

Impact Modeling and Conabio's *Cactoblastis Cactorum* Activities in México.

The International *Cactoblastis cactorum* Conference

May 7-10, 2007

**Eduardo Morales, Patricia Koleff, Jesús Alarcón, Elizabeth Moreno
Dirección de Análisis y Prioridades
CONABIO**



CONABIO

- A government interministerial commission
- 60% of budget from federal funds
- Created by Presidential decree in 1992 to:
 - promote and coordinate actions oriented to the knowledge and sustainable use of Mexico's biological richness
 - obtain, organize, analyze and make accessible the information about this richness
 - Serve as a “bridging institution” between academia-government-civil society



CONABIO

Conceived as a:

- demand-driven research organization
- promoter of basic (systematic, ecological, socio-economic) research
- compiler of existing national and international biodiversity information on Mexico
- generator of human capacity in the area of informatics for biodiversity
- An open resource of information to all society



Mission

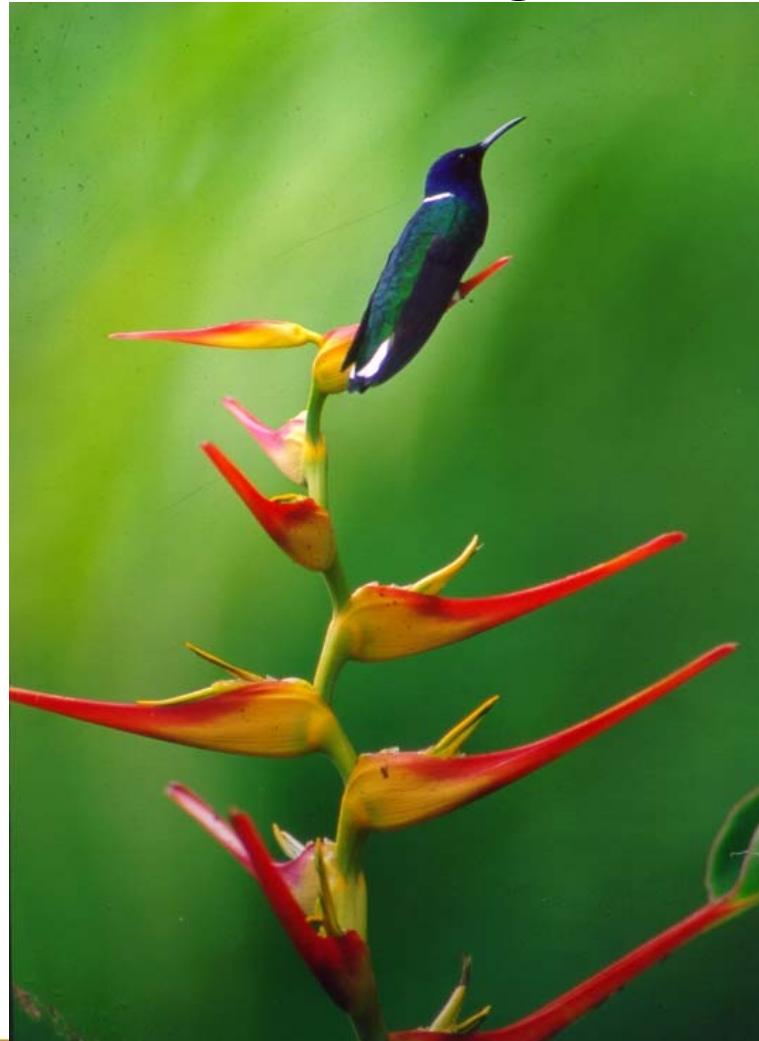
To promote, coordinate, support and carry out activities aimed at improving our understanding of biological diversity, as well as at its conservation and sustainable use for the benefit of society.

Vision

In Conabio, our goal is to become an organization that:

- Contributes significantly to decision making and to the establishment of policies regarding the conservation and sustainable use of biodiversity, providing data, information and knowledge obtained through the support of its generation and integration.
- Is a leader and innovator in biodiversity informatics, efficient processes and maintains high quality products and services.
- Is a mandatory point of reference for biodiversity issues in Mexico.

Some of CONABIO's services and products for environmental and public policy decision making



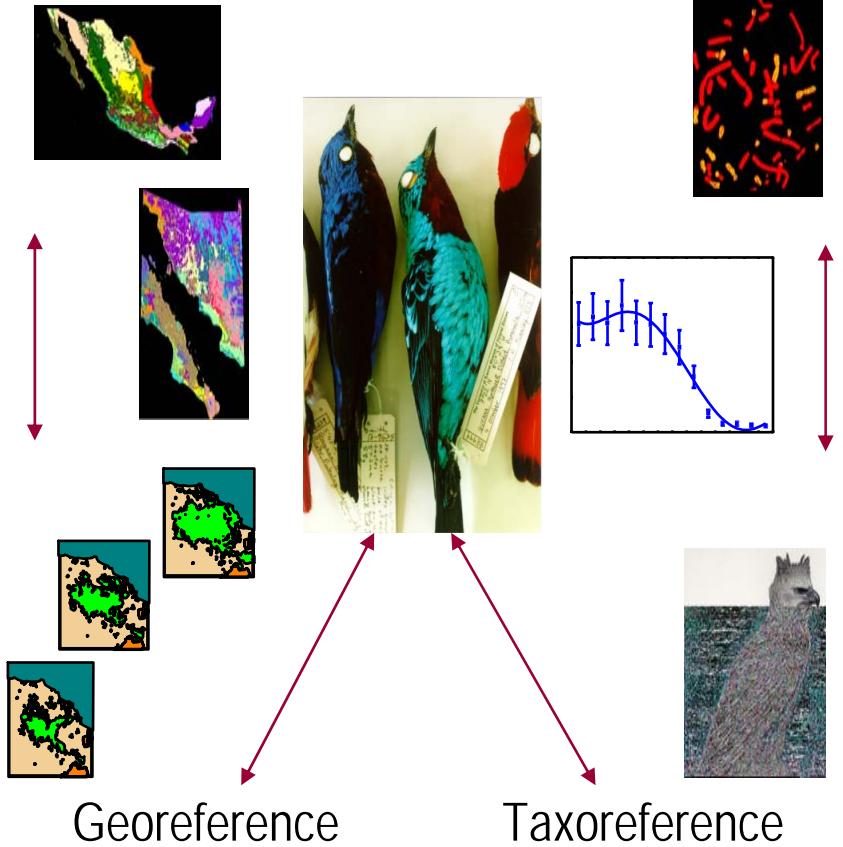
Many Relevant Problems Require Answers to “Whereabouts” Questions.

- “Whereabouts” questions refer to the presence of entities in places:
 - Which species are to be found in a given place.
 - Where can I find a given species.
- Despite their apparent simplicity, these questions are often fundamental and very relevant in both applied and basic science.

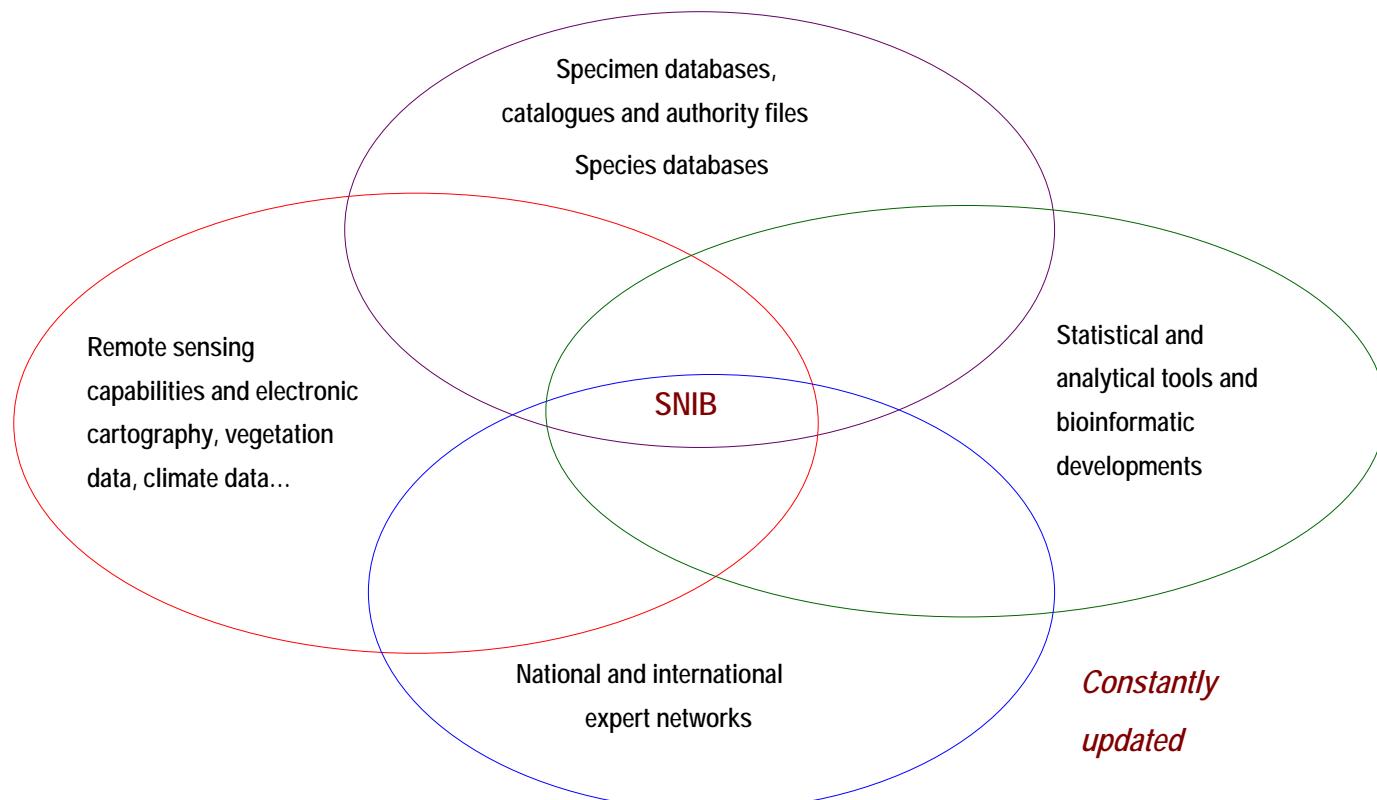


Whereabouts questions can be answered using the data in scientific collections

- The World's scientific collections have about 3 billion specimens. Only 2-3% are electronically accessible !!
- Specimens provide connections to geographically structured information and indexed information to the Latin binomial.



