The threat of *Cactoblastis cactorum* to Mexico and proposals to address the problem

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Importance of *Opuntia* in Mexico

Species diversity of *Opuntia* in Mexico

- Mexico has one of the highest diversity of *Opuntia* species (107 species).
  - 51 species are cylindropuntia -less preferred host-
  - 56 species are platyopuntias, 38 of which are native. Major host.

Ecological importance of *Opuntia*

- Ecological importance in natural habitats
  - Major component of the Chihuahuan and Sonoran desert flora (nopaleras).
  - Important agent in the fight against desertification and soil regeneration.
  - Main nest and food supply for wild life in desertic and semidesertic territories
  - The most important plant to keep ecological balance in large territories

Economical importance of *Opuntia*

- Food for humans (as green vegetable, fruit, juice, jam, alcoholic beverages).
- Fodder (stems, fruits and seeds).
- Energy (biogas, ethanol, firewood).
- Medicine (diuretic, amoebic dysentery, fiber, diabetes and others).
- Cosmetic (shampoo, soaps, dyes).
- Agronomic (fertilizer, hedges).
- Other (adhesives and glues, ornamental).

Economical importance of *Opuntia*

- Direct jobs and income generated by *Opuntia* and subproducts
- Food
  - Fruit (15 states, 120,000 producers)
  - Vegetable (14 states, 90,000 producers)
- Production Value $80 million USD
- Export $30 million USD

