

Jardín Botánico Fco. J. Clavijero

NDF CASE STUDY:

DIOON EDULE

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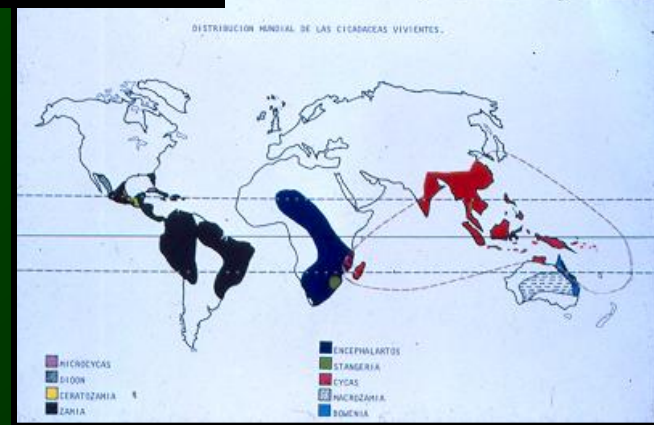
Convention on International Trade in
Endangered Species of Wild Fauna and Flora



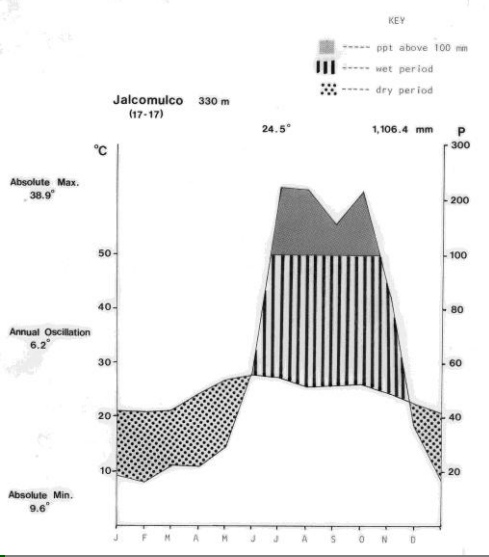


What are cycads?

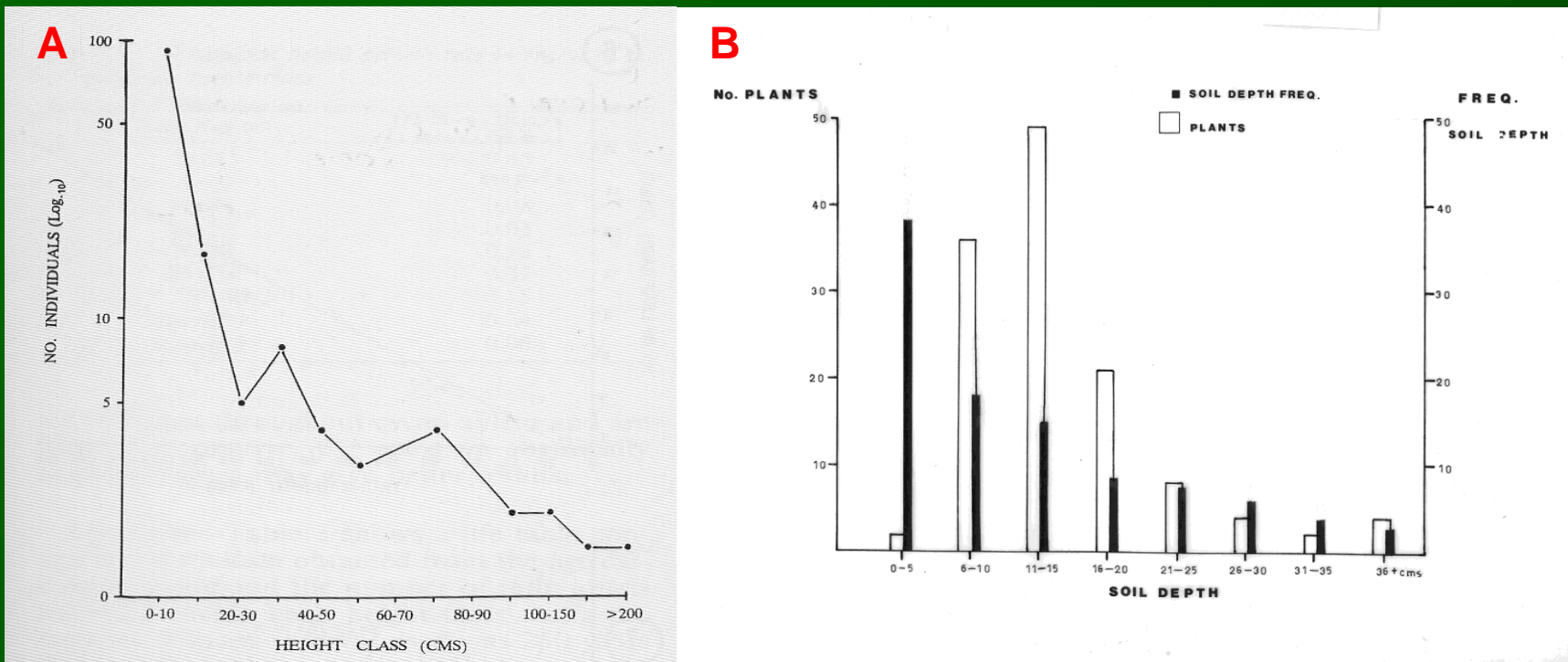
- Primitive living seed plants classified with the gymnosperms with fossil history going back to the Permian
- About 300 species known worldwide with 50 in Mexico giving it 2nd place worldwide for cycad diversity
- *Dioon edule* is endemic to Mexico and there are estimated over 10,000 plants in the wild
- Major threats are habitat loss and illegal harvesting of leaf crowns (decapitation) for the domestic market
- They are much appreciated as ornamentals