National Biodiversity Information System (SNIB)



The knowledge layer

Conservation
Invasive species
Bioprospecting
Biosafety
Restoration

Web-based applications

The information layer

Metadata
Statistical tools
Extrapolation tools
Visualization
Organization

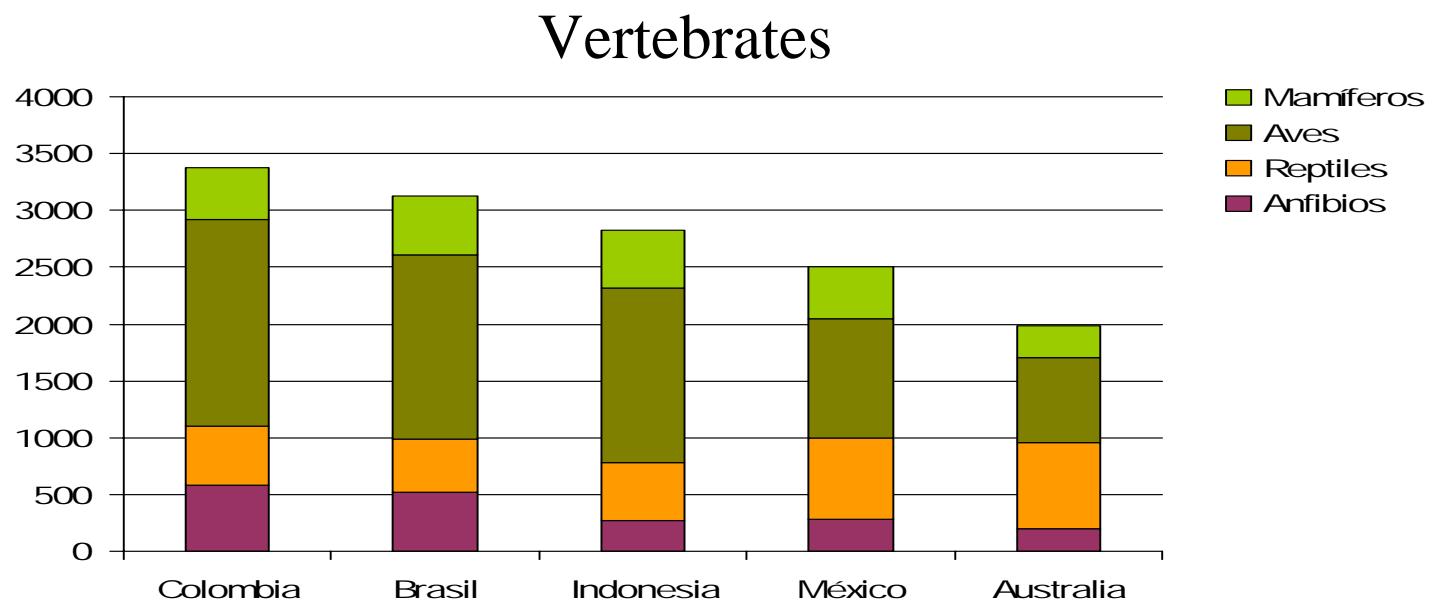
Accumulation curves
Bioclimatic models
Complementarity
Hot-spot detection

The data layer

Specimen data
Authority files
Geospatial data
Species attributes data
Updating

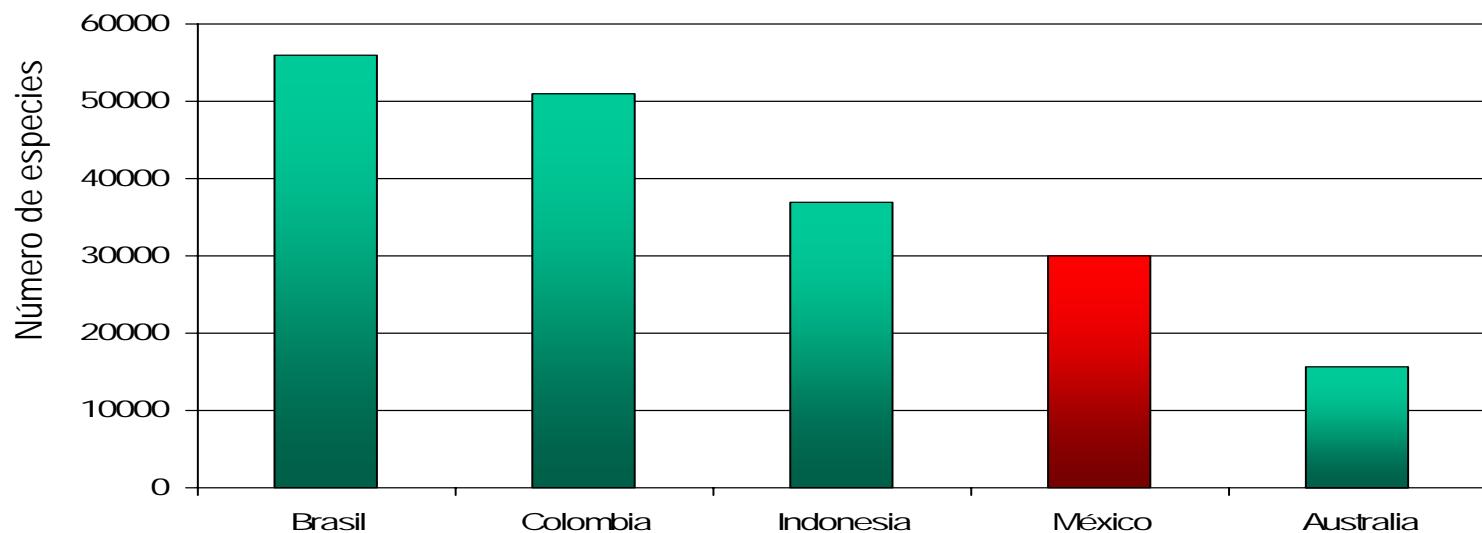
DBM
GIS
TCP/IP
XML

México is one of the five most biodiverse countries



México is one of the five most biodiverse countries

Plants



Diversity of *Opuntia* species in Mexico

- Mexico has the highest species diversity of the genus.
- 3,000,000 ha consist of wild populations.
- 56 species of *Opuntia* (platyopuntias).
- 38 of these are endemic.



Invasive species represent the second cause
for biodiversity loss worldwide.



I.- Impact Modelling

.- Historical

.- Recent (2007) analyses



Opuntia losses due to *Cactoblastis* “invasion” would affect biodiversity by collateral effects on birds, invertebrates and other plant species related with Opuntia’s.

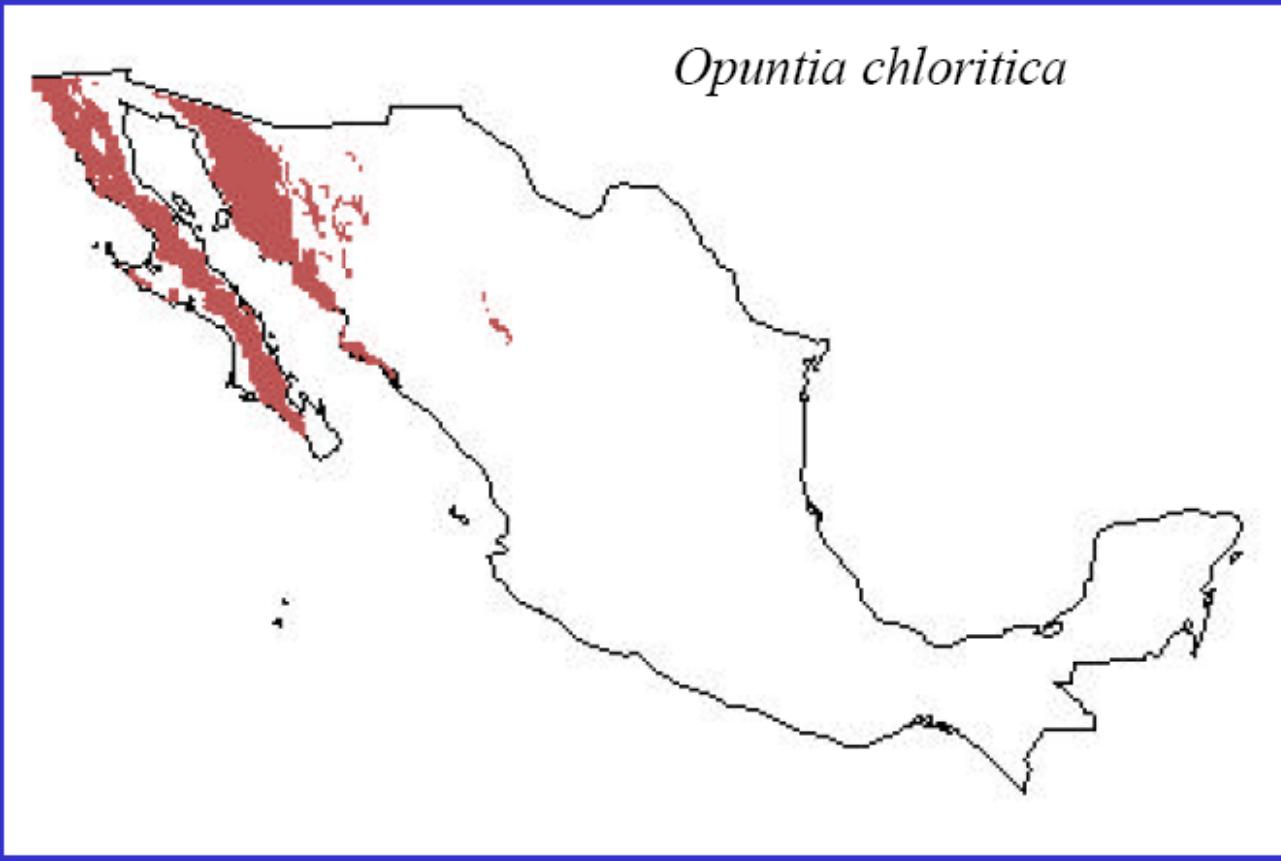


Modelling the invasion of *C. cactorum* in Mexico

- FloraMap. Distribution of areas of possible adaptation. Uses climatic variables and a PCA
- GARP. (Genetic Algorith for Rule Set Prediction)
- Identification of risk factors (susceptibility towards *C. cactorum*)
- Interpolation of the probability of *C. cactorum* habitat and *Opuntia* species richness.



The distribution of each species was modelled with GARP and “cookie cut” by ecological regions



Species of *Opuntia* that have been documented as being susceptible to *C. cactorum* in other countries

Opuntia tomentosa

Opuntia megacantha

Opuntia macrorhiza

Opuntia ficus-indica

Opuntia lindheimeri

Opuntia stricta

Opuntia streptacantha

Opuntia spinulifera



Bio-control has been generally assumed an efficient method for plague pest control, however non-target species could be damaged.

México is the country with the highest number of native species from the genus *Opuntia* which could be affected by the invasion of *C. cactorum*



Since 2000 CONABIO has been using bioclimatic modelling in order to predict the potential distribution of *C. cactorum* and overlaid this on the actual distribution of *Opuntia* species.



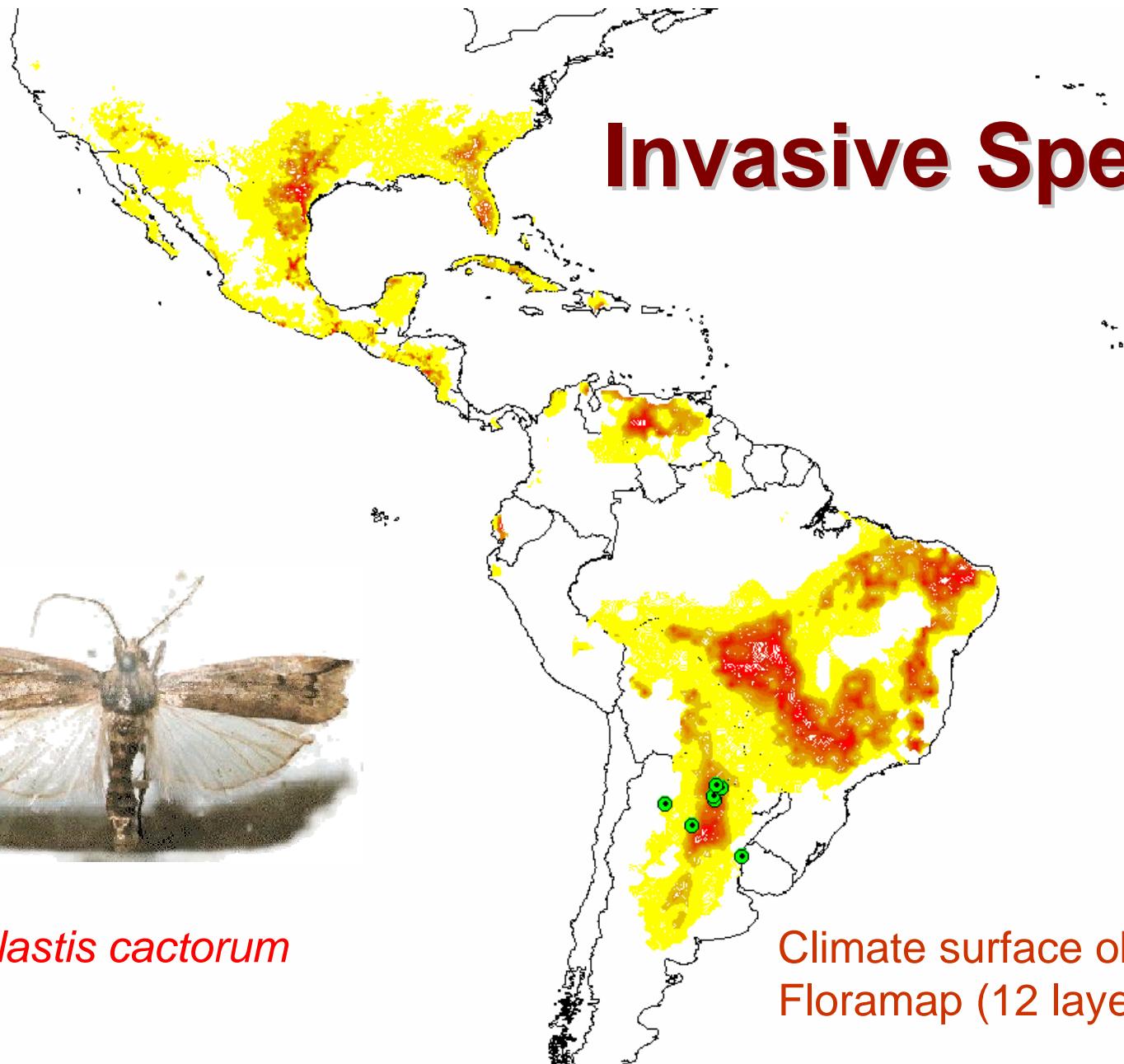
CONABIO's National Biodiversity Information System
(SNIB) contains 3874 registers from 51 *Opuntia* species
from México, Arizona, New Mexico and Texas.