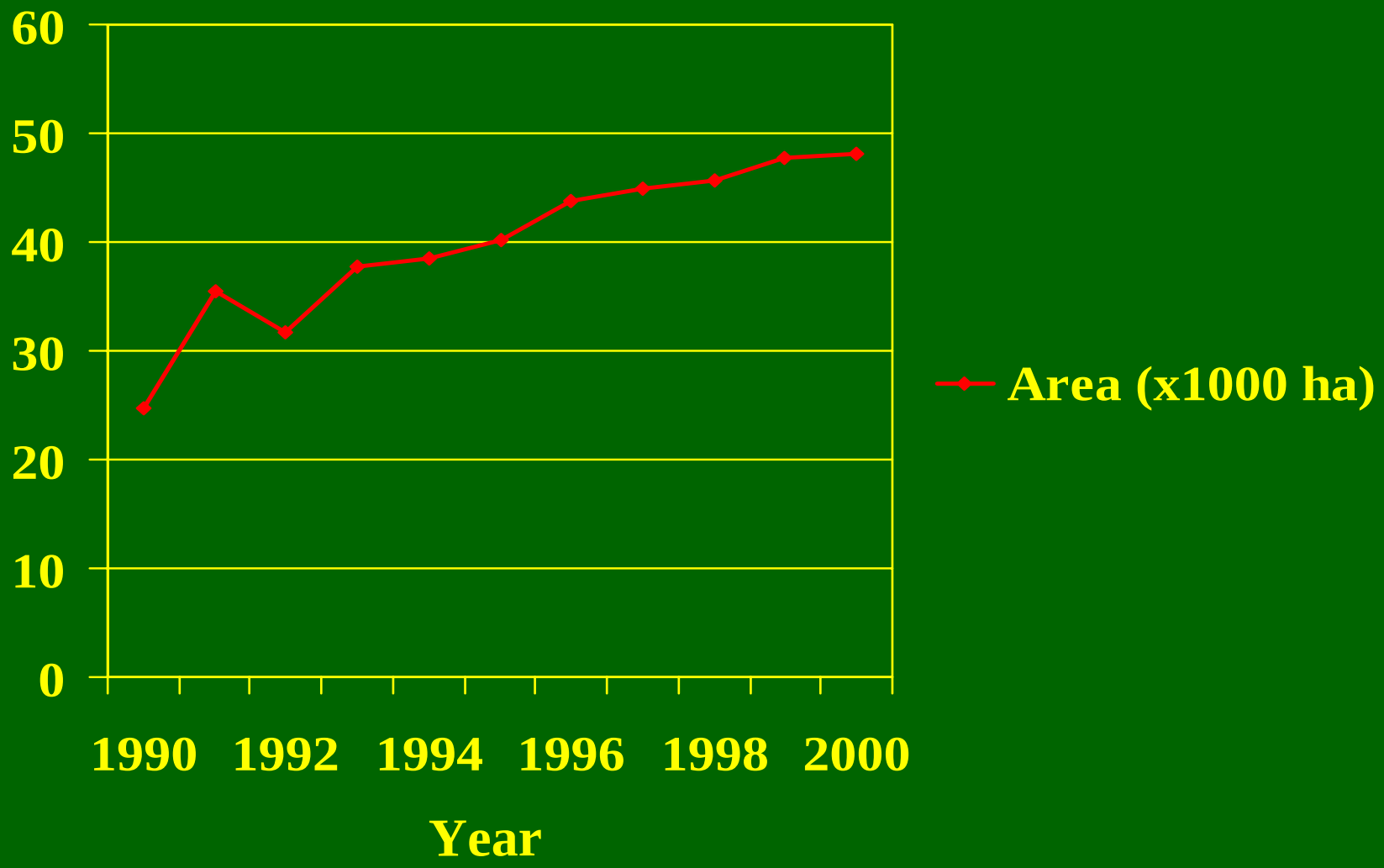
Economical importance of *Opuntia*

- Area under cultivation of *Opuntia* in Mexico for human consumption

- 60,000 ha
  - 50,000 ha of Cactus pear (greatest variety of cultivated species)
  - 10,000 ha for vegetable use

