The Ixtleros of North-Central Mexico: a Geographical Study of Man-Plant Relationships.

Samuel Richard Sheldon

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THE IXTLEROS OF NORTH-CENTRAL MEXICO:
A GEOGRAPHICAL STUDY OF MAN-PLANT
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A Dissertation

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Louisiana State University and
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Doctor of Philosophy

in

The Department of Geography
and Anthropology

by

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August 1978
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ABSTRACT

In the north-central drylands of Mexico campesinos known as "ixtleros" or "talladores" gather "ixtle," a hard fiber derived from the uncultivated plants lechugilla (Agave lecheguilla Torrey), and palma samandoca (Yucca carnerosana (Trelease) McKelvey). Within ixtlero communities the fiber is converted into rope and brushes and used for a variety of purposes. Stems, rootstocks, and pulp of lechugilla and palma samandoca are employed to meet local construction, cleansing, and dietary needs. In addition, the sale of ixtle derived from these two plants constitutes the single most important source of an ixtlero's annual income. Fiber collected in the field is sold at a fixed price to La Forestal, a government subsidized organization that exercises monopoly control over the collection, processing, and exportation of ixtle. The region in which ixtle is currently exploited for commercial purposes is known as the "Zona Ixtlera." In the Zona Ixtlera the time devoted to gathering ixtle, the implements that have been developed to collect the fiber, the material culture of the tallador, and the appellation "ixtlero" all reflect a traditional way of life in which the link between man and plants is a time-honored and deeply ingrained one.

Campesinos in the Zona Ixtlera are among the most impoverished Mexicans in terms of per capita income, material well-being, and health and educational facilities. Ixtlero indigence is rooted in the difficult environment of north-central Mexico, and perpetuated by the Mexican government's continued support of the ixtle industry.
CHAPTER I

INTRODUCTION

The Study Defined

For most of human history man has lived as a hunter-gatherer. The pursuit of wild animals and the collection of uncultivated plants sustained all of mankind from the time that man first evolved some two million years ago, until the eighth millennium B.C. Since that time hunting-gathering has been superceded as a subsistence base, initially by agriculture and pastoralism, and more recently by the industrial age. Confronted with more productive life-support systems, many hunting and gathering societies abandoned their traditional economy and adopted the newer modes of livelihood. Others, anachronisms in time and space, disappeared altogether. Today, only a handful of isolated hunting-gathering groups remain. Murdock's 1966 review entitled, "The Current Status of the World's Hunting and Gathering Peoples," cites only twenty-seven surviving groups of "pure" hunters-gatherers in the world. These groups are generally small, numbering fewer than one thousand people, and most live in lands that have little or no value for agricultural societies (Lee and Devore, 1966:5). As inroads continue to be made by agriculture and other economic activities, the number of hunter-gatherer societies will dwindle further, and this life form may eventually become extinct.

Within the broad context of hunting-gathering societies are highly acculturated groups who concurrently collect wild plants for local
needs and/or specialize in the gathering of one or more species-specific plants for part, or all, of their economic livelihood. Among the Itá people of Brazil's Amazonian region, for example, the principal "money crop" is rubber collected from the wild rubber tree (*Hevea brasiliensis*) (Wagley, 1964:82).¹ A second product of major economic significance in the Amazon forest is the Brazil nut, collected from the uncultivated tree of the same name (*Bertholletia excelsa*).² The importance of *Hevea brasiliensis* and *Bertholletia excelsa* to residents of the Amazon is such that "gathering wild rubber and Brazil nuts remains the main way to make a living from Acre to the Amazon" (McIntyre, 1977:708). In the semiarid northeastern region of Brazil products gathered from uncultivated trees such as the carnauba palm (*Copernicia cerifera*), and babassú palm (*Orbignya martiana* and *Orbignya oleifera*) are a source of remuneration for local inhabitants.³

Gatherers living in diverse habitats around the world collect and sell roots, bark, leaves, fiber, nuts, and tree trunk materials from a variety of uncultivated plants.⁴ Included among these are the chicleros of Middle America's Yucatan Peninsula and the Menomini Indians of northern Wisconsin.⁵ Included also is a lesser known group, the ixtleros of north-central Mexico.

Mexico has a long tradition of desert plant use and desert-plant industries. This tradition is particularly significant today in the arid and semiarid lands of north-central Mexico where a large rural population continues to rely on uncultivated plants for the essentials of their existence. The utilization of plants and plant derivatives remains an integral part of day-to-day living in this area for two reasons: the plants are used for a variety of utilitarian purposes...
in rural communities, and a select few are exploited for their commercial value. The most notable plants in this second group are candelilla (Euphorbia antisiphilitica), valuable because its leafless stems exude a white wax that has industrial applications; guayule (Parthenium argentatum), a shrub whose roots and stems contain a latex that closely resembles that extracted from the Hevea rubber tree; nopal cardón (Opuntia streptacantha), a cactus plant from which fruits are collected and converted into numerous confections, including "queso de tuna;" and lechuguilla (Agave lechequilla) and palma samandoca (Yucca carnerosana) from which a hard fiber, "ixtle," is extracted that has widespread applications in the cordage and brush industries.

In terms of areal extent, commercial value, and the number of people involved, the most important of the plant products gathered in Mexico's north-central drylands is ixtle. That region in which the fiber is exploited for commercial purposes is called locally the "Zona Ixtlera." This region currently encompasses twenty million hectares and includes parts of the states of Coahuila, Nuevo León, San Luis Potosí, Tamaulipas, and Zacatecas (Illustration 1).

Rural folk, or campesinos, who collect and market lechuguilla and palma samandoca fiber in the Zona Ixtlera are called "ixtleros" or "talladores." Ixtleros sell most of the fiber they collect to La Forestal, F.C.L. (Federación de Cooperativas Limitadas), a government-subsidized organization that has a monopoly on the purchase, processing, and sale of ixtle. Money derived from the sale of ixtle constitutes the single most important source of an ixtlero's annual income. Unmarketed fiber is used locally for a wide variety of purposes. Within ixtlero communities it is commonly made into rope and brushes of many types. Other
THE ZONA IXTLERA OF MEXICO
Illustration 1

STATES OF THE ZONA IXTLERA
1 - Coahuila
2 - Nuevo León
3 - Zacatecas
4 - San Luis Potosí
5 - Tamaulipas

derivatives of lechugilla and palma samandoca are used non-commercially as well. Stems, rootstocks, and the pulp of both plants are employed to meet local construction, cleansing, and dietary needs. Although *Agave lecheguilla* and *Yucca carnerosana* are the most important plants collected by ixtleros, they are by no means the only ones. A host of other uncultivated desert-steppe vegetation is collected and used as food, beverages, fiber, in construction, and for medicinal purposes. Furthermore, the gathering economy of the ixtleros is supplemented, and occasionally superceded, by agriculture and stockraising. When rainfall occurs in sufficient quantities, the campesinos divert their attention from gathering to crop cultivation.