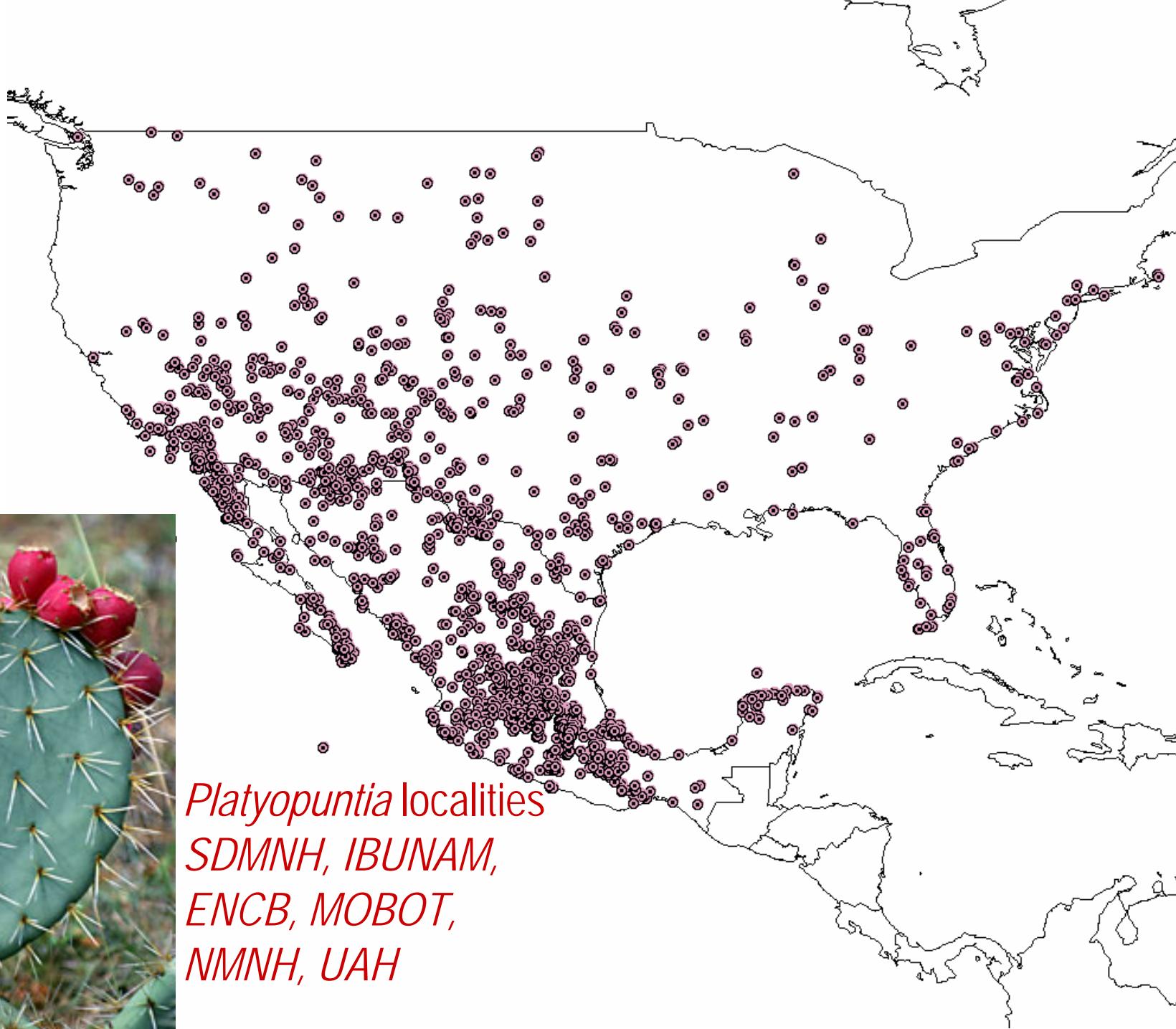


Invasive Species

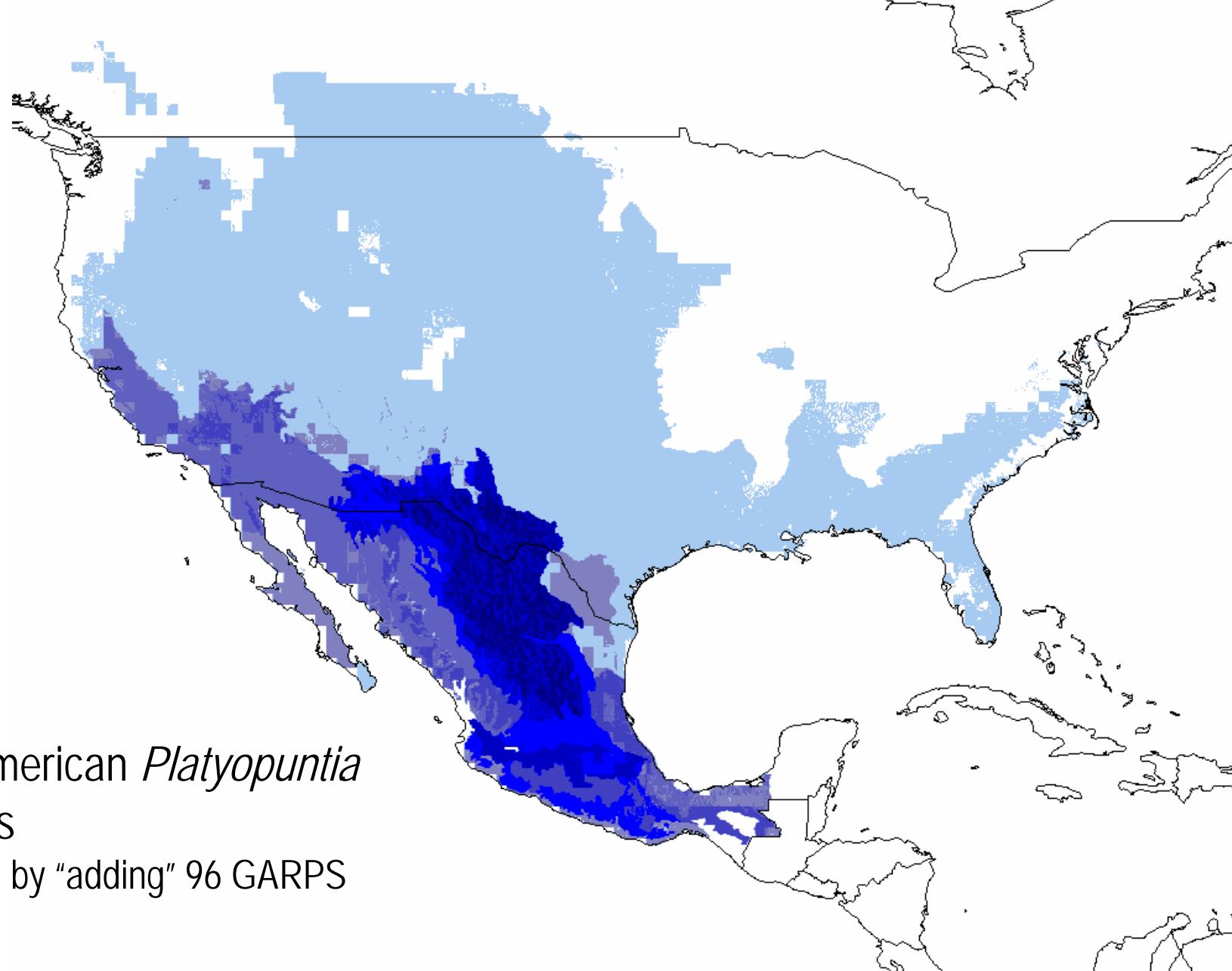


Cactoblastis cactorum





Platyopuntia localities
*SDMNH, IBUNAM,
ENCB, MOBOT,
NMNH, UAH*



Northamerican *Platyopuntia*
richness
Obtained by "adding" 96 GARPS



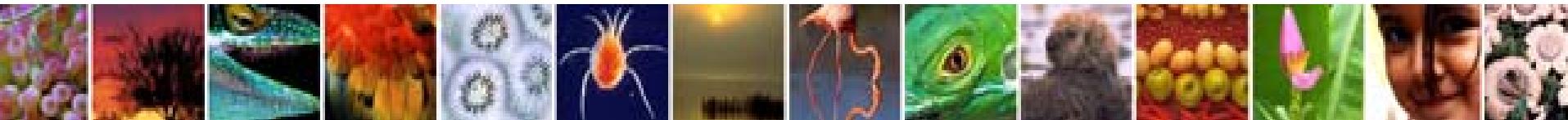
Vulnerable areas to *Cactoblastis* according to statistical and analytical tools

Red isolines:

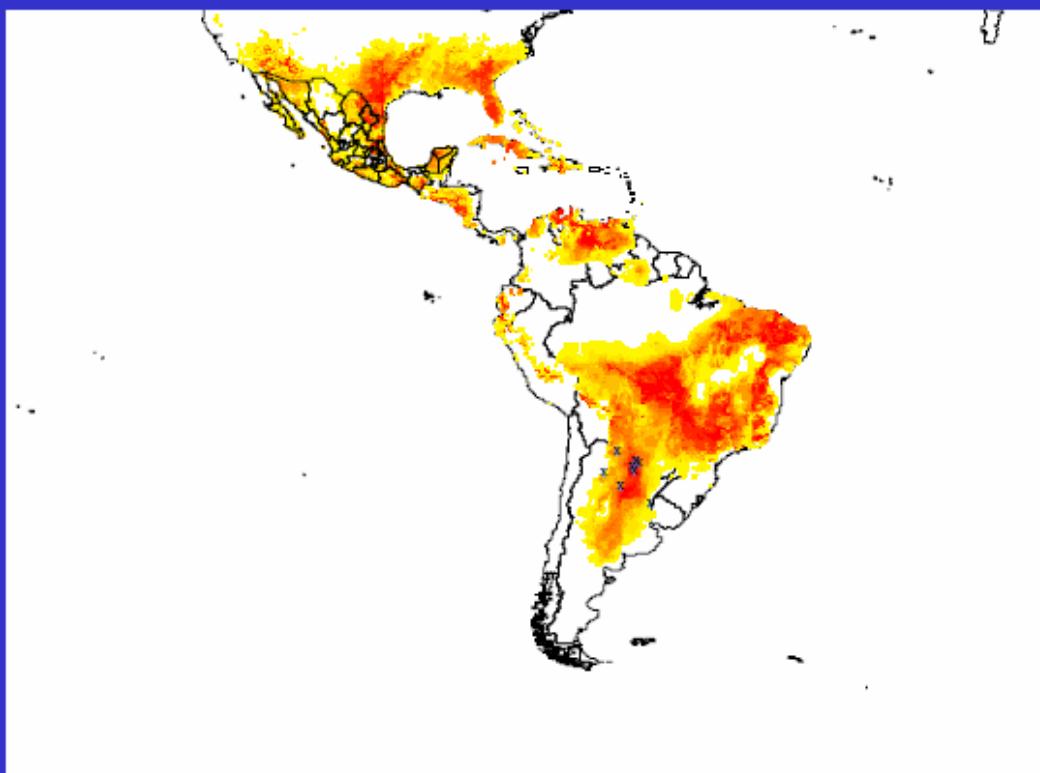
High similarity to climate in
the original *Cactoblastis*
cactorum sites.