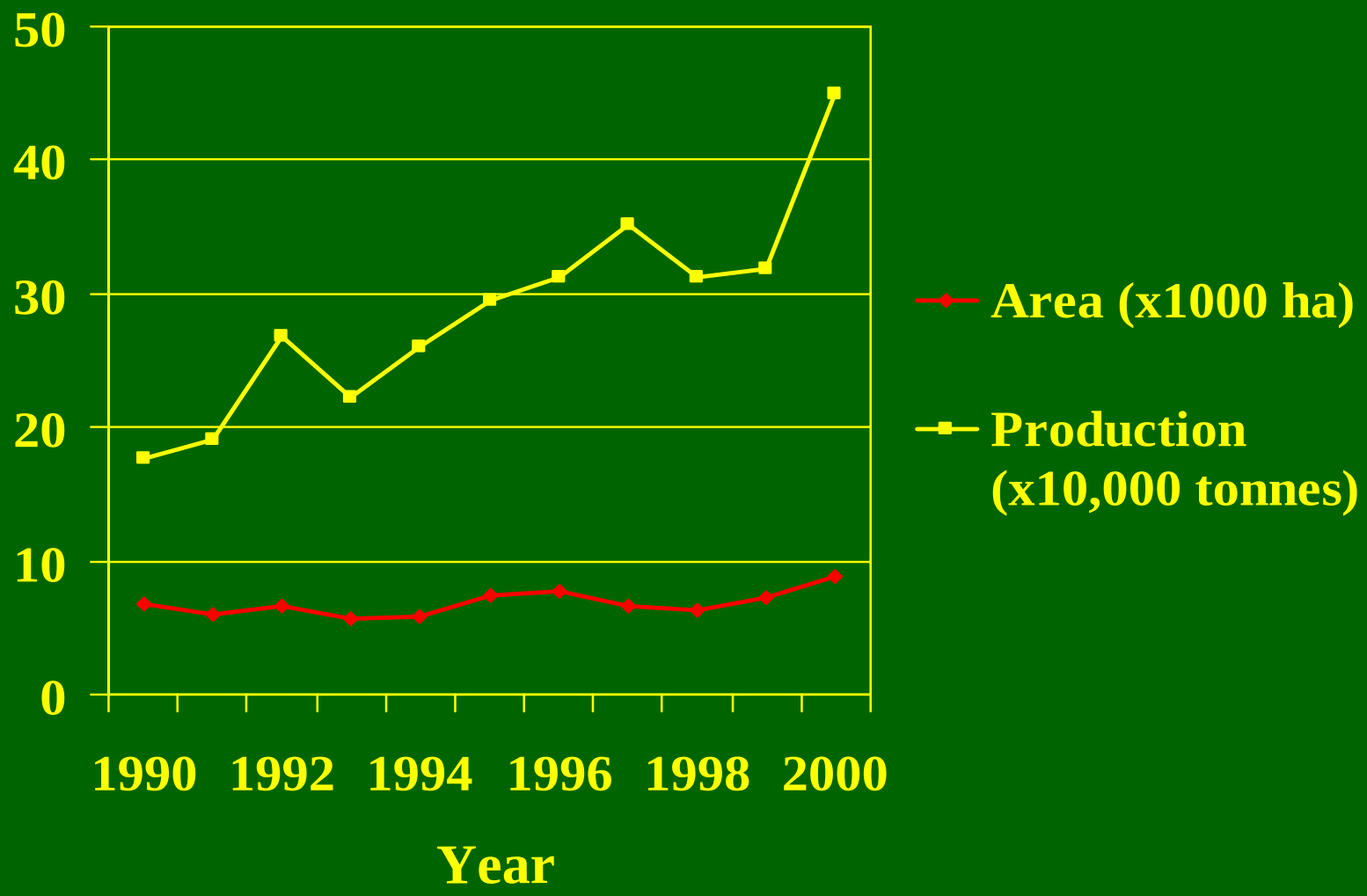
Economical importance of *Opuntia*

Opuntia cactus pears



Economical importance of *Opuntia*

Opuntia vegetable



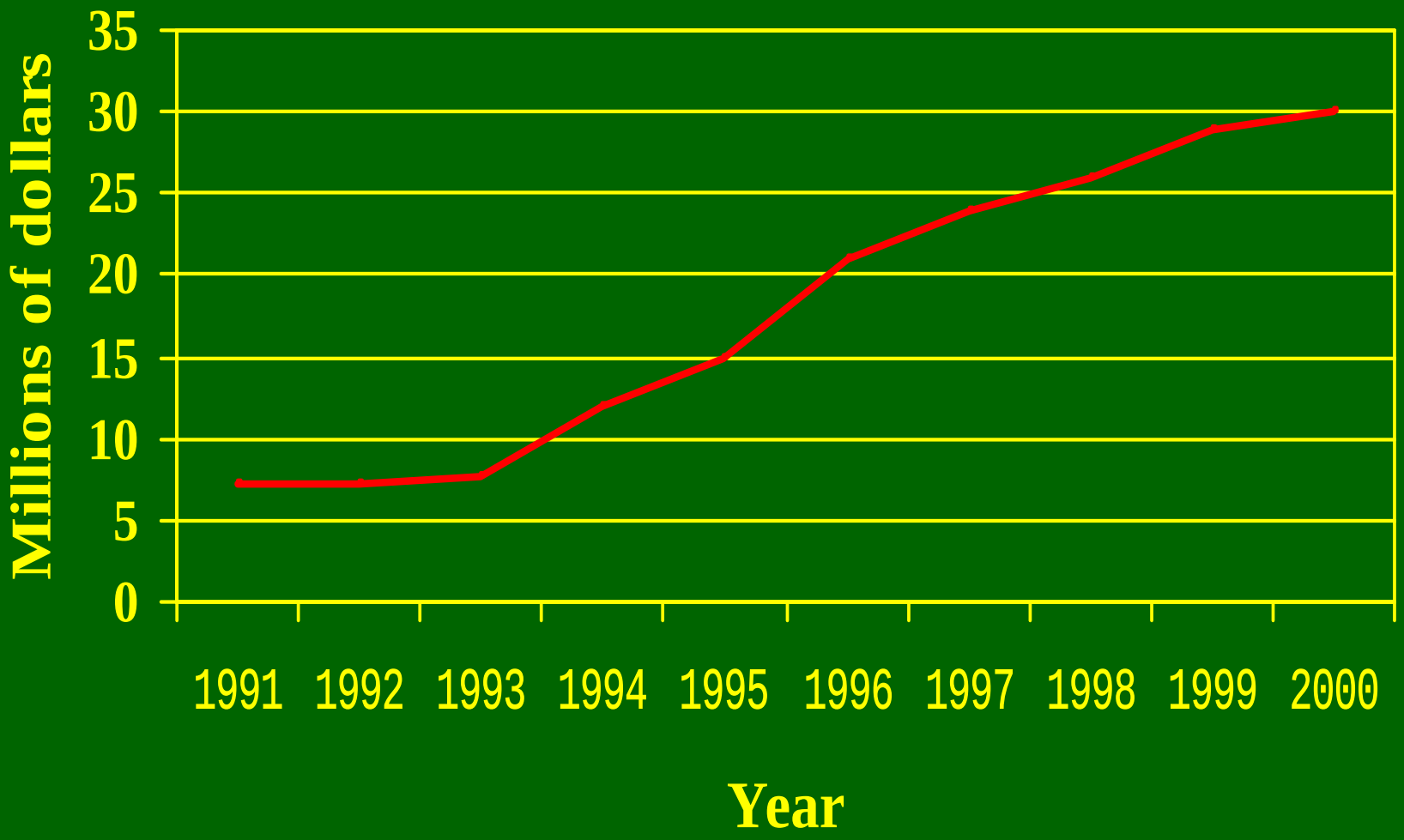
Economical importance of *Opuntia*

Opuntia as forage

- 3,000,000 ha of wild populations
- 5,000 ha cultivated intensively (several uses)
- 150,000 ha cultivated extensively
- Used in many cases as emergency fodder during prolonged periods of drought

Economical importance of *Opuntia*

Value of *Opuntia* export products



Economical importance of *Opuntia*

Average value of *Opuntia* Production

values for 1990-2000

- Cactus fruits (50 million USD / year)
- Vegetable (30 million USD / year)
- Fodder (no data available)
- Export (30 million USD / year).

Social importance of *Opuntia*

The social importance is related to the high ecological and economic importance in many aspects because of the great variety of applications of *Opuntia*; as large proportion of the Mexican population is directly or indirectly related to “Nopal”.

The threat of *Cactoblastis cactorum* to Mexico

Species of *Opuntia* susceptible to *C. cactorum*

Yellow indicates species known to be attacked by *C. cactorum*

Cactus Pears

- *O. amyclaea*
- *O. ficus-indica*
- *O. hyptiacantha*
- *O. leucotricha*
- *O. megacantha*
- *O. streptacantha*
- *O. tapona*
- *O. robusta*
- *11 local unidentified varieties ?*

Vegetable

- *O. ficus-indica*
- *O. robusta*
- *Local species?*

Forage

- *O. rastrera*
- *O. robusta*
- *O. stenopetala*
- *O. streptacantha*
- *O. stricta*
- *O. violacea*
- *O. azurea*
- *O. cantabrigiensis*
- *O. durangensis*
- *O. engelmannii*
- *O. leucotricha*
- *O. lindheimeri*
- *O. pheacantha*

Cactoblastis in Mexico

- No evidence of presence to date.
- However no specific monitoring has taken place
- Weak import restrictions on *Opuntia* products
- Extremely high risk of invasion (natural dispersion) from USA or Caribbean Islands

C. cactorum in USA

Recent impact of *C. cactorum* on the six endemic species in Florida, must be taken seriously. Mexican authorities have taken note of this.