In the Zona Ixtlera of present-day Mexico there exists a way-of-life that focuses on the gathering and utilization of uncultivated dryland vegetation. This traditional life style antedates by many years the commercial exploitation of plants in the area. In fact, its historical antecedents may have originated with the hunting-gathering economy of the nomadic Indian bands who occupied the region in pre-Conquest times. Archaeological evidence indicates that lechuguilla fiber was used in north-central Mexico as early as 8080 B.P. (Crane and Griffin, 1958:1120). The finely honed skills and tools employed by ixtleros to exploit the native resources of their environment suggest a long developmental process that further supports the antiquity of this gathering tradition.

The folk economy of Mexico's ixtleros exists as an anomaly in a nation that is rapidly expanding its industrial base and modernizing its economy. While other regions of Mexico are experiencing unprecedented rates of economic growth, residents of the Zona Ixtlera
continue to lead impoverished lives. Socio-economic conditions in the region are among the worst in all of Mexico: health and education facilities are inadequate or absent, utilities are limited, roads are poorly developed, and income levels are low. The gathering economy has reaped few social or material benefits for the ixtleros, yet it is an occupation that engages as many as 650,000 campesinos and will continue to do so in the foreseeable future. This pessimistic conclusion is based on an assessment of the environmental and economic realities that touch ixtlero existence. One reason why ixtleros persist in their relict gathering economy is that the environment in which they live is an adverse one that currently has limited economic potential. Water-deficit conditions, particularly in the more arid regions of the Zona Ixtlera, severely limit farming pursuits. Viscissitudes of precipitation therefore sustain the ixtlero-plant bond because during drought years, when agriculture is difficult or impossible, lechuguilla and palma samandoca and the potential they offer for an assured, albeit limited, income, remain. Even during those years when rainfall is sufficient and the ixtlero works his fields, his children assume responsibility for gathering ixtle and exchanging it at the local cooperative for the staples required by the family.

Equally significant in sustaining the gathering economy are international market demands for ixtle and the subsequent decision by the Mexican government to subsidize an industrial enterprise devoted solely to the purchase, processing, and export of ixtle. The Zona Ixtlera is, in fact, an institutionally inscribed economic region created, fostered, and sanctioned by the Mexican government. It is delimited solely on the basis of the commercial gathering of fiber
from two specific plants, *Agave lecheguilla* and *Yucca carnerosana*. Therefore, as long as a viable export market continues to exist for lechuguilla and palma samandoca fiber, and as long as the government continues to guarantee that market demands for ixtle are met, the ixtlero, confronted with limited economic alternatives, will continue to collect and sell fiber, and the Zona Ixtlera will persist as a recognizable entity. It is ironic that the Mexican government, while seeking to modernize the nation, is simultaneously perpetuating a folk economy through its support of the ixtle industry.

**The Major Theme: Man-Plant Relationships**

The relationship between man and his physical environment has long been a matter of academic concern to geographers. In his presidential address to the Association of American Geographers in 1922, H. H. Barrows (1923:2) defined geography as "human ecology," i.e., the tendency of many geographers of the time to treat their subject as the study of the relation of man to his environment. Barrow's address underscored the antiquity and significance of the man-land relationship in geography, a relationship that today constitutes one of the disciplines four major "traditions" (Pattison, 1964). Professional geographers have developed divergent perspectives on the spatial interactions between humans and the land they inhabit. Early in this century the physical environment was stressed as an active force that controlled or determined all of man's actions and activities (see for example, Semple, 1903, 1911, and Huntington, 1907). This philosophical doctrine, known as "environmental determinism," was subsequently disavowed and in its stead geographic studies have emphasized man's influence on the
physical environment. Man is viewed as a geomorphic agent (Sauer, 1962:32), and the impress that he and his works have on the land are considered of paramount importance in assessing organic-inorganic relationships.

Both environmental determinism and the man-oriented theme that succeeded it were often perceived as being uni-directional in their consideration of human-physical relationships: influences emanated from one source only, be it man or the environment, and reciprocity was minimal or altogether absent. In fact, the relationship between human organisms and the physical milieu in which they are enmeshed is a mutual one in which forces are operative in two directions. This dynamic cause-and-effect interplay is known as "cultural ecology." The anthropologist Julian Steward has been instrumental in promoting this approach to man-land relationships. His 1955 publication entitled Theory of Culture Change: The Methodology of Multilinear Evolution is considered a classic statement on the nature of cultural ecology. Subsequent anthropological literature detailing the interaction between man and the various components of his environment have been extensive (among others: Sahlin, 1964; Vayda and Rappaport, 1968; and Watson and Watson, 1968). Sorre (1962:46) states the case for geography by commenting that the geographer is an ecologist by definition, and in recent years the spate of publications written by geographers utilizing the ecological approach tends to substantiate his observation.

In the cultural ecology approach to man-land studies, man interacts with the entire gamut of environmental features, of which landforms, water bodies, soils, vegetation, and climate are the most prominent. That component of the physical milieu most relevant to
this study is natural vegetation. Carter (1950) was among the first to define the relationship between ecology, geography, and ethnobotany, and man-plant studies today form a significant part of the larger man-land tradition in geography (see for example: Bahre, 1974; Dickinson, 1969; Gade, 1967, 1975; Johnson, 1970, 1972; and Brand, 1941). This study employs the theme of cultural ecology to examine and to assess man-plant relationships in the Zona Ixtlera of Mexico.

Purpose

This paper examines the prominent life activities of a population that inhabits 20,000 hectares of the Mexican national territory. These people are closely bound to the native plant resources of their environment. Their daily round of activities and standard of living are largely contingent upon their interaction with the vegetative complex that surrounds them, and a rendering of their ethno-botany helps to explain how a folk economy is being perpetuated in the face of a modernizing world. In detailing the bond that exists between ixtleros and the plants Agave lecheguilla and Yucca carnerosana it is hoped that a fuller and more meaningful understanding of the relation of man to his environment will result.

Literature on Ixtle and the Ixtleros

Publications in English on ixtleros and ixtle per se are limited and generally out-of-date. Furthermore, extant literature invariably emphasizes the fiber's economic potential and/or the plants from which it eminates rather than the people who gather it for a livelihood. Expositions devoted strictly to Agave lecheguilla and Yucca carnerosana,
or products derived from them, are rare. Johns', et al., (1922) highly technical article on lechuguilla saponins; Greene's (1932) discussion of the composition of Agave lecheguilla fiber and waste; Mathews' lengthy discourse on lechuguilla poisoning in sheep and goats (1937); and DuFrane's (1946) superficial treatment of the "istle industry" are all examples. In most instances the economic botany of ixtle is included as a minor item within the broader framework of "useful desert plant products," or "fiber plants" (Armour Research Foundation, 1946; Botkin, 1945; Cruse, 1949; Dewey, 1943; Duisberg, 1952; Kirby, 1950; Mauersberger, 1954; and Rose, 1899).