Distribution of *Dioon edule*



POPULATION STRUCTURE OF *DIOON EDULE*



A) Graph shows a reverse "j" structure with high seedling mortality

B) Spatial distribution with preference on shallow soils

Vovides (1990) *Amer. J. Bot.* 77: 1532-1543

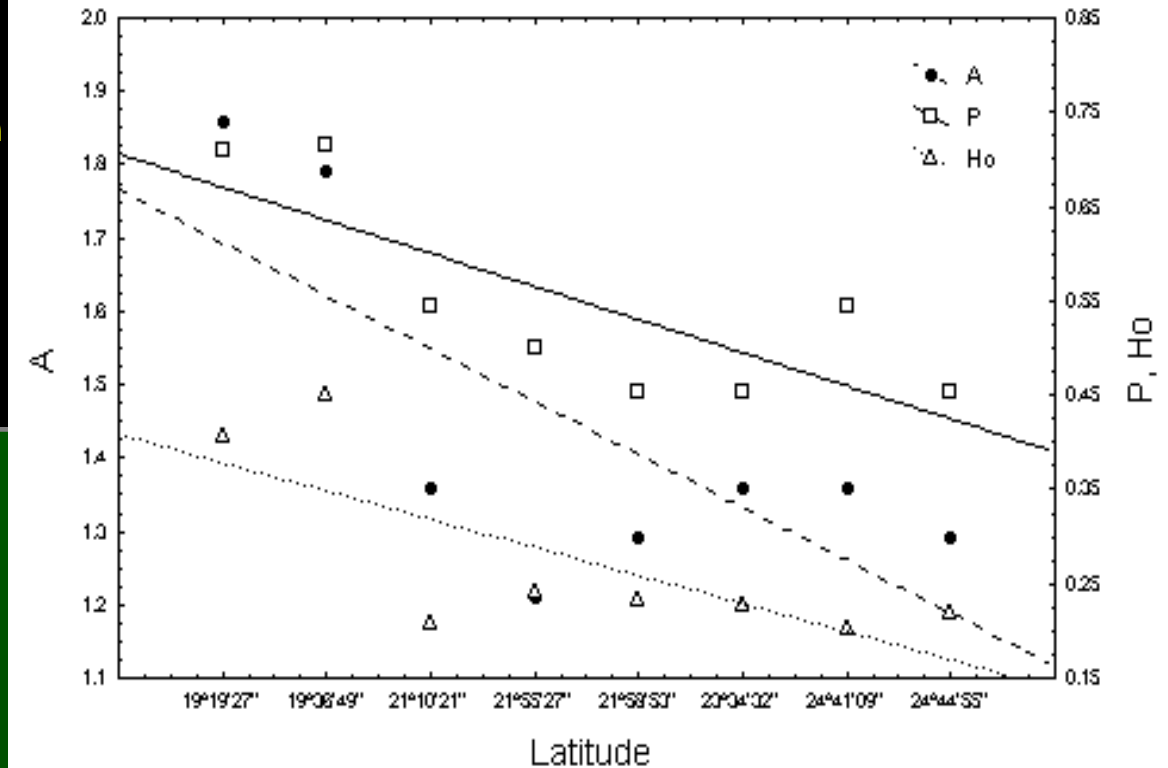
Dioon edule is genetically diverse

- Genetic diversity of *Dioon edule* is high throughout its range and is correlated with latitude

- Highest diversity is found in the south

- Seeds are a reservoir of genetic diversity

González-Astorga *et al.* (2003) *Biol. J. Linn. Soc.* 80: 457-467.
Octavio-Aguilar *et al.* (In press) *Plant Biol.*



Major threats



- Global habitat destruction:
- Land use change for agricultural expansion
- Deforestation
- Use of herbicides for land clearing
- Illegal national commercial collecting
- Decapitation of *D. edule*

