

# Sustainability of the Traditional Management of *Xa'an* Palms by the Lowland Maya of Yucatan, Mexico

A. Martinez-Balleste, J. Caballero, V. Gama, S. Flores, and C. Martorell

*Xa'an* palms (*Sabal* spp., Arecaceae), have been a multipurpose plant resource for the Maya culture of Yucatan for well over 3,000 years. They provide thatch, raw materials for handicrafts as well as emergency food, medicines, household utensils and other products for the household economy. Some of the present uses of *xa'an* probably originated in prehispanic times and have persisted until the present. This is the case for the mature leaves that are used for thatching the traditional Maya house (Caballero 1991, 1992, 1993, 1994a, 1994b; Arellano et al. 1992).

Traditional management of *Sabal* palms in the Yucatán peninsula has changed over time mainly because of the use of mature leaves for thatching. Change has not involved the substitution of one form of management for another; instead it has involved their accumulation and integration into a complex mosaic of management strategies that are associated with major land use forms in different parts of the Yucatan peninsula. Formerly gathered in the wild, these palms have been introduced into various forms of management and cultivation in different parts of the peninsula. At the present time, *Sabal yapa* Wright ex Becc. and *S. Mauritiiformis* Grisebach and Wendl are still gathered in the wild in some parts of the eastern and southern peninsula. *Sabal yapa* is also promoted and harvested in the pasturelands of the cattle raising region of northern Yucatan. This species along with *S. mexicana* Mart. is also a common element in Mayan homegardens throughout the peninsula. On the other hand *S. mexicana* has begun to be extensively cultivated (probably since the turn of the century) in Ticul, Maxcanu and other towns and villages of western Yucatan. Both field and historical research suggest that changes in the management of *Sabal* in the Yucatan is a process that has recently developed as a response to

population growth and the decreasing availability of these palms in the wild as a result of change in land use (Caballero 1994a).

Cultural change resulting from the incorporation of the Maya into the social and economic mainstream of Mexico has involved the gradual substitution of the traditional Maya house thatched with *xa'an* leaves for modern houses made out of cement. Nonetheless, in those parts of the Yucatan peninsula where Maya culture persists more strongly, the demand for *xa'an* leaves for thatching not only has not decreased but it has grown steadily during the last two decades (Caballero 1994a). Changes in land use, population growth, as well as the dramatic increment in deforestation rates have entailed a progressive scarcity of *xa'an* leaves. This has worsened because of the growing demand of *xa'an* leaves for thatching cottages and other rustic buildings in the resorts of the tourist area of the Caribbean coast of the Yucatan peninsula.

The development of sustainable forms of *xa'an* management is needed to cope with the growing demand for palm leaves. For this, it is necessary to assess the sustainability of the traditional forms of *xa'an* management by the Maya. This study is a part of a research project on the biological and cultural basis of the use and management of *xa'an* by the Yucatec Maya and presents an evaluation of the sustainability of the management of *xa'an* palms in pasturelands, homegardens and in maize fields.

### Study Area

This study was carried out in the town of Maxcanu, and the villages of Sucila and X'kon ha of the Maya area of the Yucatan (Figure 1). These places are representative of the three main forms of management of *xa'an*. Maxcanu has 15,000 inhabitants and is located in the southwestern part of the state of Yucatan in a region known as "El Camino Real." Economic activities include traditional agriculture, fruit tree growing and industrial labor. Highly rich and complex homegardens are a characteristic of the residential units of Maxcanu, and *xa'an* palms are among the most important species in these homegardens. The leaves of the palms are harvested mostly for thatching houses in the same town although some people plant *xa'an* for selling the leaves to intermediaries who later sell them in the tourist zone of Quintana Roo.

Sucilá has 5,000 inhabitants and is located in the cattle-raising zone in the northeast of the Yucatan State. In this zone, *Sabal yapa* is tolerated in the pasturelands where cattle ranchers harvest great quantities of leaves for commercial purposes, mostly to be sold in the tourist areas of the peninsula. Although all houses in the periphery of Sucila are thatched with *xa'an*, most people living in town have cement houses and only use *xa'an* leaves for thatch-