Despite the absence of a significant body of substantive information in English on ixtle there are a number of publications that provide adequate background information on the physical parameters and distribution of lechuguilla and palma samandoca. Of particular note are Standley's (1961) publication on the trees and shrubs of Mexico; Shreve's (1939, 1942a, 1951) writings on vegetation associations in northern Mexico; Muller's (1939) coverage of climate-vegetation relations in Nuevo León and Coahuila (1947); and Johnston's (1943-1944) work on the association between elevation and plant types in Coahuila, eastern Chihuahua, Zacatecas, and Durango. While not directly concerned with the Zona Ixtlera, Gentry's (1972) recent monograph on the Agaves of Sonora signifies a return to the type of comprehensive descriptive-explanation of plant associations initially provided by Shreve, Muller, and Johnston during the 1930's and 1940's.

Numerous articles in the journal Economic Botany have detailed the close association between man and the native vegetation of arid environs. In 1971, Duisberg and Hay compiled a selected list of
references on economic arid-land plants and their uses that appeared in *Economic Botany* through April-June 1969 (Volumes 1-23). The tabulation covers sixteen pages, and while references dealing specifically with lechuguilla and palma samandoca products are few (3:111-131; 4:243-252; 8:3-20; 11:39; 12:95-102; 13:243-260), information gleaned from articles included on the list provides information vital to an understanding of man-plant relationships in arid environments.

Not surprisingly, Mexican literature on ixtle and the people who gather it is more detailed than its English counterpart. A large segment of Mexico's national territory is classified as arid or semiarid, and consequently a plethora of government reports and scholarly articles have appeared in recent years delimiting the arid zones, detailing their problems, describing dryland resources, and proffering suggestions for maximizing their economic potential. Notable for their attempt to encompass all these areas are two publications of the Instituto Mexicano de Recursos Naturales Renovables: a 1955 opus entitled *Problemas de las Zonas Aridas de México*, and a 1964 monograph on *Las Zonas Aridas del Centro y Noreste de México y el Aprovechamiento de sus Recursos*, edited by Enrique Beltrán. Both publications are invaluable in providing an understanding of problems and prospects in Mexico's drylands. In the area of plant-resources Rzedowski's articles on the vegetation of north-central Mexico are notable for both their thoroughness and quality. Although much of his work is restricted to San Luis Potosí (1955a, 1955b, 1957, 1961, 1965b) Rzedowski expanded the scope of his studies in 1968 to include the vegetation of Mexico's major drylands. Others who have described plant-life in the north-central region of the nation include Miranda and Hernández X. (1973), Rojas (1965), Rojas García-Duèñas
(1954), and Takáki (1961). Because of their abundance the genera Agave and Yucca have been the particular focus of numerous publications (Berlin, 1953; Esquer Félix, 1962; García C. and Aragón S., 1975; Gómez Pampa, 1963; Piña L., 1974; and Ramírez, 1935). Literature on the economic botany of arid-land plants is extensive. If one restricts the list to authors who have only considered the subsistence and commercial utilization of Agave lecheguilla and Yucca carnerosana it includes Alviso Flores, 1958b; Borja L., n.d., Bosque Rodríguez, 1969; Campos Rocha, 1961; Cepeda, 1949; Fuentes, 1958; Garza, 1953; H. Bravo, 1960; Nava Calvillo, 1968; Patoni, 1917; Valero, 1946; and Villanueva, 1945. Despite this profusion of literature on lechuguilla and palma samandoca two points are worth noting: Patoni's 1917 publication is the seminal work, providing many subsequent authors with their information and ideas; and most publications emphasize the commercial potential of ixtle, completely ignoring or superficially treating the numerous local uses to which products from Agave lecheguilla and Yucca carnerosana are applied. The 1948 monograph by Mesa A. and Villanueva V. is by far the most comprehensive account of ixtle's history as an export commodity. It traces the gathering of the fiber from its pre-Conquest subsistence use to its nineteenth and twentieth century commercialization. In doing so, Mesa A. and Villanueva V. establish a historical perspective on the status of contemporary ixtleros who are, in effect, perpetuating a relict economic livelihood.

The socio-economic plight of ixtleros has provoked a rash of books and articles during the past decade. Publications with titles such as Hambre (De la Cerda, 1964), Problemas de las Zonas Ixtleras (Carmona P., 1963), and Problemas de los Campesinos Ixtleros y Cereros
del Norte del País (Quillares Lona, 1971), are designed to draw attention to the conditions of abject poverty that are an integral part of most ixtlero's existence. Alemán Alemán's statistical analysis of socio-economic conditions in San Luis Potosí (1966) vividly illustrates the depressed nature of ejidos located in the Zona Ixtlera vis-à-vis the remainder of the state. Solutions designed to alleviate ixtlero problems largely remain on the drawing boards of Mexican government agencies. The few development schemes that have reached print thus far (e.g., Centro de Investigación y Social Acción, n.d., Santos Saavedra, 1965, and Galván, 1973) are limited in scope and/or remain paper solutions only. The one project to date that could have a favorable impact on ixtleros is the Estudio Ecológico Dasonómico de las Zonas Aridas del Norte de México (1964) by Marroquín, et al. This inventory of native vegetation in Mexico's northern drylands is hopefully the prelude to a rational utilization of the regions natural resources, a utilization that will benefit both the environment and the people who inhabit it.
FOOTNOTES

Chapter I

1 In addition to wild rubber from *Hevea brasiliensis* the Itá collect and sell nuts from the ucuaba palm (used for palm oil) and a forest seed, the paracaxi, that supplies an oil used as a lubricant and in the manufacture of soap (Wagley, 1964:87-88).

2 Brazil nuts contain an edible seed highly prized for its food value.

3 Both trees are located in the thorny, deciduous, drought-resistant woodland known as *caatinga* (James, 1969:706). Wax scraped from leaves of the carnauba palm is used in the manufacture of phonograph records, floor waxes, shoe polish, carbon paper, coatings for metal, and waterproofing. Babassú palm, also known as babacu, *coco de macaco*, and aguassú, produces an abundance of fruit containing up to 72% oil (National Academy of Sciences, 1975:89).

4 In a 1975 publication entitled *Underexploited Tropical Plants with Promising Economic Value*, the National Academy of Sciences cites thirty-six uncultivated plants that are currently exploited for commercial purposes. The NAS study concludes that the export value of these plants could be greatly increased if they were brought under cultivation.