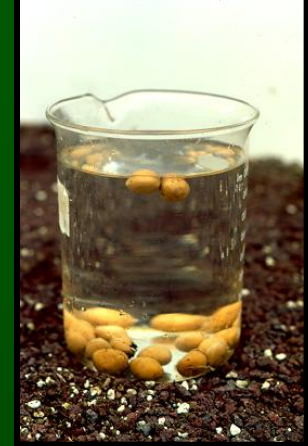


THE JARDIN BOTANICO FCO. J. CLAVIJERO & The National Cycad Collection

- For education, outreach and extension
- For research and *ex situ* conservation
- For propagation and assessment to sustainable management nurseries (UMAS)



PROPAGATION & CULTIVATION



Cultivation and germination trials on cycads enabled us to produce an adequate technology easily transferable



D. edule presents over 90% germination



Monte Oscuro Nursery, Veracruz

(*Dioon edule*)

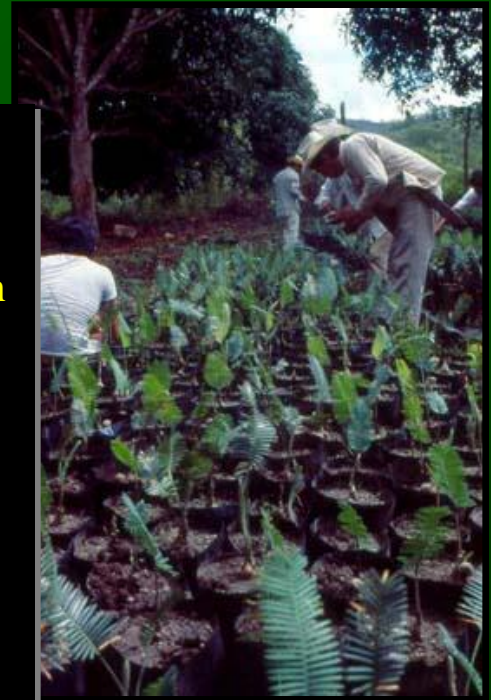


Based on ecological studies and germination trials:

- Farmers who own cycad habitat were given talks and invited to take part in a sustainable management project
- Hands-on basic horticultural training was given
- First sustainable management nursery established in 1990
- Many drop-outs during early years

