep Sea	5	19	6	23	15	58
Total	41	39	33	31	31	30

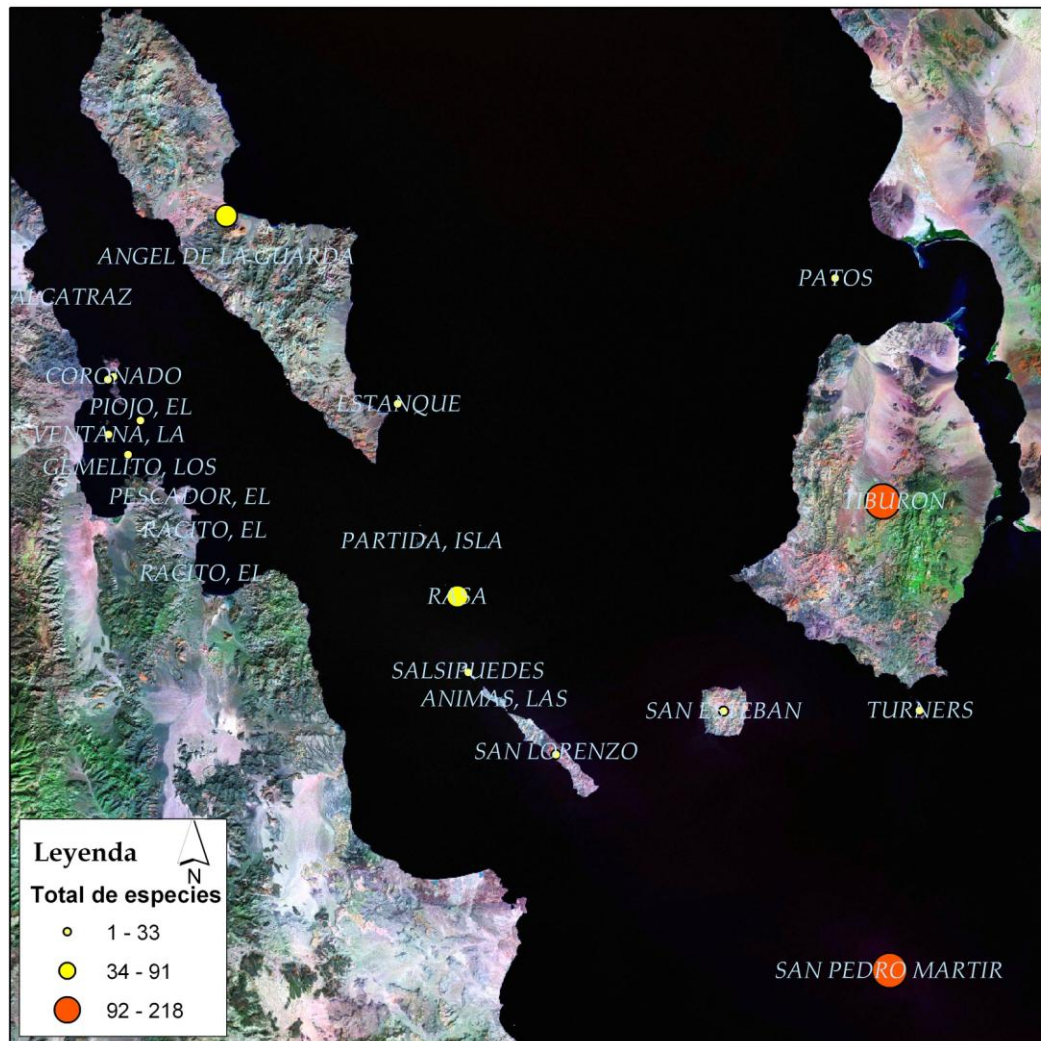
Low representativity levels of priority sites in the **protected area** system (18.33%)

78 priority sites are represented with **less than 20%** of their area in the **PA system**.