5 Chicle is gathered from chicosapote trees (*Achras sapote*) that grow wild in Guatemala's Peten region, and in the Mexican states of Campeche and Quintana Roo. The development of synthetic chewing gums in recent years has effected a sharp drop in the number of chicle gatherers. The Menomini have long been dependent on plant life such as "wild rice" for food and other uses. Wild rice (*Zizania aquatica*) gathered by the contemporary Menomini is marketed nation-wide. The importance of this plant is such that the Menomini word for wild rice is "Mä'nomän," and the Indians took to themselves the name of the "wild rice men," Mä'nomäneo iña'niwug (Smith, 1923:10).

6 Hard fibers are those that occur throughout the leaves or stems of monocotyledonous plants. Soft fibers are produced in the bast area of stems (Fishler, 1961:5).

7 *Agave lecheguilla* and *Yucca carnerosana* are distributed beyond the limits of the Zona Ixtlera (Illustrations 4 and 5, Chapter II:27,31). For example, both plants grow in parts of Chihuahua and Durango states, and lechuguilla extends into the arid rangelands of southeastern New Mexico and southwestern Texas in the United States. Neither plant is commercially harvested in these areas however, and the name "ixtlero" is not used in association with the rural populace of these locales.
CHAPTER II

AN OVERVIEW OF CONTEMPORARY ENVIRONMENTAL AND ECONOMIC PATTERNS IN NORTH-CENTRAL MEXICO AND THE ZONA IXTLERA

The Environmental Setting

Landforms

The natural habitat of both Agave lecheguilla and Yucca carnerosana are the drylands of north-central Mexico. Their distribution coincides, in large part, with that landform region known as the Mesa del Norte (Altiplanicie Septentrional) (Illustration 2), although outliers of both plants extend to the lower western slopes of the Sierra Madre Oriental in the states of Tamaulipas and Nuevo León.

The Mesa del Norte is not a homogeneous physical unit. Its western periphery has a tectonic history different from that of the remainder of the altiplano, and at least two distinct landform areas are discernable on the present-day surface: a western high basin and range area with a predominantly volcanic rock surface, and a central-eastern lowland region covered by clastic rocks, principally limestone. This difference accounts in large part for the distribution of Agave lecheguilla and Yucca carnerosana on the Mesa del Norte. Since climatic conditions are relatively uniform throughout the region, edaphic parameters become important in accounting for the distribution of plant species. Lecheguilla and palma samandoca thrive on calcareous soils, and the limestone rocks that dominate the surface material of the central-eastern Mesa del Norte contain from 50% to 80% calcium carbonate. Consequently, the distribution of the plants is coincident with the location
of calcareous rocks and soils in central-eastern portions of the Mesa del Norte, as well as in sedimentary formations along the western foothills of the Sierra Madre Oriental.

The central-eastern part of the Mesa del Norte is an arid land composed largely of isolated mountain ranges interspersed by broad, alluvium-covered plains. This alternating plain and mountain topography has been defined physiographically as "basin and range." The folded and faulted mountain ranges rise 600 to 900 m above the adjacent depressions. In general, they are inclined in a northwest-southeast direction, but in a few sections, such as to the west of Monterrey, and in central Coahuila, they assume an east-west orientation.

Between the sierras are numerous desert basins, or bolsones. These depressions constitute the largest and most conspicuous landform feature of the central-eastern Mesa del Norte. The basins are aggraded areas filled with water-deposited detritus from adjacent mountains. Toward the center of the enclosed bolsones, the finest materials collect to form an almost level plain called the barrial (West, 1964:50). When runoff waters from the surrounding slopes and mountains are excessive, many bolsones become ephemeral lakes. The water subsequently evaporates, leaving behind thin layers of gray calcareous clays, alkali, or salt encrustations (Jaeger, 1957:33). Many of these deposits are of commercial import.

Climate

The outstanding climatic feature of the Mesa del Norte is its aridity. Rainfall is limited and irregular, and a pattern of interior drainage subsequently characterizes most of the area. The drylands of
the Mesa del Norte have long been a matter of concern to Mexican government officials. This concern derives from a cognizance that a large portion of the national territory experiences water deficit conditions.\textsuperscript{1} Numerous classification schemes have been devised to delimit the nation's drylands.\textsuperscript{2} Illustration 3 depicts one of the most recent classifications.\textsuperscript{3} Arid and semi-arid zones on the map are separated by the 350 mm isohyet. Semi-arid lands have their outer limits defined by the 600 mm isohyet (Martínez and Maldonado, n.d.: 3-4). The eastern two thirds of the dryland region is coincident with the Chihuahuan Desert. The boundaries of this desert have been variously defined, but in general it encompasses nearly two-thirds of the state of Chihuahua, and parts of the states of Coahuila, San Luis Potosí, Nuevo León, Zacatecas, and Durango in Mexico, and sections of western Texas and southern New Mexico in the United States (Shreve, 1942b:236; Jaeger, 1957:33).

Precipitation in the Mesa del Norte is as erratic as it is limited. Amounts vary both seasonally and annually. Wallen's (1956:150) study of long-term fluctuations in Mexican rainfall revealed that the highest variability occurred in areas of low precipitation in the northern and north-western parts of the nation, with a maximum of approximately 50% in the extremely dry areas. A secondary maximum of ca. 40% coincided with the central-eastern parts of the Mesa del Norte.

Pluvial conditions vary most dramatically from month to month. The "rainy season" occurs during the summer months in conjunction with an influx of moist air from both the Gulf of Mexico and Pacific Ocean toward a semipermanent low-pressure system centered in northern Mexico.
ARID AND SEMIARID ZONES IN MEXICO

Illustration 3

SOURCE: Martínez and Maldinado, n.d.: 3-4, from a map by COTECOCA.
Precipitation between June and September normally accounts for 60% to 70% of the annual total (Table 1). Only light drizzles of frontal origin interrupt the almost continuous drought that lasts from November through May (Vivo' Escoto, 1964:203).

The absence and variability of rainfall throughout the Mesa del Norte imposes severe limitations on agricultural pursuits. Limited precipitation reduces the range of crops that can be grown, and the unreliability of rainfall makes crop cultivation of any kind a hazardous venture.

**Soils and Vegetation**

Gray desert soils (siernozems) and red desert soils dominate the surface materials of the Mesa del Norte. In less arid peripheral areas these give way to brown and chestnut soils. Siernozems contain little humus due to the sparse vegetative cover. Their color ranges from light gray to grayish brown and although horizons are present, they are not conspicuous. In the more arid expanses of the Mesa del Norte, red desert soils prevail. Color varies from a pale reddish gray to a decidedly reddish tinge, as a result of greater dehydration of iron compounds. Both the siernozem and red desert are zonal soils that result from the calcification process common to arid and semi-arid environments. Lime carbonates (CaCO₃) accumulate in the soil, a process made possible because the soil is not continually moist and the lime carbonate and other minerals, formed from solutes in the water, are precipitated by evaporation within the soil profile at a faster rate than they are removed by leaching.