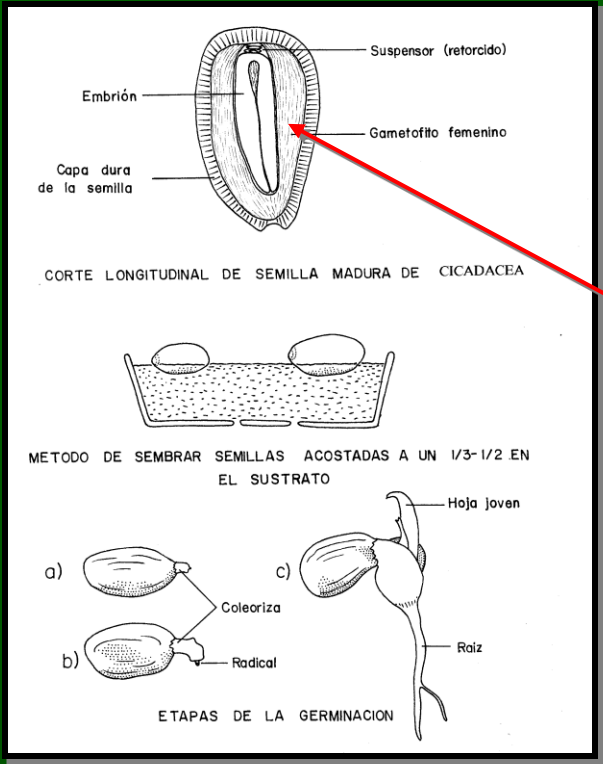
(Vovides 1990 *Amer. J. Bot.* **77**: 1532-1543)

(Vovides & Iglesias, 1994, *Biodiversity and Conservation* **3**: 137-141)



AT MONTE OSCURO

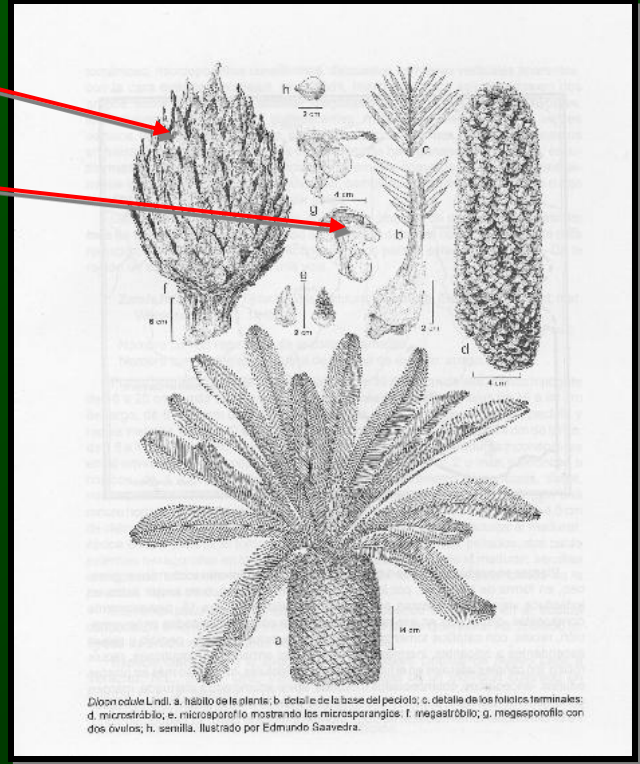
- Ca 80 ha of relatively well-preserved tropical dry forest is harvested
- Seeds (500 - 10,000) are harvested from a population of ca 3,000 plants
- Harvesting done in autumn but not every year
- Female cone monitoring is done to ensure ripe seed since the female cone cycle for *D. edule* is two years
- A seed scale is removed and the seed cut lengthwise to examine embryo
- Cone harvested if embryo length is $\frac{3}{4}$ of the seed length or more
- If less cone is left for a further period to ripen



Female cone

Seed scale with seeds

Seed cut lengthwise exposing embryo

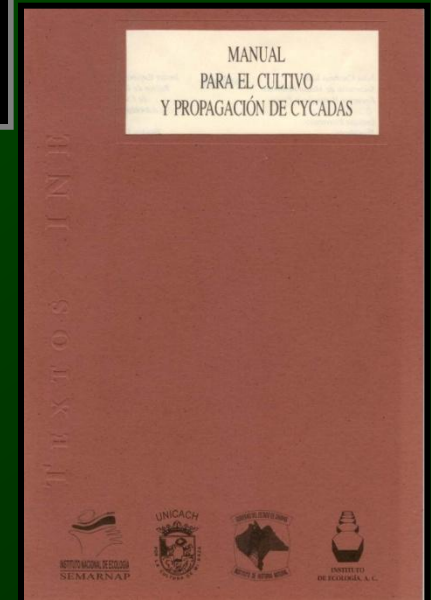
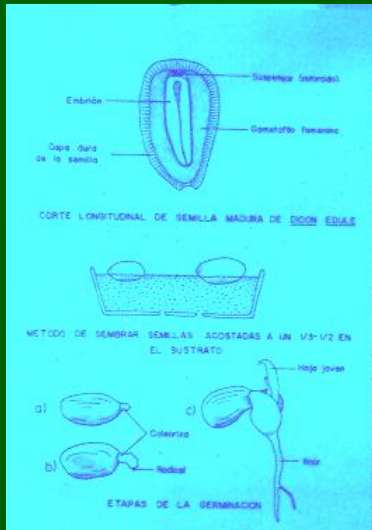