All **deep marine** priority sites are **without** protection



Mexico's island biodiversity database



- Comprises a unique portion of the country's biodiversity: 1365 insular elements (1218 islands, 75 reefs and shoal, 31 islotes, 17 cays, 12 rocks, 8 bar, 3 morros, 1 bank)
- 2450 marine and 1937 terrestrial species in 151 insular bodies
- Geomorphologic, physical, biological characteristics and human impacts
- Highly vulnerable ecosystems; since 1600, 75% of the extinct species lived in islands

Terrestrial gap

Five expert workshops were carried out to identify and define:

Biodiversity key features and surrogates (used in analyses **1450**)

Criteria for biodiversity targets (**targets ranged 5-99%**)

Major threats to biodiversity (**19 layers**)

Priorization software (**MARXAN**)

Size of planning units (**256 km²**, 100 km²)



Criteria to assign biodiversity targets

Criteria for key species:

Group	Endemism	Restricted distribution (rarity)	Mexican red list	IUCN	CITES	Sum
	Yes/No	IV Quartile divided in 4 (4, 3, 2 y 1)	E, P, A, Pr	Cr/En/Vu	I/II	
	20	20/16/13/10	25/25/15/-	15/10/5	10/5	
Species 1	20	16	25	15	5	81
Species 2		10	15	5		30

Sum range	Target (% of geographic range size within country)
85 – 64	40
63 – 42	30
41 – 22	10
< 21	5



% Target:

Species 1: 40 %

Species 2: 10 %



Criteria to assign costs

Threat and pressure factors were:

Threat layer	Cost Value
Land use change:	
▪ Rate of primary vegetation loss	10 000
▪ Fragmentation (area-perimeter index)	8300
▪ Secondary vegetation, shrubs	100
▪ Secondary vegetation, herbaceous	200
Heat points from satellite images	7500
Cattle ranching:	
▪ High impact cattle (goats and lambs)	6700
▪ Low impact cattle (bovine and equine)	6100
▪ Non-natural grasslands	6000
Agriculture:	
▪ Irrigation agriculture	5800
▪ Seasonal agriculture	4000
Human infrastructure:	
▪ Road density (paved roads)	3000
▪ Road density (unpaved roads)	2000
Human population centers:	
▪ New localities	1000
▪ Localities <1000 inhabitants	10
▪ Localities 1000- 10,000 inhabitants	20
▪ Localities 10,000- 100,000 inhabitants	30
▪ Localities 100,000- 200, 000 inhabitants	40
▪ Localities > 200, 000	50
▪ Population growth (1990-2005)	900

- compiled
- ranked
- costs assigned based on agreed biodiversity impacts

Example:

Threat and pressure factors	Calculation	Cost value	Example value
Road density (paved roads)	Longitude (m) x cost	3000	6143300
Localities 100,000- 200, 000 inhabitants	Nº. Localities x cost	40	4000
Localities > 200, 000	Area x cost	50	567557
Introduced grasslands	Area (ha) x cost	6000	370263
Total			6516623





Summary of actual and potential threats, weighted considering negative effects on biodiversity.



Summary of conservation targets for key species and surrogates

Results

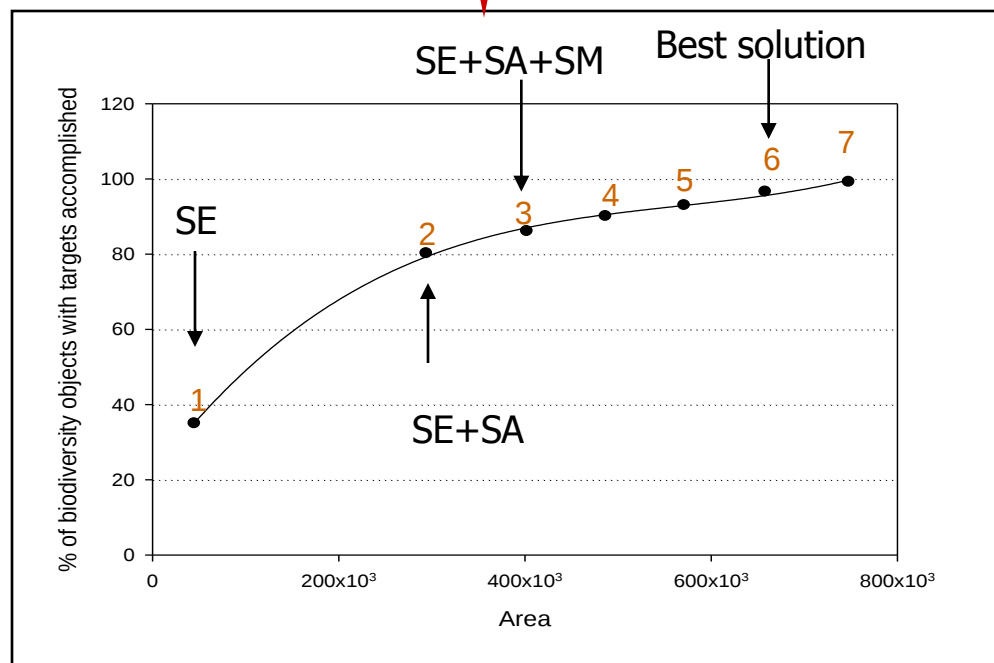
VACÍOS Y OMISIONES EN CONSERVACIÓN DE LA BIODIVERSIDAD TERRESTRE DE MÉXICO espacios y especies