Edaphic, as well as climatic, conditions have been instrumental
TABLE 1.
Average Monthly Precipitation for Selected Stations in North-Central Mexico

<table>
<thead>
<tr>
<th>Station:</th>
<th>Saltillo</th>
<th>Ramos Arizpe</th>
<th>Galeana</th>
<th>Doctor Arroyo</th>
<th>Charcas</th>
<th>Matehuala</th>
<th>Tula</th>
<th>Villa de Cos</th>
</tr>
</thead>
<tbody>
<tr>
<td>Years on Record:</td>
<td>30</td>
<td>30</td>
<td>24</td>
<td>27</td>
<td>30</td>
<td>28</td>
<td>31</td>
<td>28</td>
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<tr>
<td>Months:</td>
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<td></td>
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<tr>
<td>Rainfall in mm</td>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>January</td>
<td>9.2</td>
<td>10.6</td>
<td>3.3</td>
<td>11.4</td>
<td>6.6</td>
<td>12.2</td>
<td>10.9</td>
<td>17.5</td>
</tr>
<tr>
<td>February</td>
<td>10.6</td>
<td>10.3</td>
<td>8.2</td>
<td>10.3</td>
<td>6.5</td>
<td>10.1</td>
<td>11.3</td>
<td>9.2</td>
</tr>
<tr>
<td>March</td>
<td>5.8</td>
<td>6.2</td>
<td>5.9</td>
<td>13.5</td>
<td>9.7</td>
<td>10.5</td>
<td>8.3</td>
<td>11.7</td>
</tr>
<tr>
<td>April</td>
<td>11.4</td>
<td>13.2</td>
<td>25.2</td>
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<td>22.4</td>
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<td>May</td>
<td>22.9</td>
<td>21.2</td>
<td>41.1</td>
<td>63.2</td>
<td>34.1</td>
<td>55.2</td>
<td>25.4</td>
<td>16.3</td>
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<td>June</td>
<td>35.3</td>
<td>23.7</td>
<td>57.3</td>
<td>72.2</td>
<td>59.3</td>
<td>89.9</td>
<td>74.3</td>
<td>55.6</td>
</tr>
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<td>July</td>
<td>39.2</td>
<td>31.7</td>
<td>39.7</td>
<td>56.2</td>
<td>44.3</td>
<td>59.2</td>
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<tr>
<td>August</td>
<td>43.7</td>
<td>32.2</td>
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<td>93.3</td>
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<td>67.0</td>
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<td>September</td>
<td>46.8</td>
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<td>20.7</td>
<td>36.3</td>
<td>41.7</td>
<td>46.0</td>
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<td>9.4</td>
<td>10.5</td>
<td>11.7</td>
<td>13.2</td>
<td>14.3</td>
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<tr>
<td>December</td>
<td>10.6</td>
<td>11.4</td>
<td>6.6</td>
<td>16.3</td>
<td>11.4</td>
<td>14.3</td>
<td>10.0</td>
<td>19.5</td>
</tr>
<tr>
<td>Totals</td>
<td>269.4</td>
<td>235.7</td>
<td>365.0</td>
<td>489.9</td>
<td>358.3</td>
<td>479.2</td>
<td>435.7</td>
<td>460.6</td>
</tr>
<tr>
<td>June-Sept.</td>
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<tr>
<td>Totals</td>
<td>165.0</td>
<td>130.3</td>
<td>231.9</td>
<td>305.3</td>
<td>221.5</td>
<td>293.9</td>
<td>309.3</td>
<td>298.0</td>
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<tr>
<td>J-S Rainfall</td>
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<td></td>
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<tr>
<td>as % of Total</td>
<td>61</td>
<td>55</td>
<td>64</td>
<td>62</td>
<td>62</td>
<td>61</td>
<td>71</td>
<td>65</td>
</tr>
</tbody>
</table>
in determining the vegetative cover of the Mesa del Norte. The presence of limestone is particularly significant in accounting for the distribution of Agave lecheguilla and Yucca carnerosana. Limestone is prevalent along the mountain front in Coahuila and Nuevo León, and in that part of the Mesa del Norte coincident with the Chihuahuan Desert. The slow weathering of limestone deposits in an arid climate leaves the soil shallow and the surface stony (Shreve, 1942a:192). Under such circumstances limestone soils are unable to support heavy stands of grass. What they do support is a large number of liliaceous and amaryllidaceous species of the genera Agave and Yucca.\(^5\) Agaves in particular thrive on limestone, although they grow on igneous rocks and on other well-drained nonalkaline lands. Rzedowski (1955b, 1957:66) applied the term "matorral desértico calcícola" (desert calcícola scrub) to plants that develop exclusively on limestone, while the closely allied "matorral cactus-mezquite" (cactus-mesquite scrub) is found mainly on igneous substrata. In a later publication Rzedowski (1961:150) substituted the term "matorral desértico rosetófilo" (desert rosette scrub) for "desert calcícola scrub."\(^6\) "Desert rosette scrub" derives its name from the fact that the dominant scrub vegetation has long, narrow leaves that radiate from a center, in a fashion similar to that of a rosette or small rose. This vegetative type is most abundant on the well-drained slopes of limestone hills and the alluvial fans that form at their base. It is less frequent in level areas but will occur on any land surface rich in limestone gravel and rock fragments. The altitudinal range of this plant complex extends from 1,000 to 2,000 m above sea level. Its tolerance of climatic extremes is notable: it can survive in areas with less than 500 mm
of annual precipitation and in thermal conditions that range from -15°C to +20°C (Rzedowski, 1961:140-141, 150).

Desert rosette scrub plants can be essentially divided into two types: those that possess a visible trunk or caudex (Yucca, Dasylirion), and those that lack a trunk and subsequently have their leaves radiating from the base of the plant on the ground surface (Agave, Hechtia). It is the latter category of smaller shrubs, often no more than 20 to 60 cm in height, that dominates the landscape. This stratum frequently covers 50% or more of the ground surface, and occasionally it will completely blanket an area. Agave lechuguilla, Agave striata (espadín), and Hechtia glomerata (guapilla) are among the plant types noted for their clustering tendency. A second stratum of vegetation in the desert rosette scrub complex rises to heights of 1 to 2 m above the ground. These high, essentially trunkless shrubs include, among others, Acacia crassifolia, Buddleia marrubiifolia, Dasylirion cedrosanum (sotol), Larrea divaricata (gobernadora or creosote bush), and Prosopis juliflora (mesquite). The upper stratum of plants consists of the lofty, trunked Yucca carnerosana which attains heights of up to 6 m.