Success of *C. cactorum* as a biological control agent

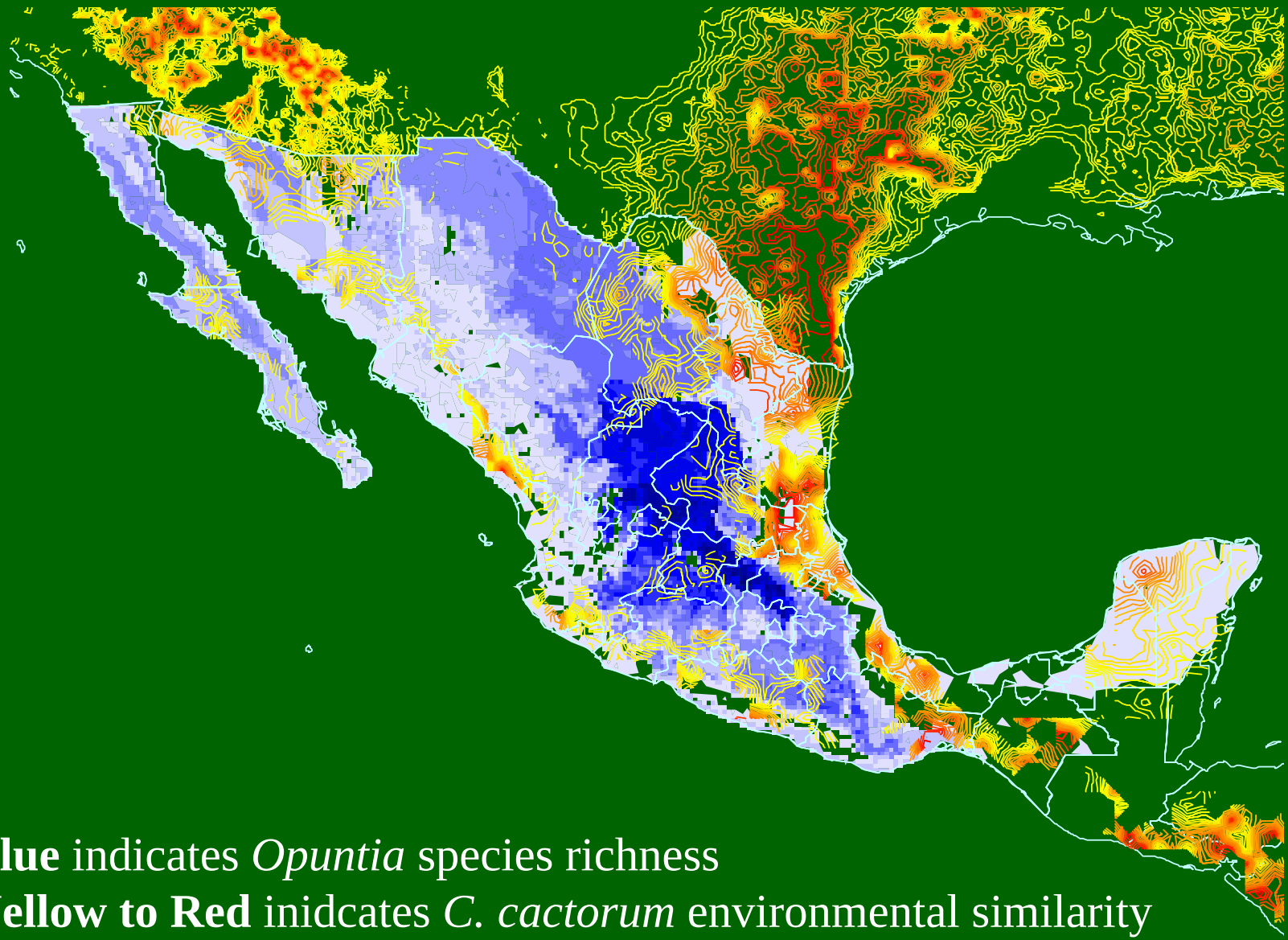
- Australia
- Hawaii
- South Africa
- Caribbean Islands