Terrestrial priority sites for conservation and their coincidence with protected areas (PA), terrestrial priority sites (RTP) and areas of importance for bird conservation (IBA)

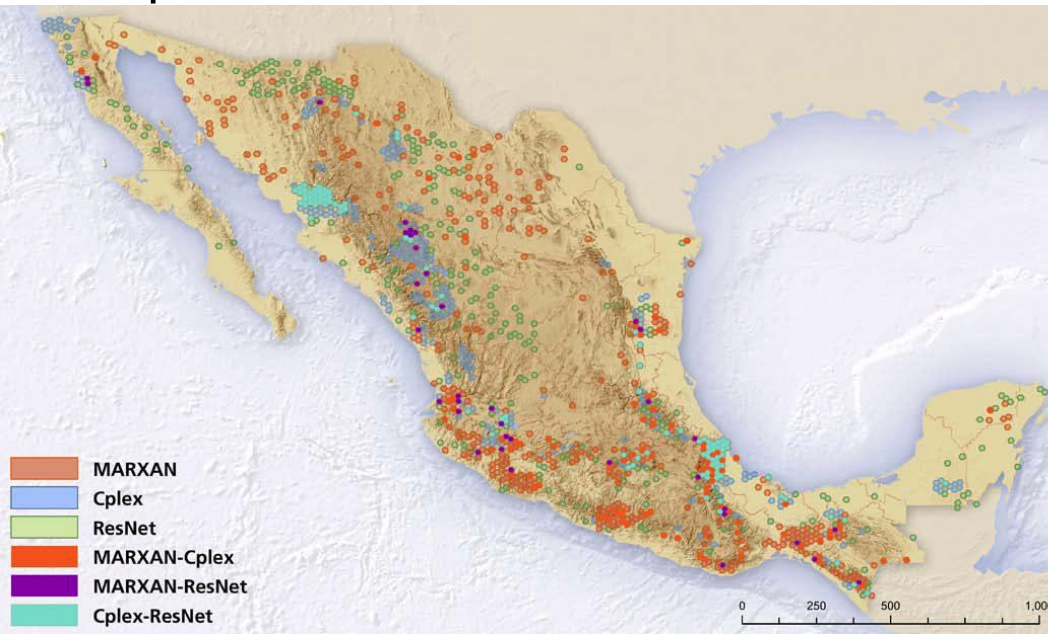
Priority sites	area (km ²)	% of Mexico's continental area	Goals* (%)	PA	RTP	IBA
Extreme priority (SE)	42 725	2.18	34.9	18.19	49.52	30.70
High priority (SA)	283 092	14.45	81.2**	15.59	39.29	24.72
Medium priority (SM)	269 077	13.73	90.5**	9.23	29.80	20.42
SE + SA + SM	594 894	30.36		12.90	35.74	23.21
Best solution***	848 881	43.32	100	12.44	32.98	20.28