The teaching process

- Basic nursery practice by using available materials
- Combining farmers' traditional knowledge
- Improving and adapting technical practices to their needs
- The publication of a practical manual

(Pérez-Farrera, M. A., & A.P. Vovides 1997. *Manual para el cultivo y propagación de cycadas*. México, D.F., INE-SEMARNAP)



Plant reintroduction into habitat

Farmers participate in reintroduction projects

- In Sept. 1997 300 2, 4, and 7 yrs old seedlings of *D. edule* were introduced into habitat
- Yearly monitoring took place to register growth and deaths
- Mortality has not been greater than 20% for all classes
- Two year old plants can safely be reintroduced



Growth in nursery 5x that in habitat

1



2



3



4



1. Reintroduced *D. edule* plants in 1997 - No significant change in stem dia, (approx 4 cm) max no. leaves 3, no appreciable stem growth detected in 2005 (ca 4 cm)
2. Plants in nursery - aprox. 12 cm stem dia, max leaf no. 15 (2005)
3. Male plants began to cone at 15 years after germination in nursery
4. Female plants cone after 17 years (2007)
(Unpubl. Data)



BUT IS IT WORTHWHILE REINTRODUCING SEEDLINGS OF *D. EDULE*?

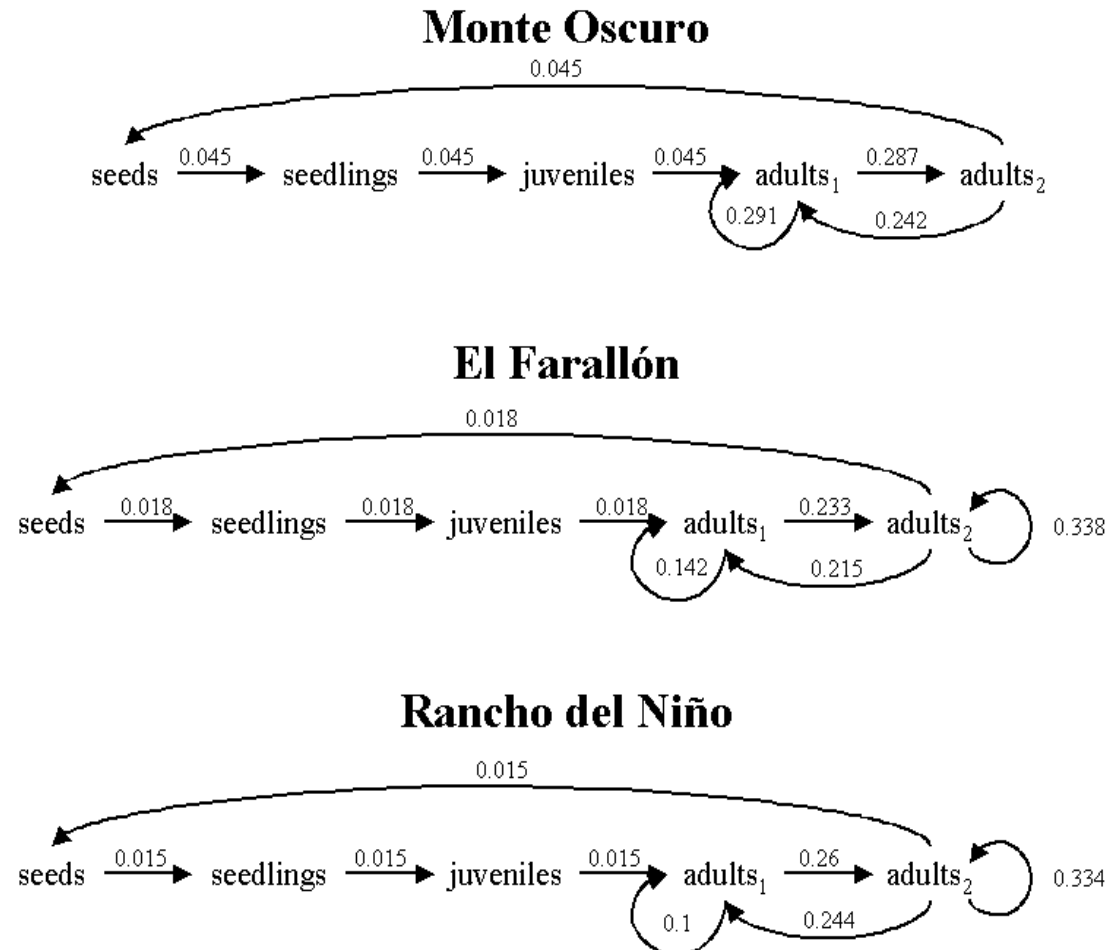
Life cycle and elasticity values in 3 populations