Lands covered by desert rosette scrub are not utilized for agriculture, and their grazing potential is limited. Nevertheless, various plants associated with this vegetative complex are, and have long been, intensively exploited by man. Most notable among these are lechuguilla, palma samandoca, candelilla, and guayule. Lechuguilla and palma samandoca are the focus of this study in man-plant relationships. Both plants are employed for a variety of purposes in the rural areas of north-central Mexico. Moreover, the commercial value of fiber extracted from
Agave lecheguilla and Yucca carnerosana is such that it provides a vital and consistent source of income to the area's rural populace.

**Agave lecheguilla** Torrey

This plant has been referred to by many different names over the years, and until the present some confusion exists about its proper nomenclature. *Agave lecheguilla* Torrey dates from 1859, the same year that a second name *Agave poselgeri* Salm-Dyck appeared for the plant. In 1915 the names *Agave lophantha*, var. *pallida* Berger and *Agave lophantha*, var. *Poselgeri* Berger were introduced. *Agave lecheguilla* Torrey now supercedes all other designations in use but there are botanists and authors (Standley, 1961:1:136; Mauersberger, 1954:467; Uphof, 1968:13; DuFrane, 1946:71) who claim that the plants growing in Jaumave and Tula, Tamaulipas, from which ixtle is extracted, are a different species of Agave: *Agave funkiana*, *Agave lophantha*, or *Agave heteracantha*. Most scientists disavow this duality and consider *Agave lecheguilla* Torrey to be the lone species of Agave from which "ixtle de lechuguilla" is extracted. The term "ixtle" is believed to have been derived from the early Mexican Indian tribe of Nahuatlans whose work "ixtli" means a plant giving fiber (Mauersberger, 1954:473).

Today the word "ixtle" is used to denote fiber extracted from a wide variety of Agave plants scattered throughout Mexico. Lechuguilla literally means "little lettuce," an appellation that doubtless has reference to the shape and disposition of the plant center and leaves.

*Agave lecheguilla* consists of a rosette of 25 to 50 green leaves radiating from the ground without an exposed trunk (Plate 1).
Although the lechuguilla plant that grows in Tula and Jaumave has noticeably longer leaves, an average plant has leaves that are 30 to 50 cm long, and 3 to 4 cm wide. Leaves are thick and stiff, and nearly always curve toward the center of the plant. Each leaf terminates in a sharp spine 25 to 40 mm long. The sides of each leaf are liberally bordered with hooklike barbs 3 to 7 mm long, spaced at 20 to 40 mm intervals. Outer leaves of the lechuguilla plant are hard, coarse, and difficult to work. Younger and more tender leaves are constantly being formed at the plants center. These grow in a tightly formed cluster, or cogollo, and it is from this central spike of unopened leaves that the commercially valuable ixtle is extracted. The life span of Agave
lecheguilla is contingent upon whether the cogollo is removed. After the sixth year of growth, the center bud contains a marketable fiber. If the plant is not harvested, the cogollo grows into a flower stalk 1.5 to 3 m high that bears light-yellow flowers in a close spike. After flowering, the plant dies, a phenomenon common to all species of Agave. If the cogollo is cut after the sixth year, and periodically cut thereafter, the plant may live 15 to 20 years before flowering and dying (Patoni, 1917; Cepeda, 1949:15). Regeneration of new cogollos after cutting varies in accordance with pluvial conditions. If rains occur in sufficient quantities, a new centerbud can be ready for harvesting in six months. During drought periods, regeneration may take as long as one year (González C. and Scheffey, 1964:42). Agave lecheguilla reproduces vegetatively. Young shoots (hijuelos) are emitted by the rhizomes of the mother plant. Field work conducted at experimental stations in Mexico suggests that the greater the exploitation of the cogollo, the more rapid the increase in the number of new hijuelos (Campa and Barragán, 1974:34; personal interview with Jorge S. Marroquín, April 22, 1976).

Lechuguilla is distributed from 99°W. longitude (just southwest of Ciudad Victoria, Tamaulipas) to 106°45'W. (southeast of Ciudad Juárez, Chihuahua), and latitudinally from 22°N. (southwest of Cárdenas, San Luis Potosí) to 31°40'N (Ciudad Juárez) in Mexico (Illustration 4). Within this broadly defined area, the greatest abundance of plants occurs in northern Zacatecas, southeastern Nuevo León, north-central Coahuila, northern San Luis Potosí, and southeastern Chihuahua (Marroquín, et al., 1964:130). Densities are greatest on rocky soils along limestone slopes at elevations between 200 to 2,000
DISTRIBUTION OF LECHUGUILLA: *Agave lecheguilla*

AREA: 11,020,000 Has.

Illustration 4

m above sea level (Plate 2). At times it grows in such dense clusters that mobility by humans and animals can be impeded.¹

Plate 2. *Agave lecheguilla* on rocky limestone slopes southwest of Saltillo, Coahuila.

**Yucca carnerosana** (Trelease) McKelvey

Palma samandoca was initially classified by Trelease in 1902 as *Samuela carnerosana*. McKelvey's studies of the genus *Yucca* in 1938 modified the plant's nomenclature to the present *Yucca carnerosana* (Trelease) McKelvey.¹⁰ Unlike lecheguilla, palma samandoca is arboreal in appearance (Plate 3). The plant first develops as a rosette of long, narrow leaves rising from the ground, but eventually this rosette surmounts a trunk 1.5 to 6 m high. Trunks are rarely branched, a characteristic that helps distinguish palma samandoca from other species of *Yucca* such as palma china (*Yucca filifera*). Leaves that
crown the trunk are a dark, dull green, 60 to 110 cm long, 6 to 8 cm wide, and 4 to 7 mm thick, concave, rigid, terminating in a sharp point, with coarse brown curled fibers projecting out of the margins near the point. As with lechuguilla, exterior leaves are hard, and the younger, more tender leaves of the cogollos are the source of "ixtle de palma" (Plate 4). Palma samandoca's meter-long flower stalk is crowned with a dense cluster of cream-white flowers. Unlike lechuguilla the plant does not die after flowering, and under favorable pluvial conditions the same plant may flower twice a year. Palma samandoca's normal life-span is 50 to 75 years (González C. and Scheffey, 1964:51). It reproduces either vegetatively or from seed.
Yucca carnerosana grows abundantly on alluvial fans at the base of limestone mountains, although it is also found at or near the crests of sierras. In the latter instance, the plant may grow at elevations up to 2,900 m above sea level. Even in those areas where it grows in greatest profusion, density per unit area is considerably less than that of lechuguilla. In a good stand, densities average 100 to 120 plants per hectare, with the plants usually clustered together in groups of 2 to 8 (Marroquín, et al., 1964:128).

The spatial distribution of Yucca carnerosana is roughly the same as that of lechuguilla (Illustration 5). Heaviest concentrations of the plant are in the Coahuila municipios of Ocampo and Saltillo (Marroquín, et al., 1964:125-126).