*Acumulated value

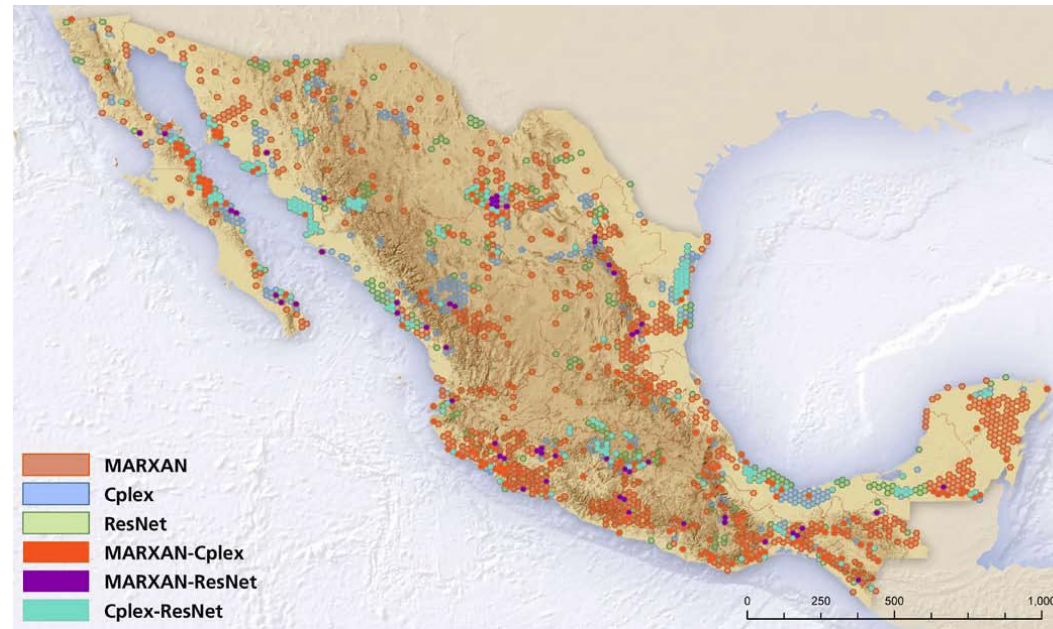


Gap Analyses by taxonomic group