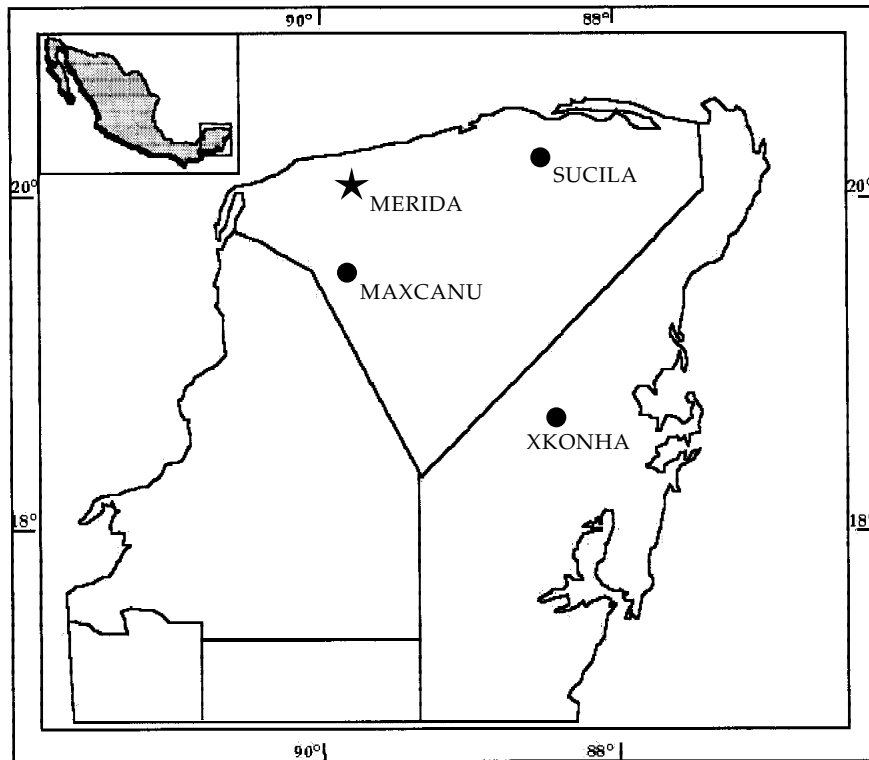


Figure 1. Map of the Yucatan peninsula showing the study sites.

ing the kitchen and other domestic facilities. As a result of this, local demand of *xa'an* leaves in this zone is less important than in Maxcanu.

X'Kon ha is located in the central part of the state of Quintana Roo and belongs to the municipality of Felipe Carrillo Puerto. This is a small village with only 21 families that are devoted to traditional agriculture. Each family owns 10 hectares of land with primary and secondary forest, fallows, and *milpas* (maize fields) where they harvest *xa'an* leaves mostly for household needs. Local people harvest leaves for selling only on an occasional basis.

## METHODS

Intensity of use of *xa'an*, and its ecological impact was used to compare the management of *Sabal* palms in homegardens, pasturelands and in *milpas*. A

Table 1. Number of individuals observed in each site during the demographic study.

COMMUNITY	TYPE OF MANAGEMENT	<i>Sabal yapa</i>	<i>Sabal mexicana</i>
		NUMBER OF INDIVIDUALS MARKED	NUMBER OF INDIVIDUALS MARKED
Maxcanú	Homegarden	161	274
Maxcanú	Homegarden	156	178
Sucilá	Pastureland	239	
X'kon há	Milpa	188	

random sample of households were interviewed in the three villages to obtain information on the intensity of *xa'an* use. A total of 35 householders were interviewed in Sucilá, 32 in Maxcanú and 17 in X' Kon Há. The number of leaves used for thatching and repairing the house and other domestic construction, as well as the frequency of thatching events, number of leaves harvested per year, and other related data were obtained during these interviews.

The ecological impact of *Sabal* utilization was assessed by conducting a demographic study of *Sabal mexicana* and *S. yapa* in three different sites corresponding to the three forms of management. The demographic study was carried out in four plots: one in Sucila pasturelands, one in a maize field of X'kon ha, and two in homegardens of Maxcanu. *Sabal yapa* was present in all plots while *S. mexicana* was present only in the homegardens. Following previous studies on palms (Olmsted and Alvarez-Buylla 1995; Bullock 1980; Piñeiro and Sarukhán 1982), we distinguished four growth categories of *xa'an* palms. These were seedlings, infantile (individuals with non-elongated subterranean stems), juvenile (pre-reproductive individuals with stems that start to elongate) and adult (reproductive individuals). All individuals marked within the plots were selected at random along transects (see Table 1).

For each individual marked we recorded its size class, number of leaves, evidence of harvest as well as height and reproductive features when appropriate. The number of seedlings recruited per year was also recorded. Following the criteria suggested by a number of scholars for the study of demography of palms (Lubchenco et al. 1991; Martínez-Ramos y Alvarez-Buylla 1995; Olmsted y Alvarez-Buylla 1995; Joyal 1995, 1996), we estimated annual growth, survival and fecundity for each population studied. The finite growth rate ( $\lambda$ ) estimated for each population was used as a measure of sustainability of the corresponding form of management.