The "Zona Ixtlera" - Location and Components

The zone in which ixtle is exploited for commercial purposes is considerably more restricted than the areal distribution of Agave lecheguilla and Yucca carnerosana, the source plants for fiber. In
DISTRIBUTION OF PALMA SAMANDOCA: *Yucca carnerosana*

AREA: 10,970,000 Has.

Illustration 5

their inventory of flora in north-central Mexico, Marroquín, et al., (1964:162) included a table on the area occupied and under exploitation of the more important economic species of native vegetation. In the arid areas of Chihuahua, Coahuila, Durango, Zacatecas, and San Luis Potosí, lechuguilla occupied 142,115 km², of which 41,035 km² (28.8%) was harvested. For palma samandoca, corresponding figures are 61,185 km², 31,420 km², and 51.3%. These figures fail to provide a completely accurate assessment of lechuguilla and palma samandoca's distribution or exploitation because both plants grow in abundance on the limestone slopes and adjacent valleys of Nuevo León and Tamaulipas, states excluded from the study. Illustrations 4 and 5 show the distribution of these plants for Mexico. Lechuguilla covers a surface area of over 11,000,000 hectares in the states of Coahuila, Nuevo León, San Luis Potosí, Tamaulipas, Zacatecas, Chihuahua, and Durango. Palma samandoca is spread over almost 11,000,000 hectares in the same seven states (COTECOCA maps, included in Martínez and Maldonado, n.d.:20,25). Commercial harvesting of the plants is currently restricted to sections of the first five states only. Table 2 lists the municipios in Coahuila, Nuevo León, Tamaulipas, San Luis Potosí, and Zacatecas where ixtle de lechuguilla and ixtle de palma are gathered by campesinos and sold to La Forestal, F.C.L.

The municipios listed in Table 2 constitute the "Zona Ixtlera" (Illustration 6), an area designated by La Forestal within which the company exercises its monopoly over the purchase of ixtle. A core area within the Zona Ixtlera is delineated on the basis of information taken from tables in Appendices I and II. Municipios that comprise the core annually produce the most fiber, have the highest production per
TABLE 2

States and Municipios in Which Fiber from
*Agave lecheguilla* and *Yucca Carnerosana*
is Gathered for Commercial Purposes

<table>
<thead>
<tr>
<th>State</th>
<th>Number of Municipios</th>
<th>Municipios</th>
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<td>Castaños</td>
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</table>

STATES OF THE ZONA IXTLERA

1 - Coahuila
2 - Nuevo León
3 - Zacatecas
4 - San Luis Potosí
5 - Tamaulipas

hectare, the largest number of campesinos gathering ixtle, and the most communities affiliated with La Forestal. Specifically, municipios of the core produced at least one million kilograms of ixtle during one or more years from which production figures are taken (1968, 1970, 1972, and 1973), or they averaged over 500,000 kgs during the four years. Other criteria used to designate core region municipios include: at least 1,500 ejidatarios dedicated to the collection of ixtle de lechuguilla and ixtle de palma, and an average production for 1968 and 1972 of 200 kg per km² or more.

Over the years, the Zona Ixtlera has experienced a marked spatial contraction. In the 1950 agricultural census, a total of 79 municipios in the states of Coahuila, Nuevo León, San Luis Potosí, Tamaulipas, and Zacatecas are listed as producers of lechuguilla and palma samandoca fiber (Secretaría de Economía, 1957). The 42 municipios in the contemporary Zona Ixtlera represent a near halving of the 1950 total (Illustration 7). Quillares Lona's meticulous rendering of ixtle-producing municipios in 1968 includes eight municipios in the above five states, and four municipios in Durango that are no longer on the rolls of La Forestal. Diminution of the Zona Ixtlera is explained by the emergence of economic alternatives in former fiber-gathering communities, and by La Forestal's attempts to maximize the efficiency of their operations. Outlying areas in which production was limited because ejidatarios devoted most of their energies to other activities have been abandoned by La Forestal. Slender profit margins were being eroded by costs attendant upon servicing peripheral municipios. Consequently, La Forestal has chosen to maximize its efforts in a more restricted area, the present-day Zona Ixtlera (personal interview with
IXTLE PRODUCING MUNICIPIOS
IN 1950 AND THE CONTEMPORARY
ZONA IXTLERA
Illustration 7

Although the spatial dimensions of the Zona Ixtlera have been shrinking, the number of communities associated with La Forestal has risen dramatically. When La Forestal was first incorporated in 1940, only 79 ixtlero communities affiliated with it. Today, that number has grown to 1,761 (personal interview with Quirino Orta, August 17, 1977). The cooperatives are operated by ixtleros in their respective communities. They serve as the vehicle by which ixtleros share in the benefits of La Forestal profits and socio-economic programs. Cooperative members also act as a collective body on occasion, purchasing foodstuffs from Compañía Nacional de Subsistencias Populares (CONASUPO) wholesalers at reduced prices and/or agricultural necessities (e.g. seed) from other government agencies.

With very few exceptions, people who gather and sell ixtle are ejidatarios. The "ejido" is a collective land-holding unit whose immediate existence dates from the Agrarian Revolution of 1910, although the concepts of land ownership it embodies pre-date Spanish arrival in the New World. Of the two major types of ejidal tenancy, collective and individual, the latter dominates throughout the Zona Ixtlera. Male members of the community (ejidatarios) receive village plots to which they have usufruct, or land-use, rights only. The individual cannot sell or mortgage his land, and if he fails to till it for two consecutive years, it reverts back to the community and is reassigned. Pasture and woodland surrounding the community are used in common. It is this latter area that is exploited for ixtle.
The number of campesinos whose livelihood is dependent upon the gathering and selling ixtle is difficult to ascertain with any degree of certainty. La Forestal claims that 100,000 families are affiliated via cooperatives with the agency (personal interview with José Bernardo Solís Robledo, May 25, 1976; La Forestal, 1976:26). The Instituto Nacional Para el Desarrollo de la Comunidad Rural y de la Vivienda Popular (INDECO) (n.d.:1) elevates this figure to 124,000 families. Average family size in Mexico is 5.3 members (Secretaría de Industria y Comercio, 1973b). If this figure is applied to La Forestal's estimate of families associated with the organization through cooperatives there are approximately 530,000 people in the Zona Ixtlera whose economic livelihood is linked to ixtle. This figure rises to 657,000 if the INDECO estimate is employed. Campos Rocha (1961:33) suggests 45,000 heads of families and a population of 300,000. In a 1968 study of Mexico's arid zones the Secretaría de Salubridad y Asistencia cites a total of 44,026 ejidatarios dedicated to the gathering of lechuguilla, and 25,749 to the collection of palma samandoca, in the five states of the Zona Ixtlera. The significance of these figures for ascertaining the total number of people linked to Agave lecheguilla and Yucca carnerosana is suspect, however, because many ixtleros gather both plants, and the SSA study provides no clarification as to whether the same ejidatario is included on only one, or both, lists.