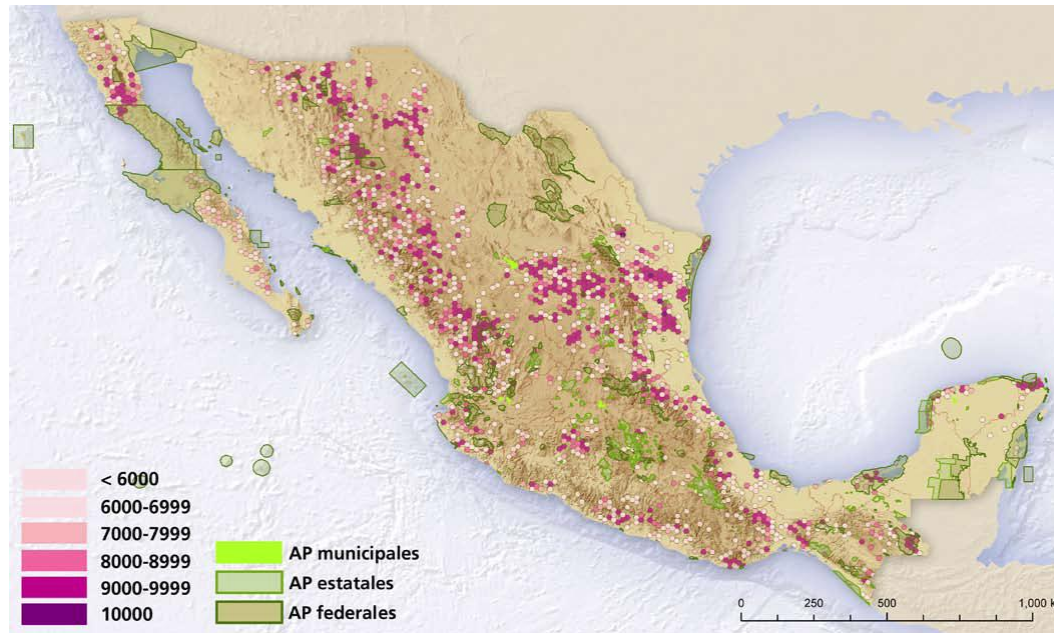
Amphibians



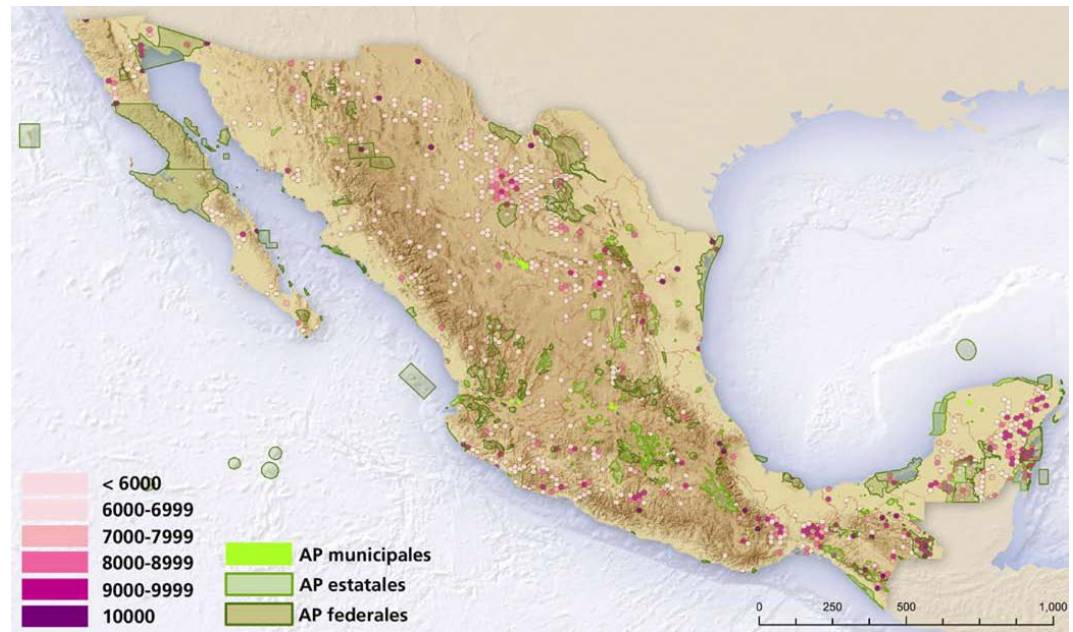
Reptiles



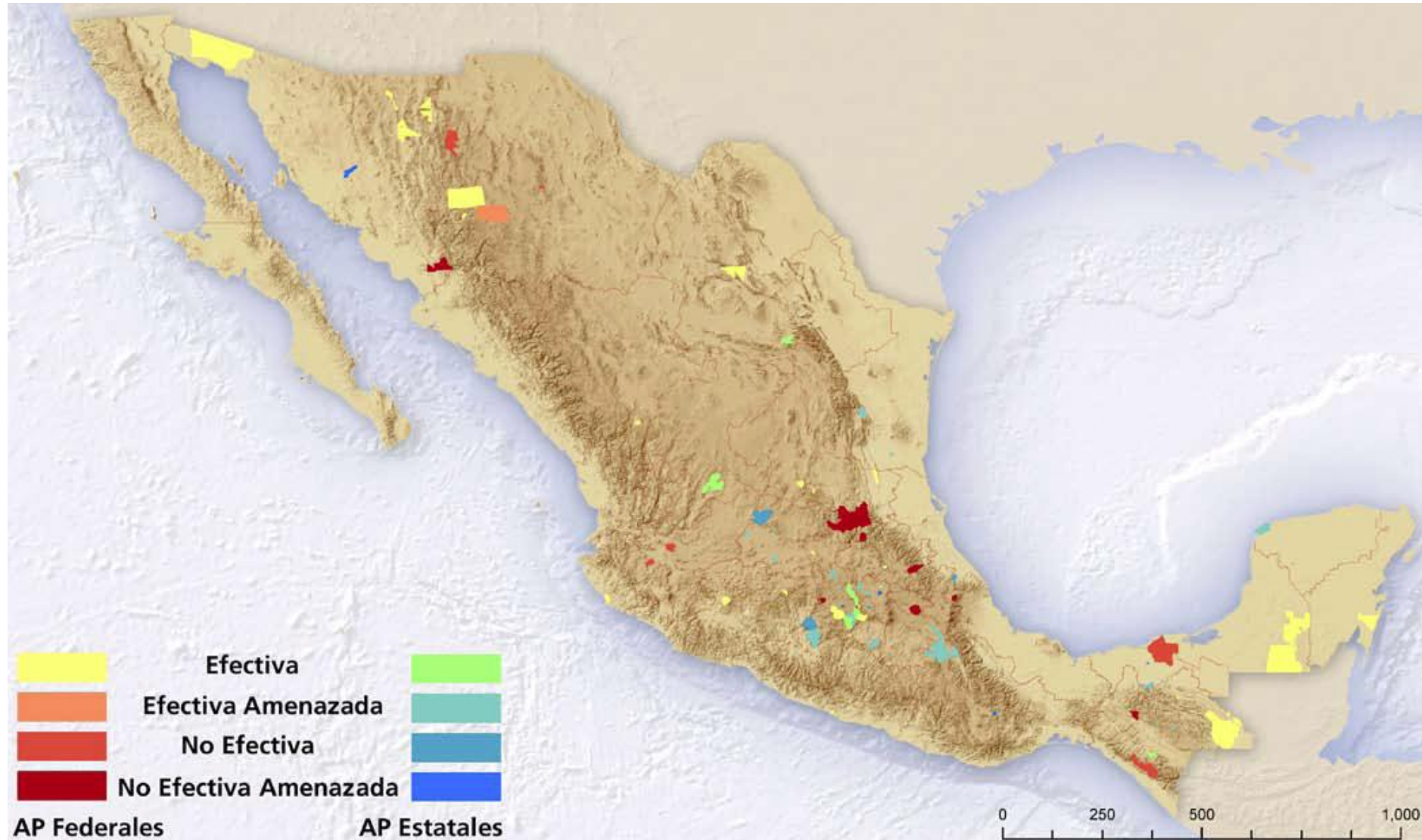