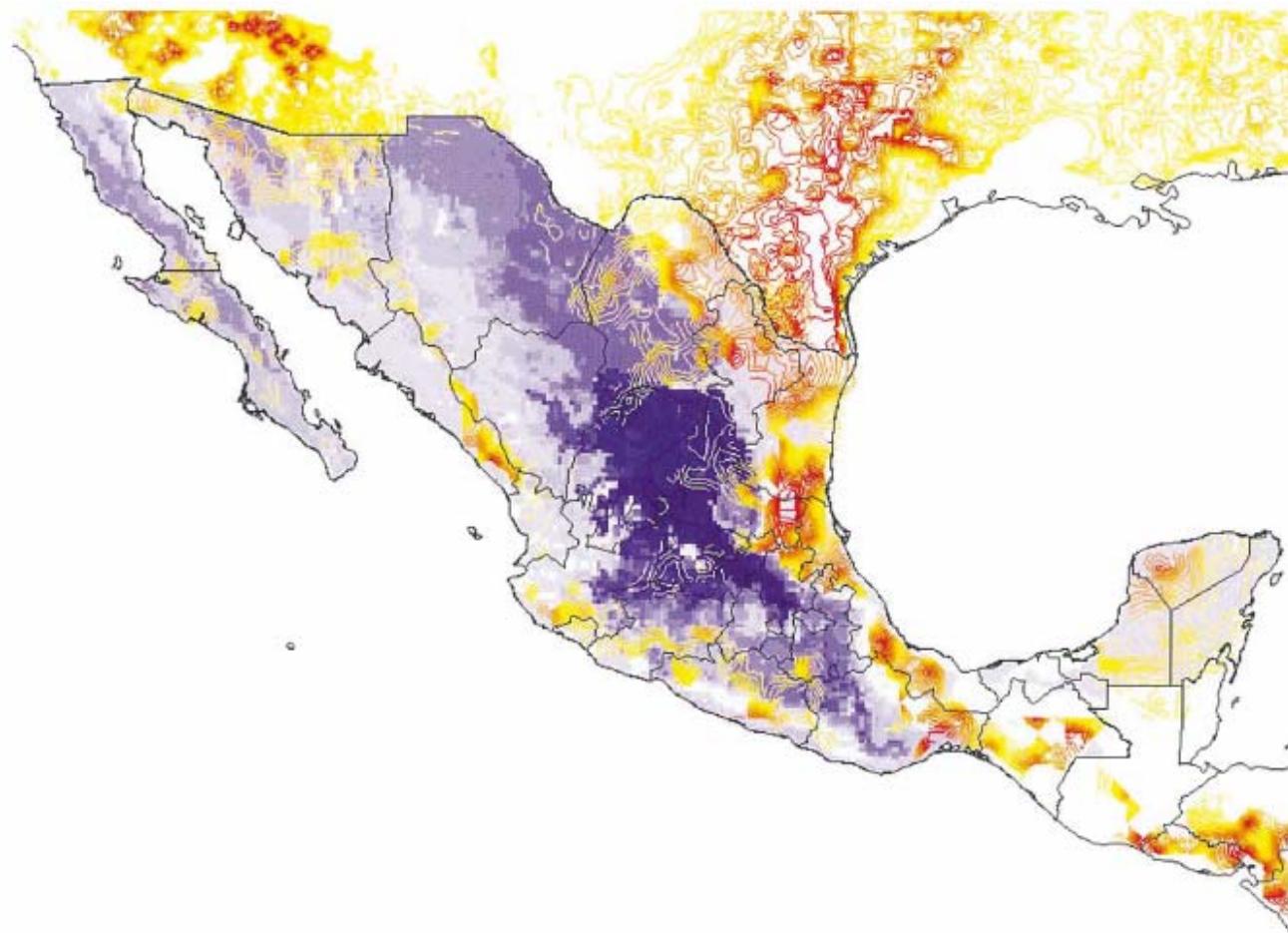
Blue regions:

Richness of species of *Platyopuntia*.



Regions in Mexico and the Caribbean having climatic similarities with original *C. cactorum* distribution





Nopaleras susceptible to *C. cactorum* (red) and zones for high *Opuntia* Biodiversity (blue).



Risk Factors assumed

- High Risk
 - Species of *Opuntia* (subfamily *Platyopuntia*) that have been susceptible to *C. cactorum*
- Medium Risk
 - Species of *Opuntia* having taxonomic affinities
- Potential Damage



These results indicate that areas with high Opuntia diversity would be slightly affected, and the invasion would be associated with low diversity regions.