- Demographic studies and elasticity matrix modelling (Lefkovich) indicate that the most important life-cycle stage for maintaining the population is the adult stage

- Habitat conservation and especially adult plants (avoid decapitation) is more efficient for population growth and conservation than introducing seedlings

- It is better to reintroduce few nursery produced reproductive plants than many seedlings

Octavio-Aguilar et al. (2008) *Bot. J. Linn. Soc.* **157**: 381-391



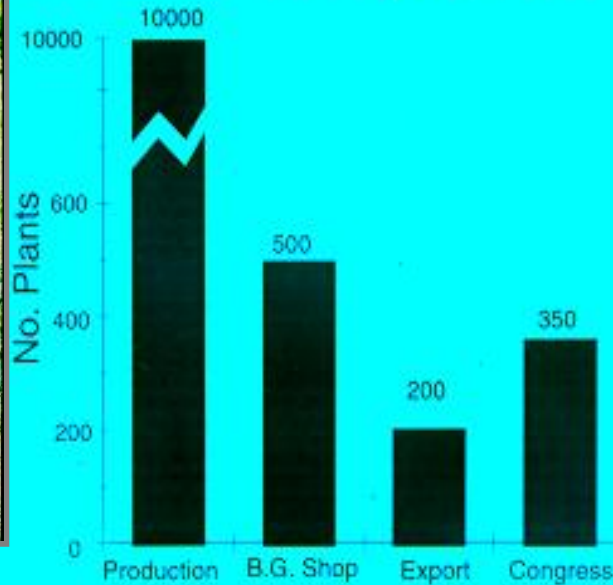
EARLY MARKETING



Nursery production

+ preliminary sales (\$15,000)

Plants of *D. edule* produced:



1994-95: 25,000 Pesos (Garden shop & congress)

+ 200 USD (export to USA)

Export of 500 plants to Europe (1998-99) not successful



Education for marketing



Marketing workshop, Tuxtla Gtz, May 2006

- Creation of CYCAMEX 1998
- Web page 2006
- Sales point: Botanic Garden shop 1994
- Official plant labels 2000
- Meeting with producers in Chiapas to connect with CYACMEX 2006
- Invitation of local authorities