Birds



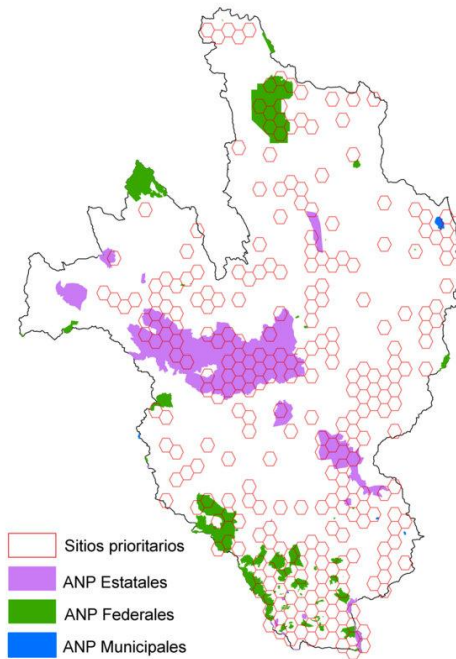
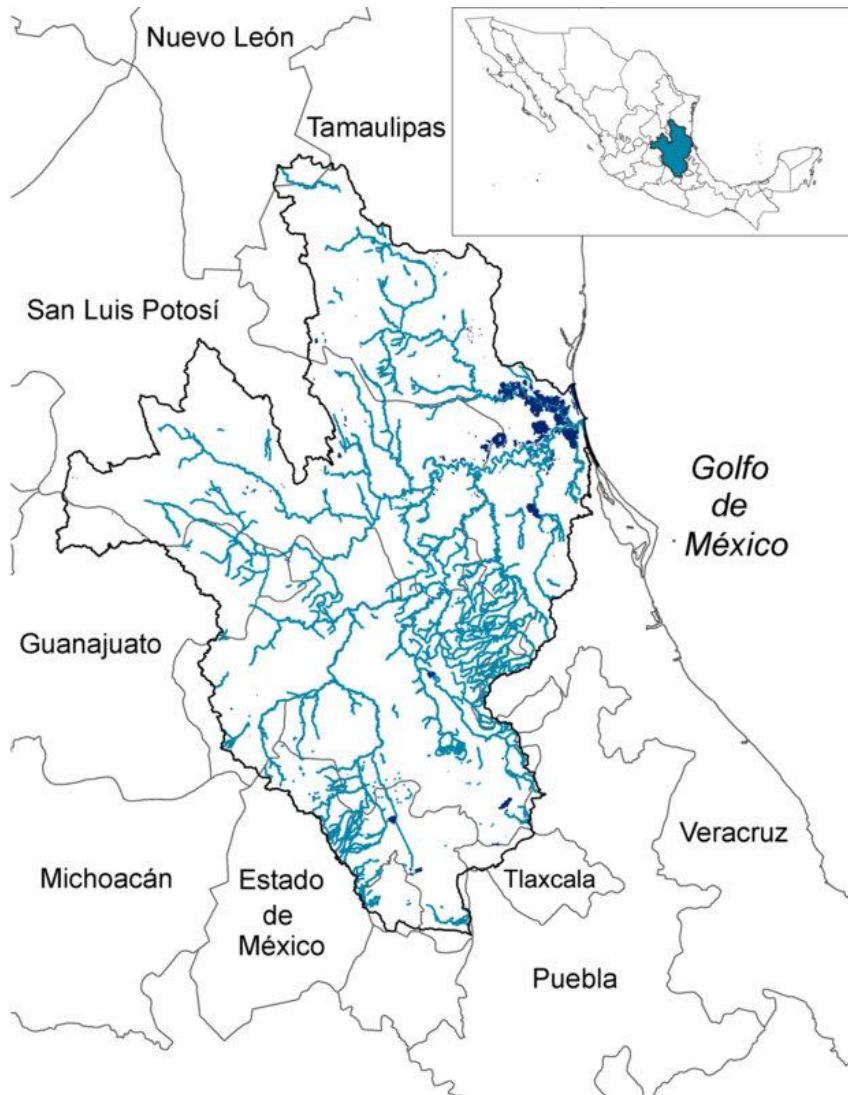
Mammals