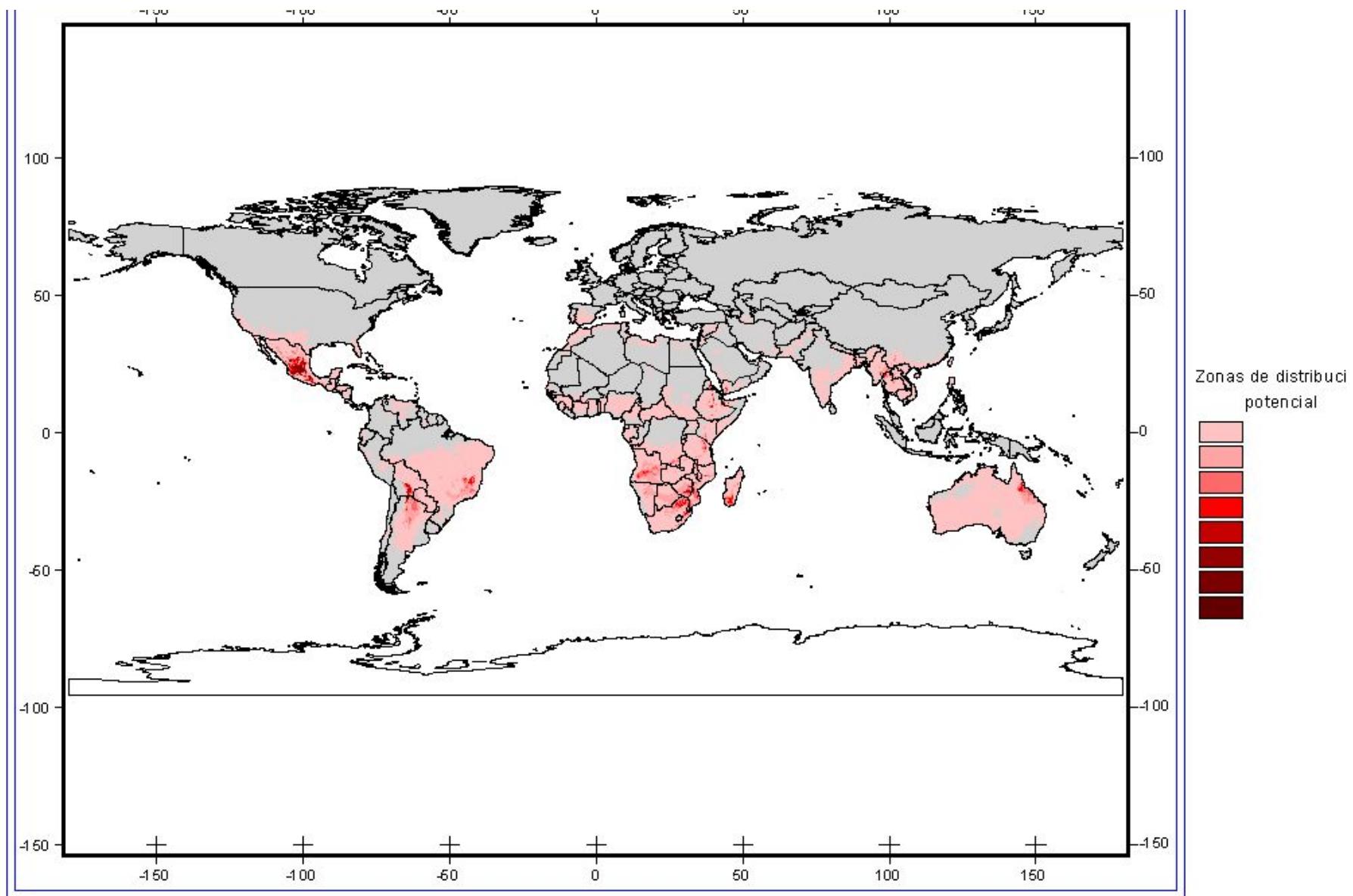
I.- Impact Modelling

.- Historical

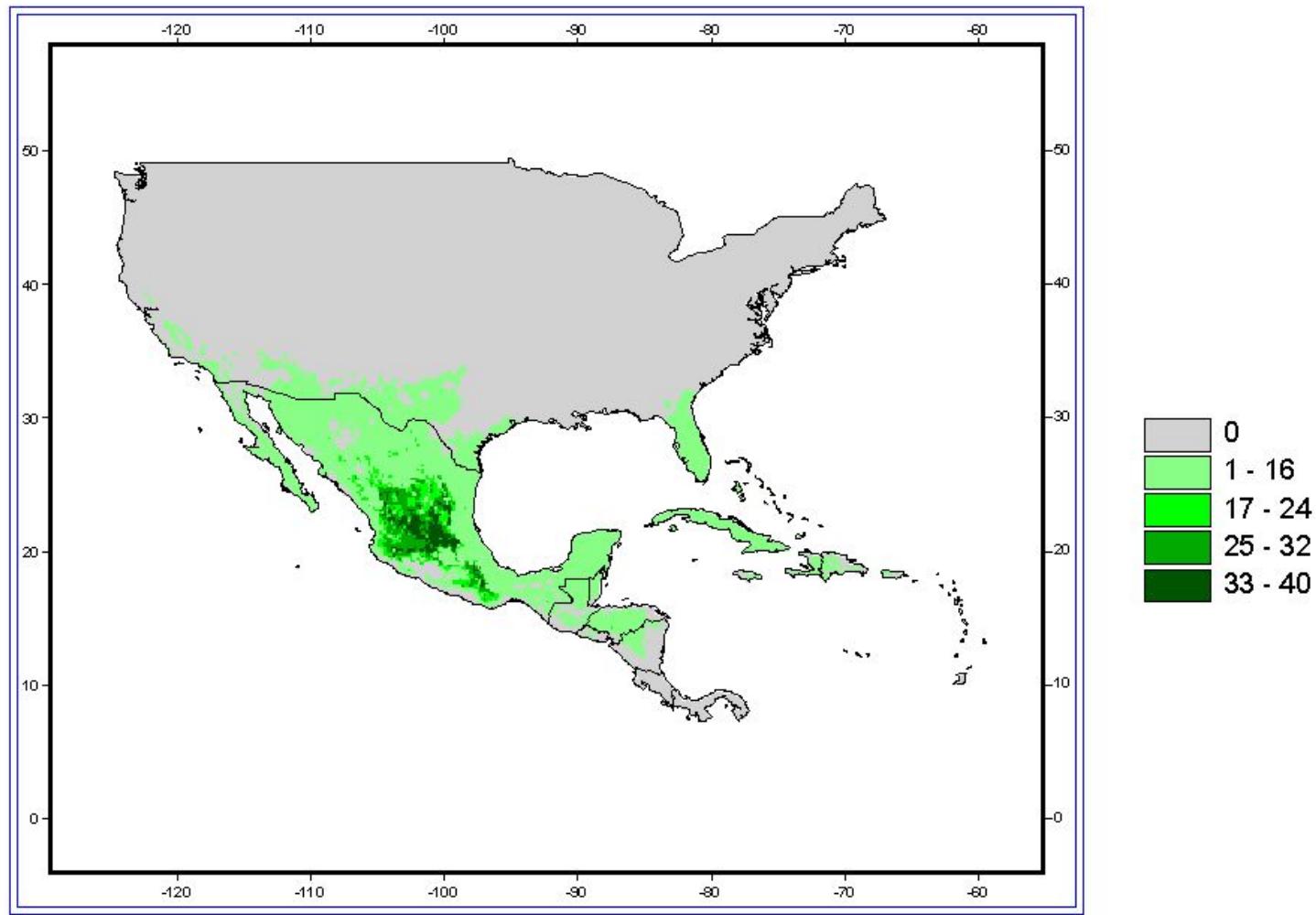
.- Recent (2007) analyses



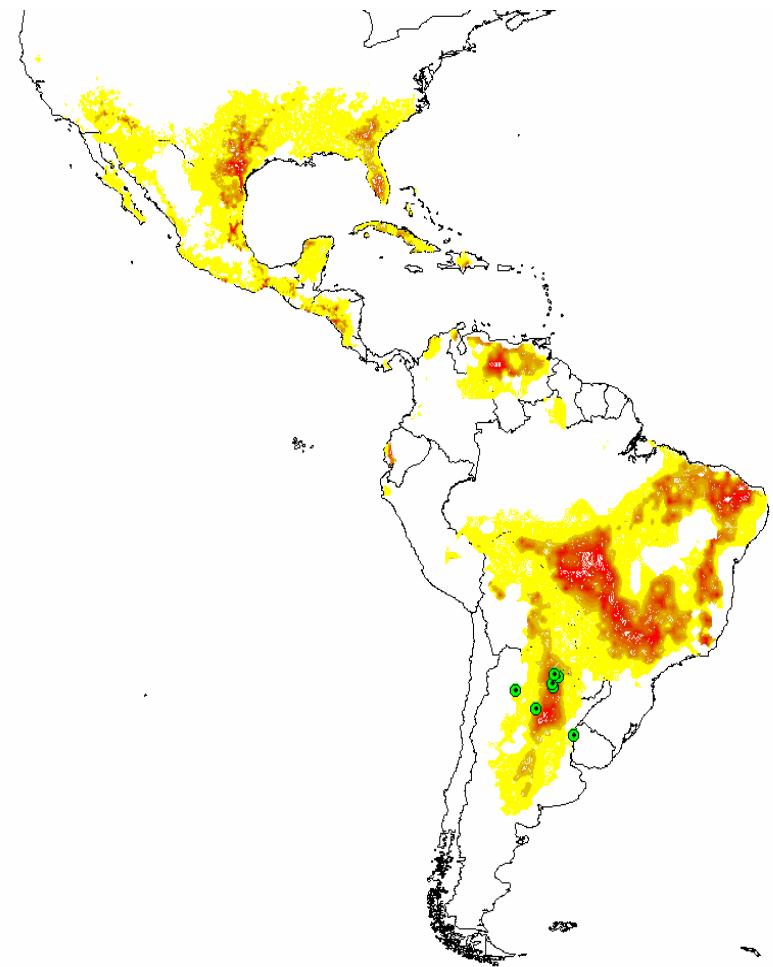
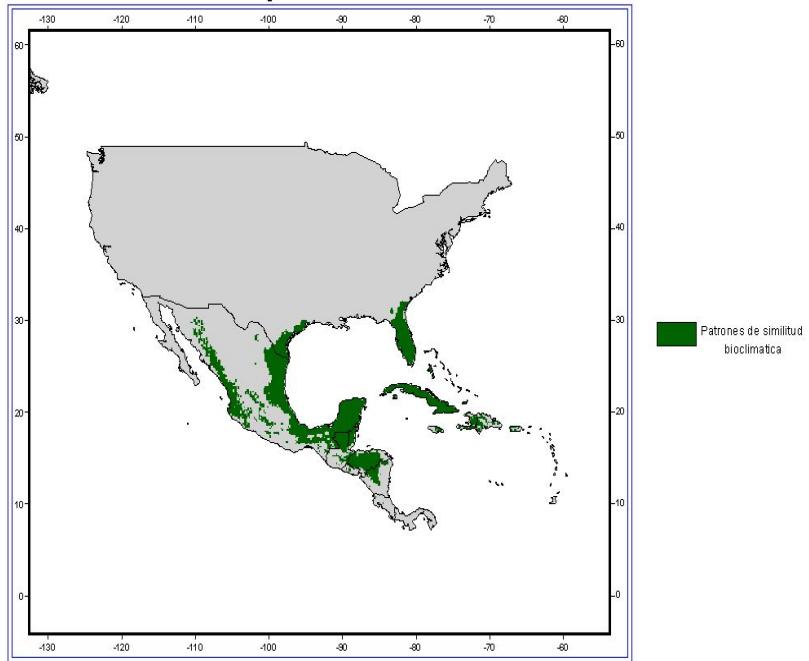
Global bioclimatic patterns for *Opuntias* in the world



Patrón ecológico de las principales especies de opuntias en América.



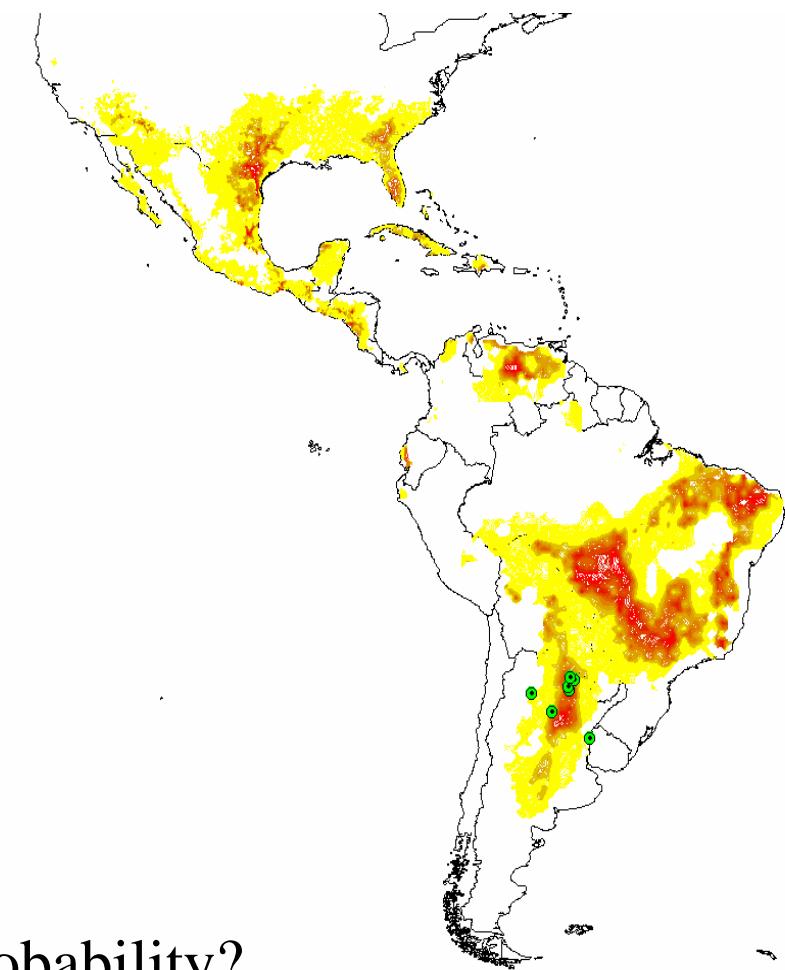
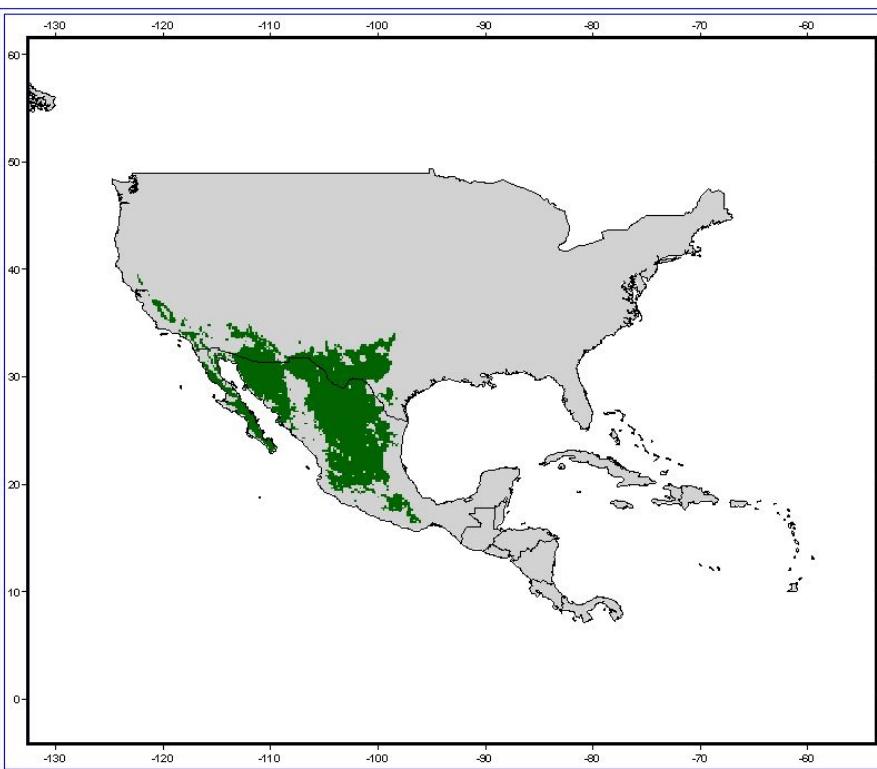
Opuntia dilleni potential distribution



High risk?