Species of *Opuntia* found in Mexico that have been attacked by *C. cactorum* in other countries

Opuntia ficus-indica
Opuntia lindheimeri
Opuntia macrorhiza
Opuntia megacantha
Opuntia spinulifera
Opuntia streptacantha
Opuntia stricta
Opuntia tomentosa

Potential damage

(45 species)



Blue indicates *Opuntia* species richness

Yellow to Red inidcates *C. cactorum* environmental similarity

Susceptibility

- Wild populations are highly susceptible especially due to inacessibility of control programs.
- Small communal farmers may not have the resources to control aggressive pests.
- Impact of the pest to commercial growers will have a major economic impact.
- Extensive acreage of *Opuntia* does not receive economical (or any) support from owners.

Impact of *C. cactorum* to *Opuntia* in Mexico

Ecological, economical and social impact will be so high that it will not be possible to measure it.

Coping with the possible invasion of *Cactoblastis cactorum*

- Prevention of its arrival is crucial.
- Most likely routes are either man-induced (commercial, illegal plant trade, accidental transport, etc) or through climatic events (cyclones, hurricanes).
- Natural ways of dispersion.

Action Plans

- *Action Plan A*:

  To prevent the introduction of *C. cactorum* to Mexico.

- *Action Plan B*:

  To control and erradicate *C. cactorum*, if outbreaks are detected in Mexico.

Action Plan A

Prevention

- Risk Assesment of potential impact of *C. cactorum* on ecological , economical, and social aspects.
- Public Awarness Campaign
- Training on identification and detection (international cooperation)
- Establishment of an advisory expert group (national and international members).
- Monitoring stations (Tamp., N.L., Ver., Yuc. & Camp.)
- Surveillance at posible routes of invasion
- Training phytosanitary, customs personnel at control points and national boundaries and producers.

Action Plan A

Prevention

Current Initiatives

- Funding for awareness campaign is underway.

  - National level awareness campaigns aimed at a wide public (television, pamphlets, posters, radio)

  - National Universities have started publishing technical brochures

- Contact between mexican scientists (CONABIO, SAGARPA, Sociedad Mexicana de Cactología) and foreign institutions (**IAEA**, USDA-APHIS-USA, PPRI-ARC-SA, University of Florida, USA)

Action Plan B

Control and erradication

- Immediate Control Methods (Dispositivo Nacional de Emergencia).
- Implementation of monitoring stations at national levels
- Implementation of an Integrated Pest Management program where *C. cactorum* is detected
  * Cultural practices
  * Biological control
  * Sterile *C. cactorum* releases (inductive sterile technology)
  * Chemical control
  * Legal control
  * Others...

Action Plan B

Control and erradication

- Research into emergency control methods such as sterile *C. cactorum* releases

- Host preference studies to predict susceptibility of all mexican species

- Improvement of local inventories cactus-feeding insects, predators and parasitoids, ecological studies to predict population impacts

- Phytosanitary agents trained for field observations, data collection and monitoring (follow-ups of invasion).

Conclusions

- *Opuntia* is extremely important to Mexico
  - great tradition of use and consumption
  - “Nopal” is part of Mexican culture
  - the highest biodiversity of *Opuntia* species
  - ecological balance
  - local and national economy
- Extremely high risk of *C. cactorum* introduction and establishment in Mexico
- Impact will be so high that it will not be possible to measure it

Conclusions

- Urgent need for a national and international program to prevent dispersion of *C. cactorum* from its present locations
- Immediate implementation of preventive and monitoring measures in Mexico
- Fortunately, Mexico has well trained cactologists and cactus farmers that can be trained to cope with the problem.
- International cooperation is vital, particularly in regard to funding research.

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