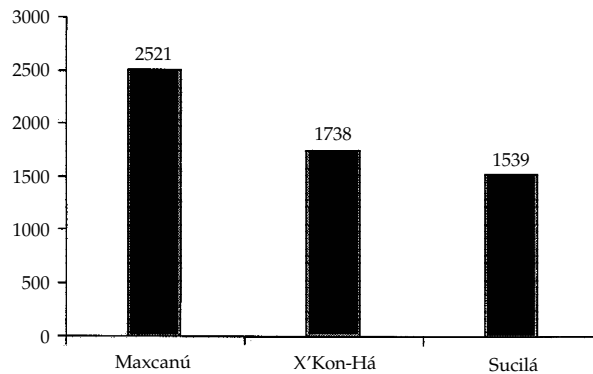


Figure 2. Average number of leaves utilized per household in the three villages studied (n=32 informants in Maxcanú, n=35 in Sucilá, n=17 in X'Kon-Há).

## RESULTS

Based on the interviews of 84 households, it was found that leaf demand is higher in Maxcanu, followed by X'kon ha. Sucila is the town where fewest leaves per household were used during this study (Figure 2).

The degree of manipulation of *xa'an* palms is different under the three forms of management. In the three sites, people harvest only the juvenile individuals and those adults whose leaves may be easily reached. In the pasturelands of Sucila and the *milpas* of X'kon ha, the Maya do not carry out any action for increasing the availability of any particular type of palm individuals besides tolerating both the individuals that were originally present in the site and those that grow spontaneously. In contrast, people at Maxcanu planted *xa'an* seeds in their homegardens. They also protect seedlings and infantile individuals from periodical burnings and from being foraged by domestic animals. These actions increase the proportion of harvestable individuals in the homegarden. By modifying the population size structure, the Maya assure that the needs of the household may be met by utilizing only the palms growing in their homegardens.

The population finite growth rates were 1 or close to 1 (Table 2) for the three forms of management. This indicates that the populations studied are stable under the present conditions of management if we assume that environmental conditions remain constant. Only in one of the homegardens an increment in the mortality of seedlings provoked negative growth of the population of *Sabal yapa* during 1999. The comparison of the density of *xa'an* palms in the differ-

Table 2. Population finite growth rate of *Sabal* spp. during two years.

PLOT	SPECIES	LAMBDA (1998)	LAMBDA (1999)
Homegarden 1	<i>Sabal mexicana</i>	0.997	1.001
	<i>Sabal yapa</i>	0.991	1.000
Homegarden 2	<i>Sabal mexicana</i>	0.991	1.000
	<i>Sabal yapa</i>	0.971	0.875
Pastureland	<i>Sabal yapa</i>	0.990	1.000
Milpa	<i>Sabal yapa</i>	0.990	1.000

ent plots sampled indicates that management in homegardens maximizes the number of palm individuals by area (Table 3). The proportion of individuals of different size classes is significantly different between the three forms of *xa'an* management ( $\chi^2 = 92.01$ ,  $P < 0.0001$  for *Sabal yapa* and  $\chi^2 = 66.46$ ,  $P < 0.0001$  for *Sabal mexicana*). These differences indicate that the proportion of juveniles in the homegardens is significantly higher than in the *milpa* and the pastureland. The high proportion of juveniles in the homegardens seems to be a result of both seed planting and protection of seedlings and infantile palms by local people. Since in Maxcanu the homegardens are practically the only places where *xa'an* leaves can be obtained, intensifying the manipulation of palm populations, particularly by modifying its size structure, is a conscious action directed to maximize the availability of *xa'an* leaves in rather small areas.

## DISCUSSION

The results obtained in this study show that there is a close relationship between local leaf demand, the form of management of *xa'an* palms, the intensity of manipulation of palm populations, and the main form of land use. Thus, in towns of the cattle raising area such as Sucila, the intensity of manipulation of *xa'an* populations is low, although leaf demand is relatively high. However, since pasturelands with tolerated *xa'an* palms occupy extensive areas, local leaf needs can be met through little or no human management of the palm populations. In contrast, in Maxcanu, where fruit tree cultivation and other forms of commercial agriculture are the predominant forms of land use and leaf demand is high, homegardens are the major source of *xa'an* leaves despite their small area. Thus, intensive manipulation of palm populations becomes the strategy for maximizing leaf supply. As shown by the demographic study, the tree forms

Table 3. Density of *xa'an* palms (ind/ha.) according to the form of management.