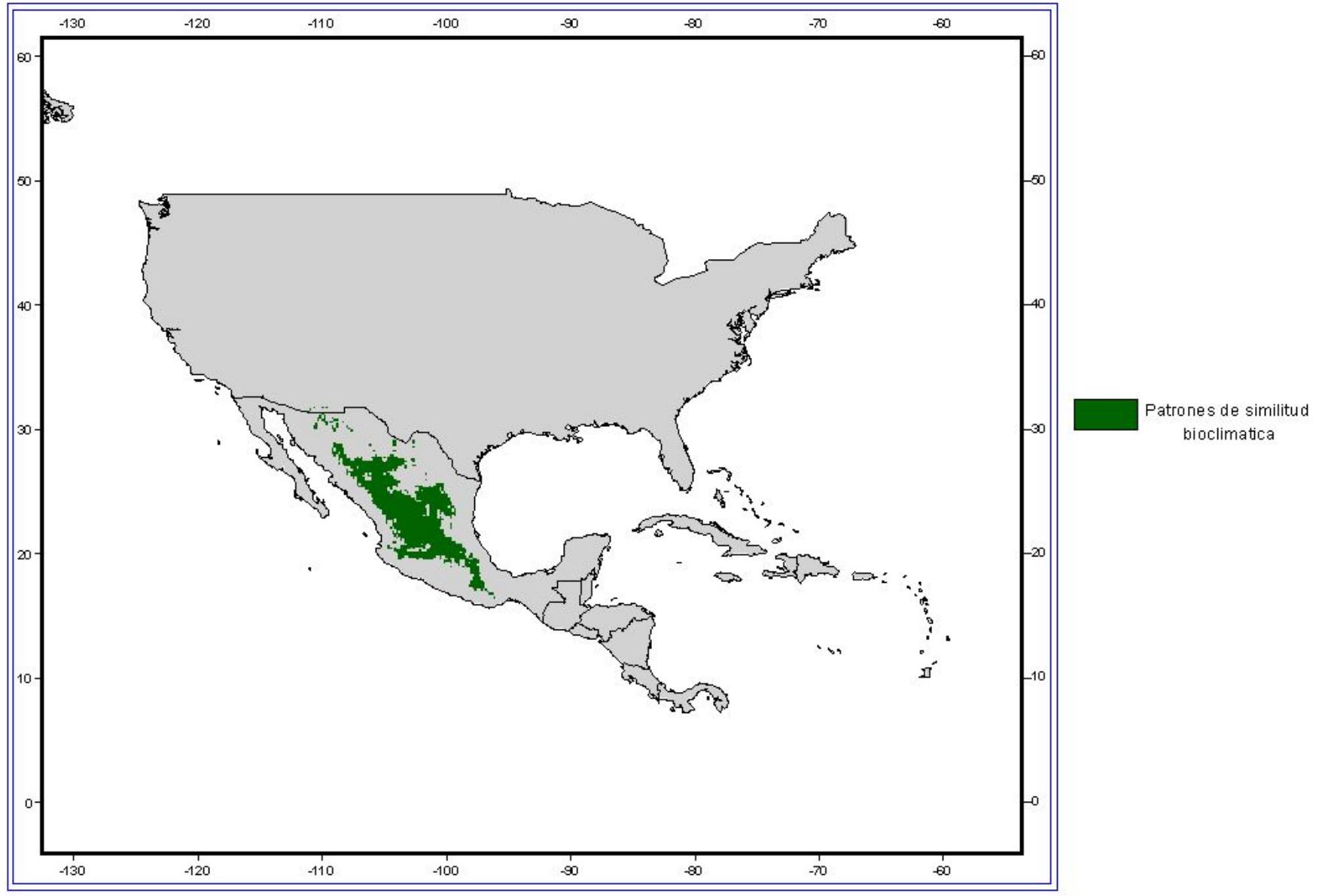
Distribución potencial de *O. macrocentra*



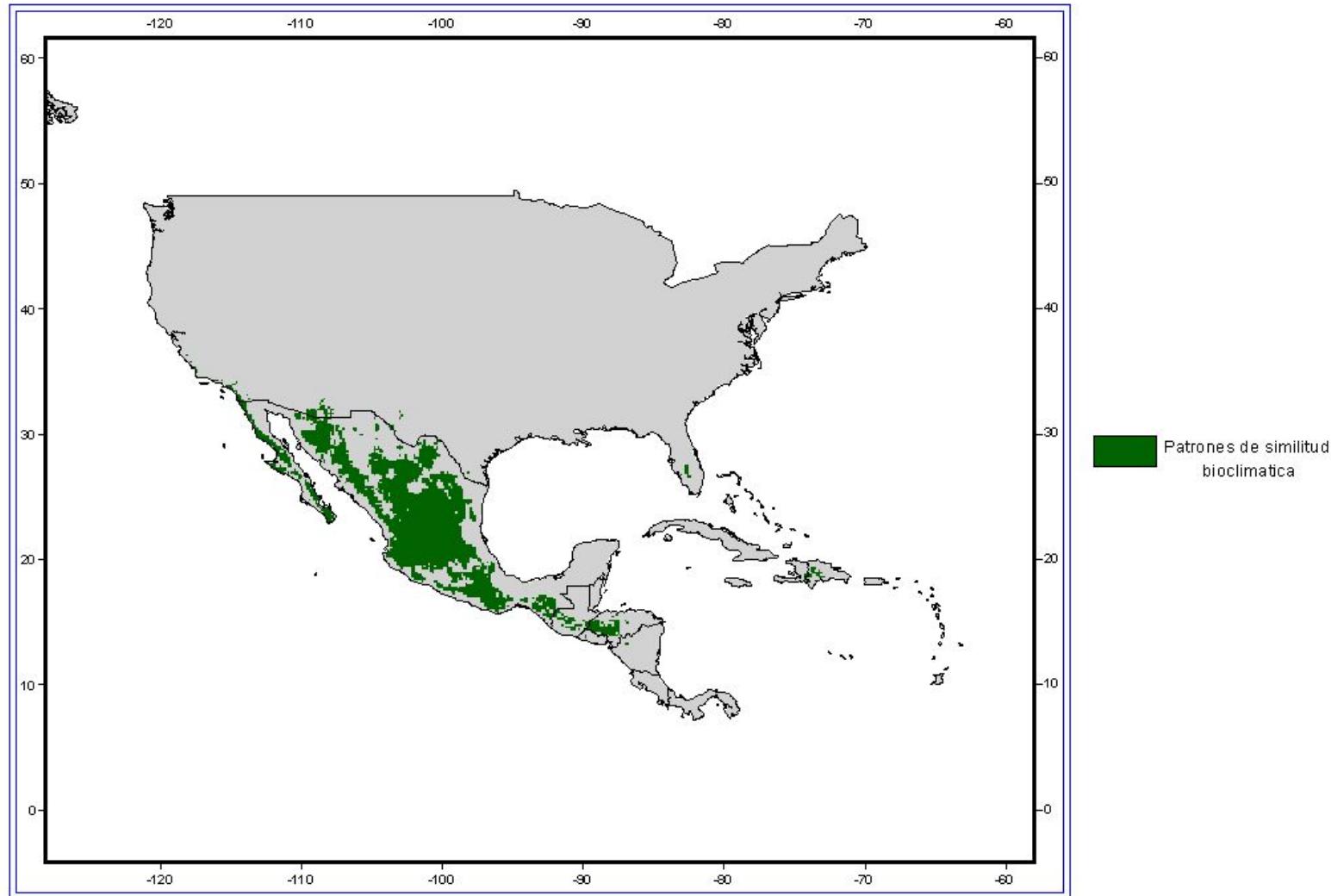
Low risk probability?



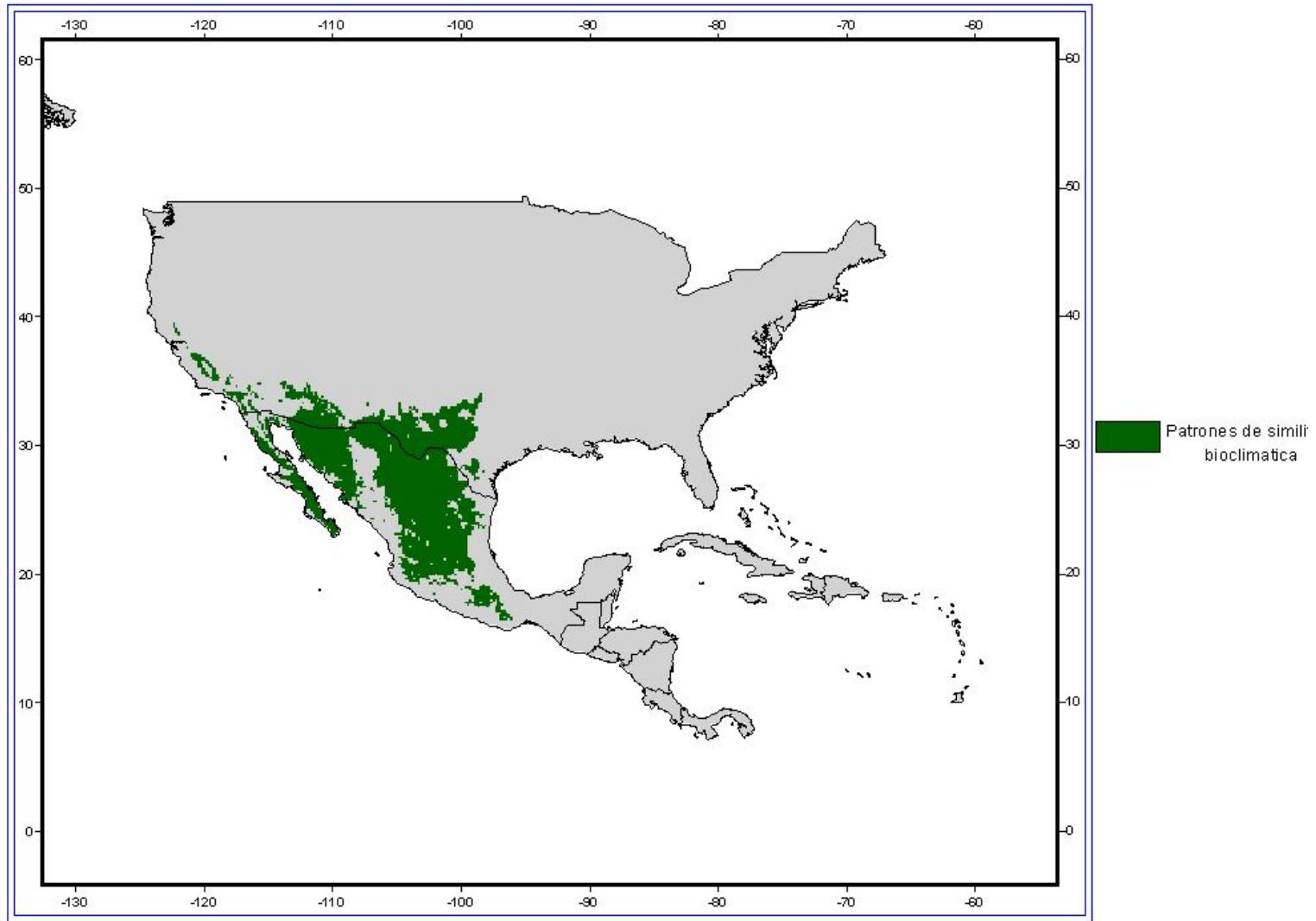
Distribución potencial de *O. duranguensi*



Distribución potencial de *O. ficus-indica*



Distribución potencial de *O. macrocentra*



CONABIO



How can we define the risk for Mexican nopaleras?

- .- Probability of encounter?
- .- Probability of Opuntia´s extinction?
- .- Probability of migration of *C. Cactorum*

The risk is not to manage this emergency correctly!



II.- Activities in México

.- WEB PAGE

.- Interminesterial Actions

Support for SAGARPA erradication campaign

Advice to the Minister of Environment about invasive spp

.- Leadership in invasive species programmes

CCA programmes





Conabio

Comisión nacional para el conocimiento y uso de la biodiversidad

. Mapa de sitio
y búsqueda

[Mamíferos terrestres de
Centro y Norte América](#)

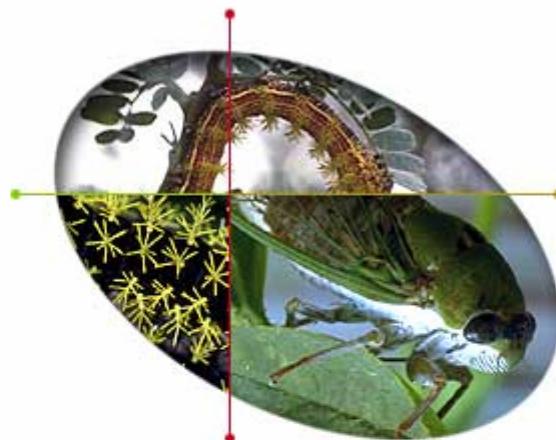
[Catálogos de especies](#)

[Colecciones científicas](#)

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Biótica](#)

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sobre biodiversidad](#)



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sitios de interés](#)

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acceso a la información](#)

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[. Información sobre especies](#)

[. Regionalización](#)

[. Monitoreo de puntos
de calor \(Incendios\)](#)

[. Monitoreo de ecosistemas](#)

[. Monitoreo de especies](#)

[. Estrategia nacional
de biodiversidad](#)

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[Capital natural
y bienestar social](#)

[. Bioseguridad](#)

[Diversidad de maíces](#)

[Alerta: palomilla del nopal
amenaza nopaleras
y desiertos mexicanos](#)

Avenida Liga Periférico - Insurgentes Sur No. 4903, Col. Parques del Pedregal
Delegación Tlalpan. 14010 México, D.F.