Effectiveness of protected areas to conserve primary vegetation (1993-2002)



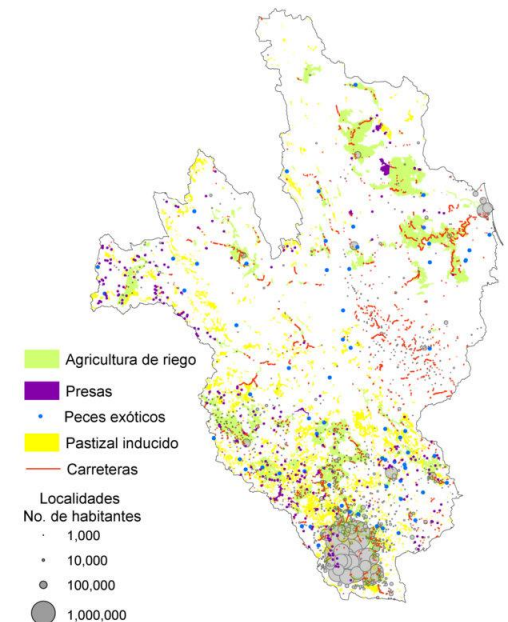
Fresh water gap first approach: the Panuco hydrological region



- Organisms with aquatic affinity
- Ecosystem layers
- Major threats

100 km²
analysis units

Working
on
Regional
analysis
throughout
the
country





www.wiki.gap

www.conabio.gob.mx/gap

Gap website same engineering as the Wikipedia / discussion / peer review

The screenshot displays the CONABIO Gap website interface, which is designed to facilitate peer review and discussion of biodiversity data. The page is titled "gap terrestre" and features a prominent discussion section on the right side, mirroring the structure of Wikipedia. The left sidebar contains a navigation menu with links to various sections, including "Portada", "Entrar", "Metodologías", "gap terrestre", "gap marino", "Material de apoyo", "Documentos", "Referencias", "Organización", "Portal de la comunidad", "Ayuda", "Preguntas frecuentes y contacto", "Buscar", "Lo que enlaza aquí", "Seguimiento de enlaces", "Subir archivo", "Páginas especiales", and "Entrar al sitio". The main content area on the right includes a "Bienvenido a la página del gap terrestre" message, a list of criteria for biodiversity conservation, and a section for "Análisis de vacíos y omisiones". The page also features a search bar and a "Buscar" button. The overall design is functional and user-friendly, emphasizing community engagement and data quality control.

CONABIO

gap terrestre

Ir a Portada | Comentar esta página | Ver los comentarios de esta página | Ayuda

Bienvenido a la página del gap terrestre

El esfuerzo que realiza México por integrar una mayor cantidad de objetos, enfoques y metodologías que han identificado áreas y sitios prioritarios para la conservación de la biodiversidad a diferentes escalas y para diferentes elementos es fundamental dadas sus características que lo hacen un país megadiverso.

Si se desea conocer más sobre los análisis de vacíos y omisiones de otros países: e.g. Belice, Ecuador, Bolivia, Granada, Colombia y Micronesia, Tailandia puede consultarlos en (Meerman, 2005; Trisurat, 2006;).

En el primer taller de metodologías gap realizado el 11 y 12 de abril del 2005 se propuso una serie de criterios y elementos de conservación que se deben considerar en el análisis de vacíos y omisiones:

1. Representatividad en el sistema de áreas protegidas de las ecorregiones, tipos de vegetación, pisos altitudinales y cuerpos de agua así como en relación a priorizaciones realizadas antes, como las regiones terrestres e hidrológicas prioritarias (liga a página de regiones prioritarias).
2. Identificación de áreas de alta concentración de especies (riqueza) y de concentración de especies endémicas.
3. Análisis de complementariedad.
4. Especies con valor para la conservación: amenazadas, endemismos, rareza (*sensu* Rabinowitz, 1986, incluye: microendemismos, especies de distribución marginal en México, especies con números de poblaciones bajos).