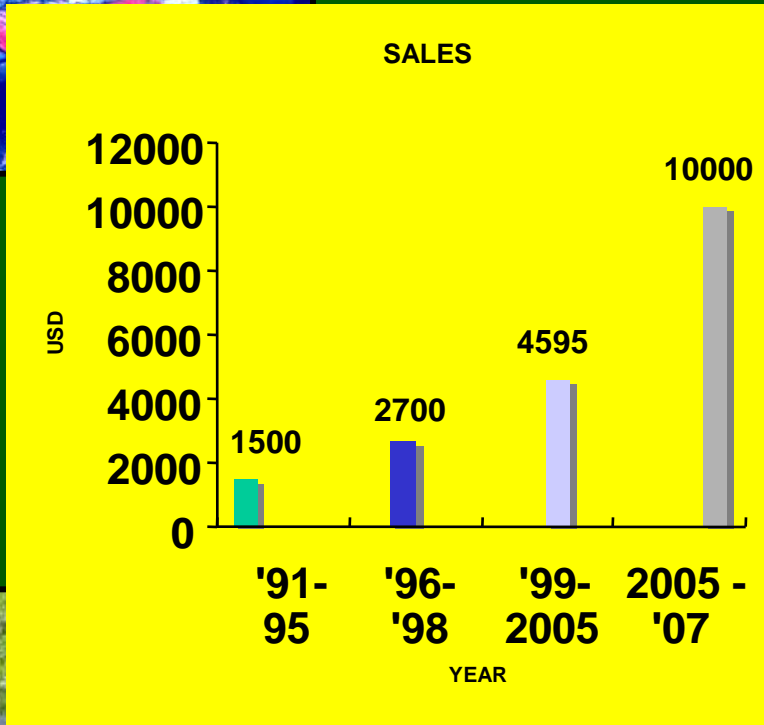
Cycadáceas MEXICANAS

CYCAMEX SHOP INAUGURATION: PARQUE DOÑA FALLA, XALAPA 30 JUNE 2006

It is hoped to link nurseries to national and international markets



Market and sales



- **Successes:**
 - Conservation through propagation accepted by farmers
 - Other communities are following example
- **Failures:**
 - Cycads relatively unknown in Mexico
 - Sporadic and inconsistent sales
 - Competition by poachers
 - Lack of marketing experience
 - Lack of coordination between producers and authorities
- **Challenges:**
 - Improve cultivation
 - Market exploration



OUTCOME



Landscaping with *Z. furfuracea*



Landscaping with *D. edule*

Growing interest in cycads among landscape architects

It is becoming fashionable to use native plants

- Residential estates
- Hotels
- Municipal landscaping

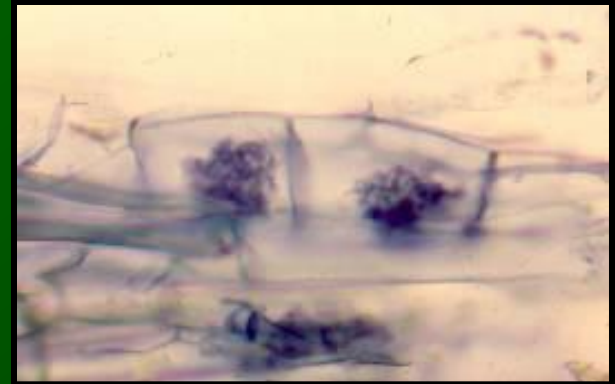


CHALLENGES: Cultivation improvement

Experiments at the Botanic Garden

ENDOMYCORRHIZA

- *Dioon edule* has mycorrhizal symbiosis with *Glomus* sp.
- Better growth of *D. edule* seedlings after inoculation with *Glomus*
- Mycorrhizal and root pruning experiments in process at the Botanic Garden with *D. edule*



VISIBLE DIFFERENCES IN GROWTH



ANOVA of FW differences between treatments and controls after one year (n = 15)
P = 0.019 (significant)

ANOVA

Origen de las variaciones	Suma de cuadrados	Grados de libertad	Promedio de los cuadrados	F	Probabilidad	Valor crítico para F
Entre grupos	153.536	1	153.536	6.243	0.019**	4.196
Dentro de los grupos	688.599	28	24.593			
Total	842.134	29				



The importance of solidarity

("If you sink, we sink with you")

- Training must be kept simple, and by example
- Much repetition is necessary
- Continuous assessment essential
- Local idiosyncrasies must be considered
- Assessor identification and solidarity with the farmers is also essential

(Vovides et al. 2002. Peasant nurseries: A concept for an integrated conservation strategy for cycads in Mexico. In: Maunder, M. et al. (eds) *Plant Conservation in the Tropics: perspectives and practice*. Pp. 421-444. RBG Kew)



RECOMMENDATIONS



- Marketing assessment is crucial during the early stages
- More long-term funding is required
- A multidisciplinary team required in; conservation biology, horticulture, anthropology, sociology and marketing expertise
- Start off with small medium-term pilot project rather than to inject mega-scale funding on a short-term basis.
- The species/habitat to be managed should be on the farmers' collective or individual private property and must be an integral part of the management system
- Close coordination between producers and authorities should be encouraged, possibly a marketing officer's duties.
- Projects involving sustainable management of threatened species should be encouraged nationally and internationally, especially within buffer zones of biosphere reserves.

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RESEARCHERS:

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