	PLOT AREA	<i>Sabal yapa</i>	<i>Sabal mexicana</i>
		PLAM INDIVIDUALS/HECTARE	PLAM INDIVIDUALS/HECTARE
Homegarden 1	6091 m <sup>2</sup>	2446	3616
Homegarden 2	2482 m <sup>2</sup>	2720	1937
Pastureland	38796 m <sup>2</sup>	2409	
Milpa	17207 m <sup>2</sup>	834	

of traditional management of *xa'an* are sustainable under the present conditions of leaf demand. Although the *xa'an* management in homegardens is more productive, the three forms compared are adequate to satisfy the local demand. It could be said that they represent an equilibrium between the needs and the technological capabilities of the Maya people and the possibilities and the limitations that the environment imposes on them.

#### ACKNOWLEDGMENTS

This study was funded by the Comisión Nacional para el Conocimiento y Uso de la Biodiversidad (CONABIO M111) and by the Consejo Nacional de Ciencia y Tecnología (CONACYT 31846-B). The authors thank Juan Tun and Luis Salinas for their collaboration in fieldwork and Jorge Saldivar for the computer assisted formatting of the final manuscript. Dr. Ana Mendoza and Dr. Hermilo Quero made valuable observations and recommendations that improved this study.

#### LITERATURE CITED

- Arellano, L.G., M.E. Carranco, F. Perez-Gil, A. Montiel and J. Caballero. 1992. *Sabal mexicana* Mart. y *Sabal japa* Wright. Ex Becc. (Palmaceae); Recursos Potenciales para la Alimentación Animal. Revista Cubana de Ciencia Agrícola. 26:317-322.
- Bullock, S.H. 1980. Demography of an undergrowth palm in Littoral Cameroon. Biotrópica 12(4):247-255.
- Caballero, J. 1991. Use and management of *Sabal* palms among the Maya of Yucatan: A case of technological innovation based on the folk biological knowledge. Pp. 13-23 in Best Paper Awards 1990, Rhoades, R.E., V.N. Sandoval, y C.P. Bagalanon (editors). Manila, Philippines International Potato Center and User's Perspective with Agricultural Research and Development.
- . 1992. The Maya homegardens of the Yucatan Peninsula: Past, present and future. Etnoecológica 1(1):35-54.

- . 1993. El caso del uso y manejo de la Palma de Guano (*Sabal* Spp.) entre los Mayas de Yucatán. Pp:203-248 in *Cultura y Manejo Sustentable de los Recursos Naturales*, Leff, Enrique. y Julia Carabias (editors). México: Cii-Unam and Grupo Editorial Miguel Angel Porrua.
- . 1994a. Use and management of Sabal Palms among the Maya of Yucatan. Ph.D. dissertation, University of California at Berkeley.
- . 1994b. La dimension culturelle de la diversite vegetale au Mexique. *Journal D' Agriculture Traditional. Et De Botanica Applied* Vol. Xxxvi (2):1-12.
- Joyal, E. 1995. An ethnoecology of *Sabal Uresana* Trelease (Arecaceae) in Sonora, México. Ph.D. dissertation, Arizona State University.
- . 1996. The palm has its time: Ethnoecology of *Sabal Uresana* in Sonora México. *Economic Botany* 50(4):446-462.
- Lubchenco, J., A.M. Olson, L.B. Brubaker, S.R. Carpenter, M.M. Holland, S.P. Hubbell, S.A. Levin, J.A. Macmahon, P.A. Matson, J. M. Melillo, H.A. Mooney, C.H. Peterson, H. R. Pulliam, L.A. Real, P.J. Regal and P.G. Risser. 1991. The sustainable biosphere initiative: An ecological research agenda. *Ecology* 72(2):371-412.
- Martínez-Ramos, M. and E. Álvarez-Buylla. 1995. Ecología de poblaciones de plantas en una selva húmeda de México. *Boletín de la Sociedad Botánica de México* 56:121-153.
- Olmsted, I. and E. Álvarez-Buylla. 1995. Sustainable harvesting of tropical trees: Demography and matrix model of two palm species in México. *Ecological Applications*. 5(2):484-500.
- Piñero, D. and J. Sarukhán. 1982. Reproductive behaviour and its individual variability in a tropical palms *Astrocaryum mexicanum*. *Journal of Ecology* 70:461-472.