Imagen: Banco de datos, Conabio.

A su vez, se definieron niveles de análisis por ecorregiones y con retículas uniformes de mayor resolución (~1/6° o mayores), utilizando como información biológica a grupos taxonómicos para los cuales se tiene un mayor conocimiento y calidad de información. Se ha identificado que en un futuro valdría la pena incorporar datos de variabilidad y unicidad a nivel genético.

Debido a que los inventarios biológicos de las especies no se han completado para muchas regiones del país y a que existen sesgos espaciales en el conocimiento del área de distribución de las especies basado sólo en registros de especímenes recolectados, existen vacíos de información. Para evitar estos sesgos en los mapas de riqueza y concentración de endemismos, una alternativa es usar modelos de la distribución potencial de las especies, o en otros casos también se puede optar por la utilización de índices que permitan estimar el número de especies por área para poder superar el problema de los huecos en el conocimiento de la distribución de las especies.

Imagen: banco de datos, Conabio.

En el caso de los vertebrados y de algunas especies de plantas amenazadas, se cuenta con modelos del nicho ecológico de las especies, los cuales representan la asociación de los sitios de recolecta registrados y validados para cada una de las especies con un conjunto de variables ambientales (principalmente bioclimáticas y topográficas); en todos estos casos se ha utilizando el programa Desktop GARP (*Genetic algorithm for rule set prediction*; disponible al público en <http://www.lifemapper.org/desktopgarp/>). Los modelos, han sido generados, revisados y editados por los especialistas para corregir problemas de sobre o subestimaciones en áreas de poca coincidencia con el área de distribución conocida de los taxones analizados.

CONABIO

gap análisis

Portada

Entrar

Metodologías

gap terrestre

gap marino

Material de apoyo

Documentos

Referencias

Organización

Portal de la comunidad

Ayuda

Preguntas frecuentes y contacto

Buscar

Ir

Buscar

Lo que enlaza aquí

Seguimiento de enlaces

Subir archivo

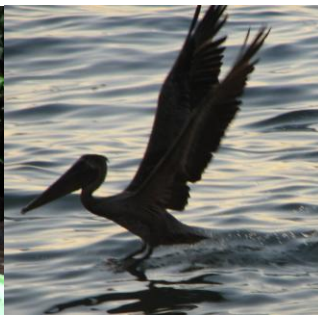
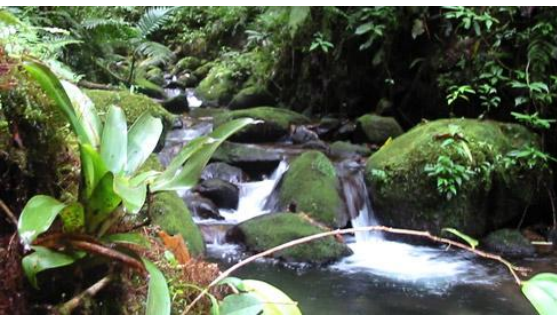
Páginas especiales

Mexico's gap assessment: next steps

- Analyses at different scales
- Carry out a revision and validation process
- Integration of gap results of different environments and taxonomic groups with a quantitative and qualitative approach
- Inclusion of priority sites for migratory species & areas
 - stopovers, nesting beaches, etc.
- Development of models to estimate viability and to define required redundancy and resilience.
- Define different categories to analyze and represent the gaps (Representativity, management, etc).
- Analyze the tendencies of pressure factors, such as deforestation and climate change.
- Incorporate new elements and knowledge to update Gap analyses in the future

Conservation recommendations

- Given Mexico's exceptional **high biodiversity**, it will be **necessary** to implement **diverse strategies**, such as the establishment of **new** protected areas, social and private reserves and integral **management** programmes.
- The participation of the **society** as a whole will be a key factor towards the conservation of our **natural capital**
- It will be crucial to identify the factors of **success** and **failure** of different **instruments** and areas, taking into account socioeconomic aspects



M. Kolb



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Foto: Conabio

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Foto: Melanie Kolb

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