Tel. 5004 5000 y fax 5004 4931

[Plano de localización](#)

conabio@xolo.conabio.gob.mx

[Derechos de autor de las imágenes](#)

Certificación ISO 9001:2000





Mexican Initiative for Nopales and Deserts InMeCoND



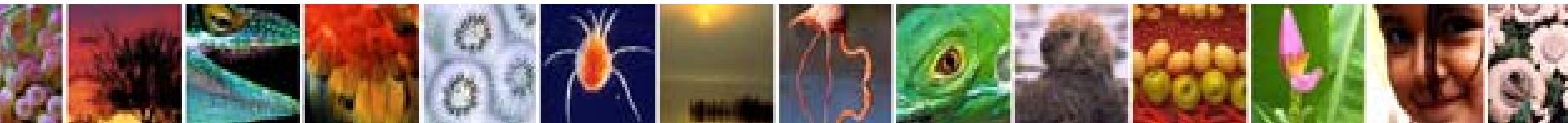
ALERT: *Cactoblastis cactorum* has been detected in Isla Mujeres, Quintana, Roo

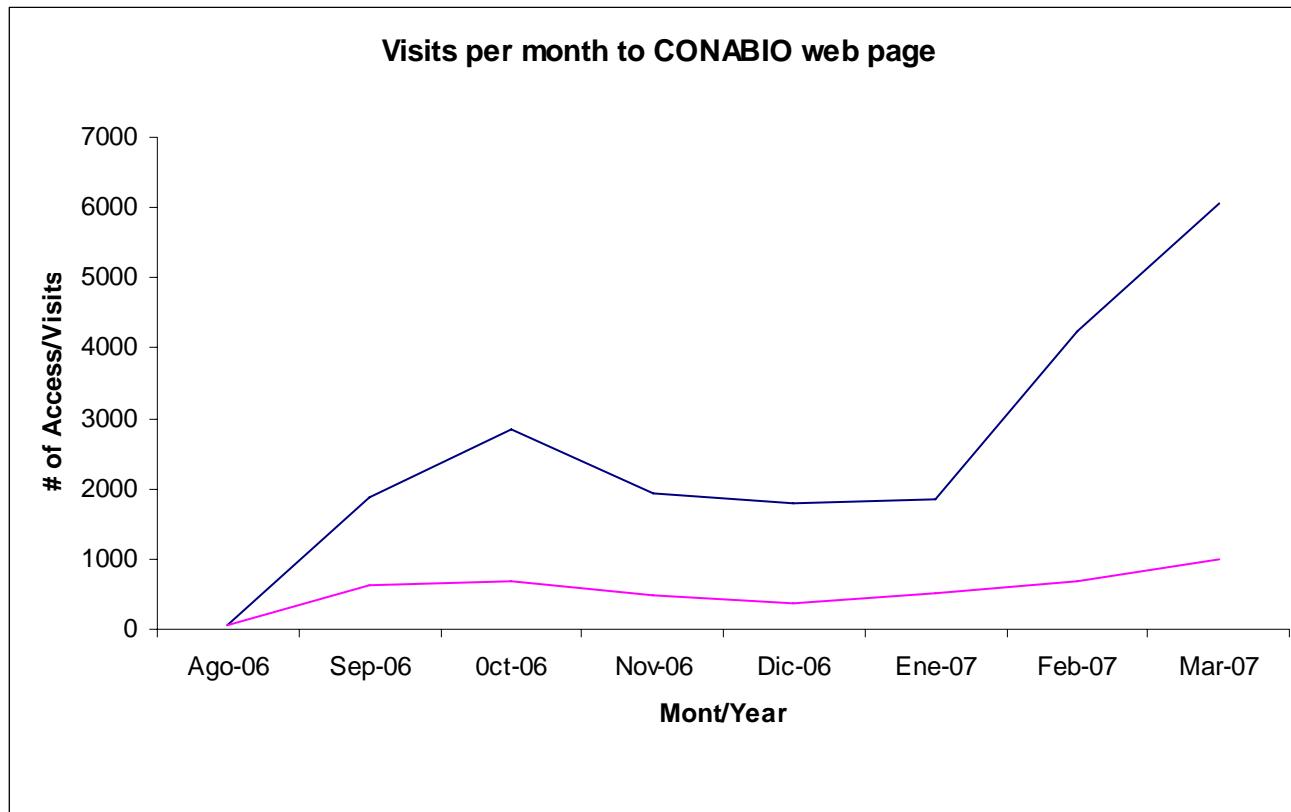
Una de las mayores amenazas para la biodiversidad de México, en particular para diversas especies de *Opuntia* entre las que se encuentran los nopal es *Cactoblastis cactorum* conocida como la palomilla del nopal, la cual es nativa de Sudamérica que se ha usado exitosamente en Australia para el control biológico de opuntias introducidas. El peligro de *C. cactorum* en nuestro país radica en el hecho de albergamos la mayor diversidad de especies de *Opuntia* en el mundo, varias de las cuales pudieran ser hospederos de esta palomilla, tal y como se ha documentado para un amplio número de especies.

En nuestro país existen 83 especies de opuntias, entre las que se encuentran los nopal, de las cuales 53 son exclusivas de nuestro país y de acuerdo con reportes recientes 19 de ellas tienen el potencial de ser dañadas. Las rutas más probables de ingreso son por migración desde Florida (donde se ha reportado desde 1989) al norte del país, así como una migración desde el Caribe.

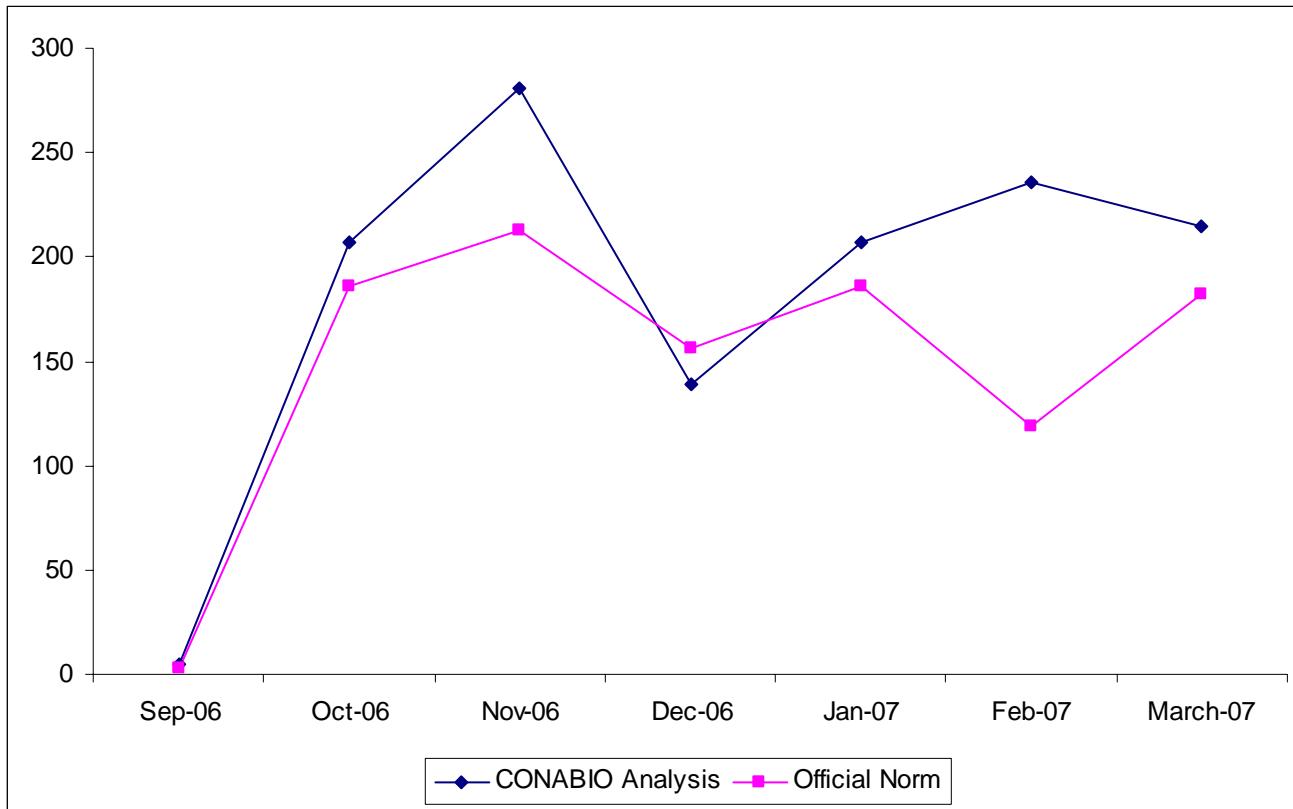
Las condiciones climáticas de México favorecen la invasión de esta polilla y estudios preliminares sugieren que la zona norte de México, que produce grandes cantidades de tuna y nopal forrajero sería la más afectada. La invasión de la palomilla del nopal podría afectar tanto las nopaleras silvestres como las cultivadas con impactos importantes sobre la biodiversidad y la producción de nopal.

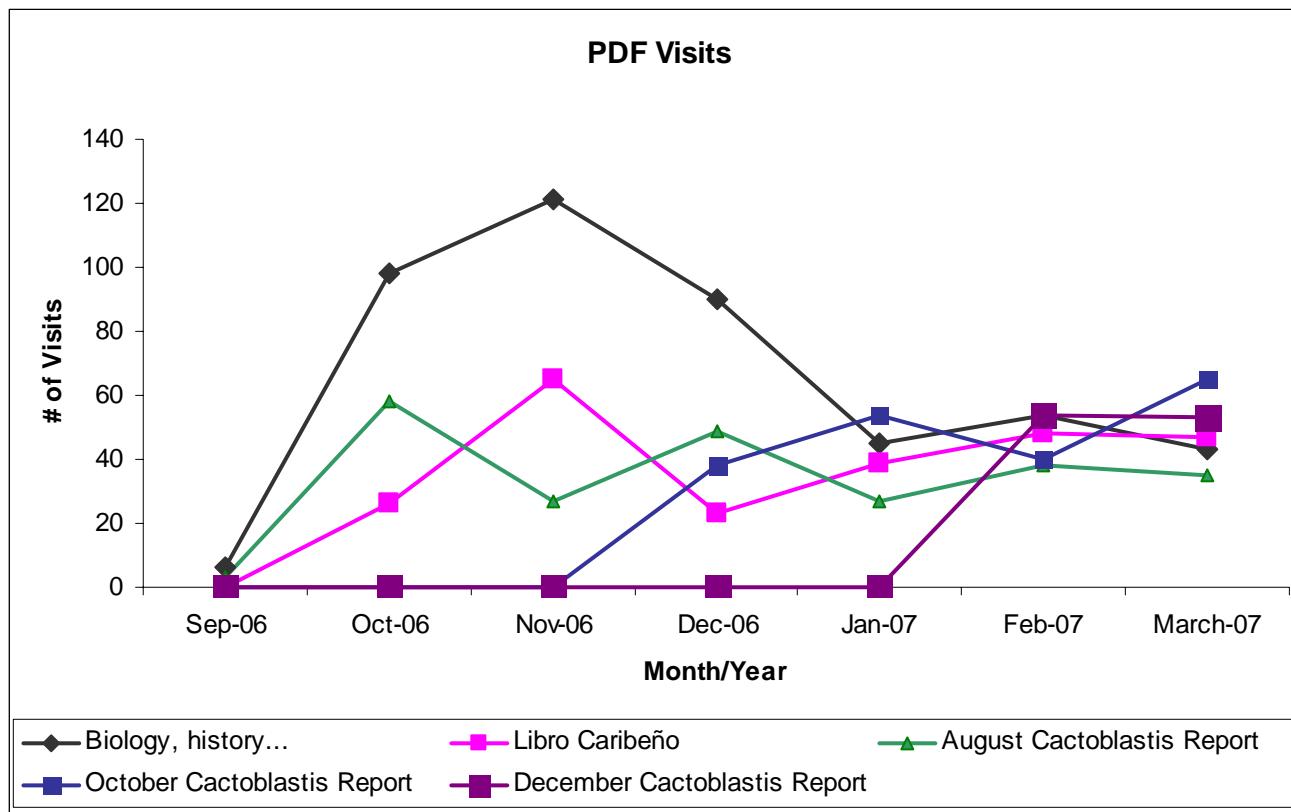
In August 2006 SAGARPA confirmed the positive identification of *Cactoblastis cactorum* in Isla Mujeres, Q. Roo. in *O. stricta* an ornamental introduced species. El brote fue ubicado en la zona sur de la Isla en las siguientes coordenadas: 21° 12.286 N – 86° 42.819 W. Como se muestra en la siguiente imagen:





Visits to reports





II.- Activities in México

.- WEB PAGE

.- Interminesterial Actions

Support for SAGARPA erradication campaign

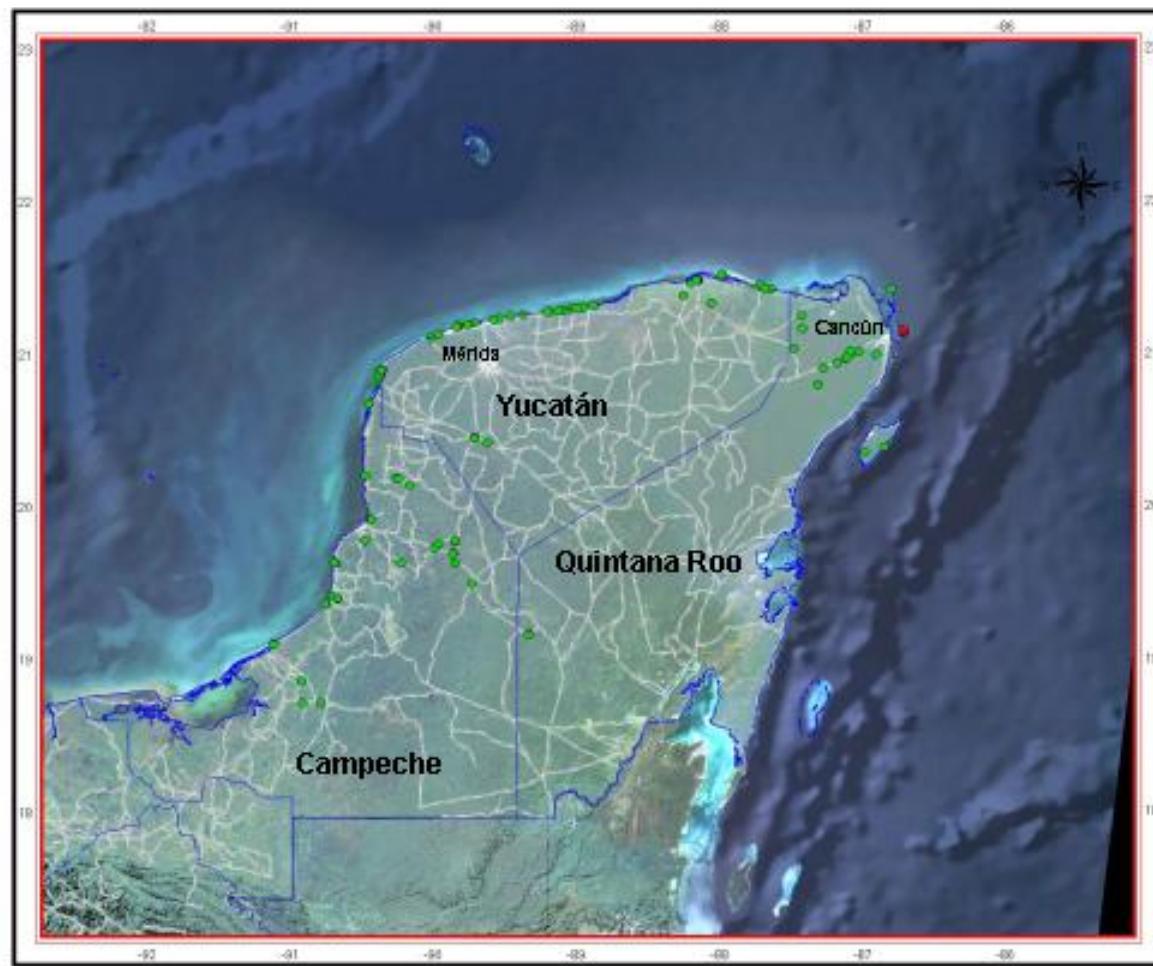
Advice to the Minister of Environment about invasive spp

.- Leadership in invasive species programmes

CCA programmes



Sitios de monitoreo de *Cactoblastis cactorum* en la Península de Yucatán



- Sitios de observación de Opuntias
- ◆ Brote de *Cactoblastis cactorum*

Responsables de la información
Dr. Helmuth Gunter Zimmerman
Dra. Mayra Pérez Sandy Cuen
Ing. Israel Javier Canul Pech
M. en C. Francisco Sánchez Rebollo
Ing. Javier Tovar Rodríguez
Ing. Rafael Zetina Rodríguez



Future Activities (Coming attractions only in Conabio´s www June 2007)

Translate to english the CONABIO´s web page and encourage other participants to share information and data.

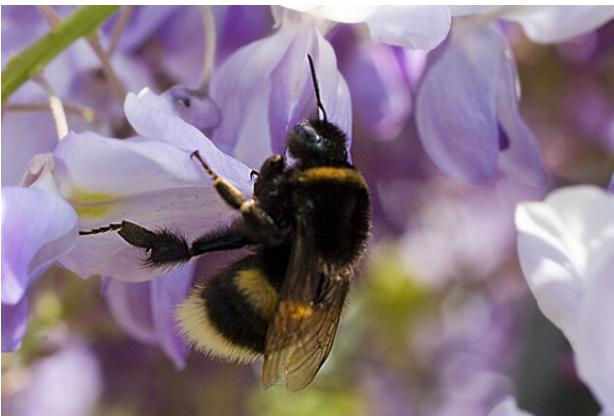
Analyses for mexican ecoregions

Increase monitoring activities





...two of the best examples of the application of predictive models to the prevention and management of invasive alien species (IAS) have come from Mexico's Comisión Nacional para el Conocimiento y Uso de la Biodiversidad (CONABIO). The cactus moth (*Cactoblastis cactorum*).... Bioclimatic modeling helps to predict the areas of highest impact from *Cactoblastis* and identify potential ways to minimize the impacts...



Likewise, concern that a species of bumble bee (*Bombus terrestris*) ... led to a similar modeling approach. The findings strongly suggested that, due to its potential impacts on native pollinators, the costs of *B. terrestris* introduction would considerably outweigh the benefits.

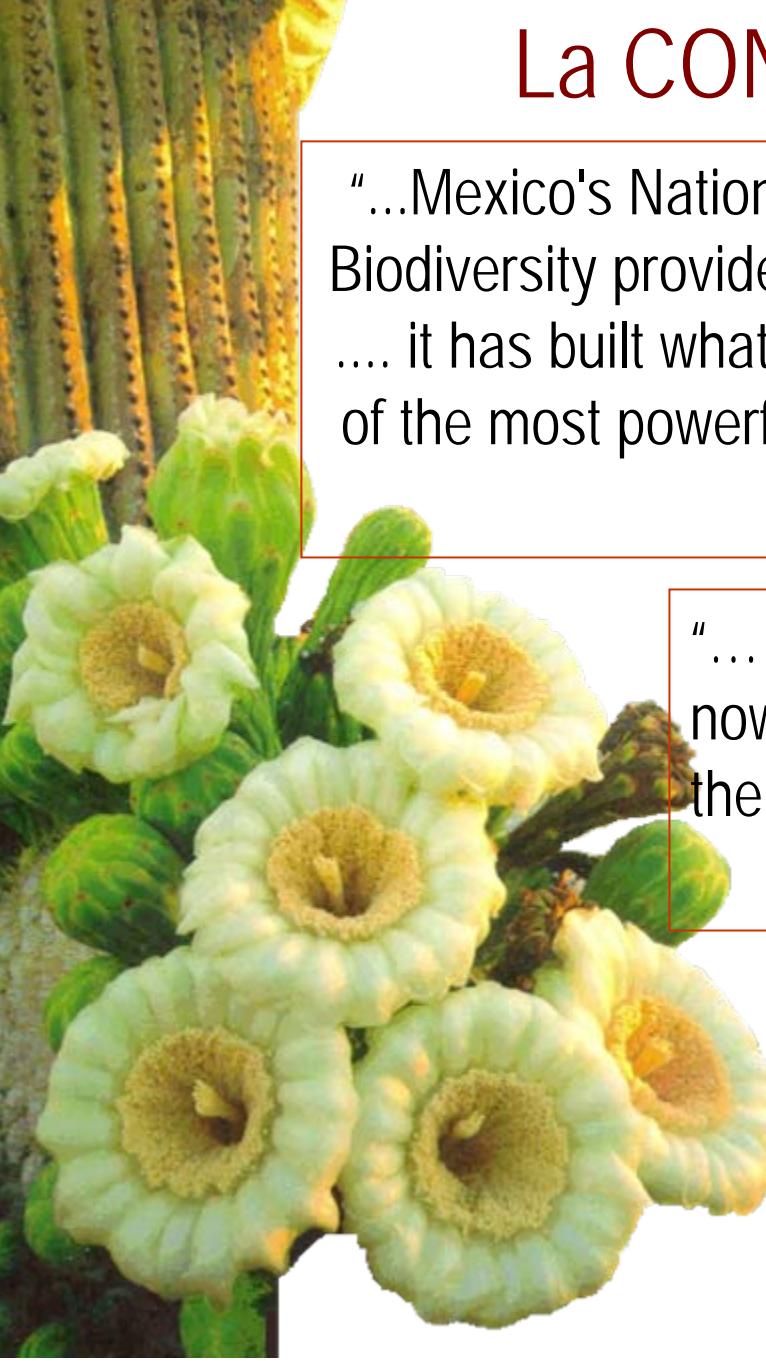
In both cases, predictive models have been critical for effective decision making.

Frontiers in Ecology and the Environment, 2003

Thank you very much for your attention!

www.conabio.org.mx





La CONABIO: una historia de éxito

“...Mexico's National Commission for the Knowledge and Use of Biodiversity provides a shining example of what can be achieved it has built what many Western scientists acknowledge is one of the most powerful biodiversity management systems around.”

Nature, 1998

“... the good news is that CONABIO's concept is now, in effect, being replicated worldwide through the Global Biodiversity Information Facility (GBIF)”

BioScience, 2004

R. M. May, Consejero Científico Principal del Gobierno Británico:

“...those countries better positioned in bioinformatics will have a strategic scientific and commercial advantage...”