Uncertainties as to the number of ixtleros are not confined to the Zona Ixtlera as a whole. Three different studies of the Zona Ixtlera of Nuevo León arrive at three different conclusions as to the number of people linked to ixtle for their economic existence in the state. The Instituto Mexicano del Seguro Social (IMSS) (1974:1)
estimates that 11,000 families live entirely from the sale of ixtle, while an additional 6,000 family units supplement their gathering income by selling agricultural commodities. If one applies the 5.3 average family figure to the IMSS results, then approximately 90,000 people subsisted on the collection and sale of ixtle in Nuevo León during 1974.¹⁴ A figure of 20,000 families (x 5.3 = 106,000 population) for nine municipios in Nuevo León was arrived at by the Centro de Investigaciones Económicas (1963:3), while the Centro de Investigación y Social Acción (n.d.:51), investigating the same nine municipios, concluded that in 1960 approximately 30% of the total population, between 31,000 and 32,000 people, lived from the sale of ixtle.

No one knows for certain how many people within the Zona Ixtlera depend upon the sale of ixtle for their livelihood, and no one can unequivocally state what percentage of that number is wholly dependent on the fiber, or what percentage supplements their income via the sale of agricultural commodities or through extra-ejido labor. The number of people who gather fiber from Agave lecheguilla and Yucca carnerosana varies annually according to pluvial conditions, and the attendant situation for agriculture. During years when rainfall occurs in sufficient quantities (e.g., 1967 and 1968) ixtleros readily abandon the arduous task of collecting fiber for the less strenuous and more rewarding labors of crop cultivation. Conversely, when precipitation is limited and drought ensues, agriculture is difficult or impossible, and the number of ejidatarios who resort to collecting lechuguilla and palma samandoca increases. Despite these annual fluctuations in the number of ixtle gatherers between 400,000 and 650,000 people earn a
living, either wholly or in part, from the collection and sale of fiber in the Zona Ixtlera today. This estimate is based upon the studies mentioned above, information gathered from Quillares Lona (1971), the IX Censo General de Poblacion, 1970, and conversations with various officials at La Forestal and numerous Mexican government agencies.
FOOTNOTES

Chapter II

1 In 1971 the Comision Nacional de las Zonas Aridas (CONAZA) was created for the express purpose of assessing conditions and effecting development schemes in the drylands of the nation. CONAZA estimates that 41% of the national territory is arid or semi-arid. Arid zones are defined as those receiving less than 250 mm of rainfall annually. Semi-arid lands have an average annual precipitation between 250 and 500 mm (Comision Nacional de las Zonas Aridas, 1974:8, 13).

2 Among them: the Comision Nacional de las Zonas Aridas, 1974; Contreras Arias, 1955; Stretta and Mosina, 1963; and Pedrero, 1963.

3 The government agency responsible for defining parameters for Illustration 3 is the Coordinador Tecnico de la Comision Tecnico Consultiva para la Determinacion Regional de los Coeficientes de Agostadero (COTECOCA).

4 Ortiz Monasteria (1956) has mapped the soils of Mexico and provided a quantitative breakdown of specific soil groups for each state in the nation. For the five states that are the focus of this study, sierozem and red desert soils account for 3% to 39% of the total state surface. Specific states and their respective percentages of those soil types include: Coahuila, 39%; San Luis Potosi, 38%; Tamaulipas, 3%; Zacatecas, 15%; and Nuevo Leon, 15% (Saman Pineda, 1965:90-92).

5 In addition to Agaves and Yuccas, a host of other plants develop on limestone surfaces. Among the most significant: Larrea, Acacia, Euphorbia, Jatropha, Fouquiera, Dasylirion texanum, and Hechtia texana. For a complete list of vegetation associated with limestone sierras see Le Sueur (1945:56-57).

6 These floristic types are synonymous with the "vegetation on isolated limestone sierras" of LeSuer (1945): the "desert" (subdivision cactus desert) of Leopold (1950); and Muller's (1939) "central plateau desert scrub" in Nuevo Leon and "Chihuahuan desert shrub" in Coahuila (1947) (Rzedowski, 1961:104).

7 Although Agave lecheguilla and Yucca carnerosana are most closely associated with the vegetative type designated "desert rosette scrub," both species are found in other plant associations. For example, lechuguilla is included in the "matorral desértica microfilo" by Rzedowski (1957:60-66), and Rojas Mendoza (1965:93) includes palma samandoca in a variant of desert rosette scrub, "matorral rosetofilo-succulento con Agave-Echino cactus-Fero cactus."
8Rose (1899:242) translated the word "lechuguilla" as "cabbage-like."

9Ballesteros (1946:13) reported densities as high as 2,000 plants per hectare in the region. The Instituto Nacional de Investigaciones Forestales (INIF), in order to undertake long-term studies in the management of native and introduced species of economic importance for the arid regions of Mexico, has established experimental field stations at El Cedral, San Luis Potosí and La Saucedá, Coahuila. At La Saucedá, an inventory of native vegetation revealed that the highest densities of lechuguilla were between 160 and 770 plants per 100 m² at an elevation of 1,520 m above sea level (Pérez Rosales, 1964:24).

10This plant is locally referred to as "palma barreta" in the countryside surrounding Saltillo, and as "palma de San Pedro" in parts of Coahuila (Piña L., 1957:37).

11At the La Saucedá experimental station maximum densities for palma samandoca were 45 plants per 100 m² (Pérez Rosales, 1964:26).

12The municipios, and their respective states, include: Monclova and Progresso in Coahuila; Hidalgo in Nuevo León; Moctezuma and Villa de Ramos in San Luis Potosí; Victoria in Tamaulipas; Villa de Cos and General Francisco Murguía in Zacatecas; and Simón Bolívar, Mazas, Cuencame', and San Juan de Guadalupe in Durango (Quillares Lona, 1971).

13Lechuguilla and palma samandoca are exploited for their fiber properties outside the Zona Ixtlera but the fiber is not sold commercially, or at least it is not done so legally, since La Forestal has monopoly control over the purchase of ixtle, and is not operating in such areas at present.

14The IMSS study focused on only seven municipios in Nuevo León: Iturbide, Galeana, Zaragoza, Rayones, Doctor Arroyo, Aramberri, and Mier y Noriega.
CHAPTER III

IXTLERO FIELD ACTIVITIES

The Gathering of Ixtle

Field Implements

Only a few rudimentary tools are employed by ixtlero campesinos in the collection and decortication of ixtle. The equipment inventory of every tallador includes a cogollero (arrancador or mula), oaxaca, tallador, banco and bolillo (Plate 5). The cogollero is used to cut the young leaves that form the centerstalk, or cogollo, of Agave lecheguilla and Yucca carnerosana. Most cogolleros consist of a metal ring attached to one end of a long wooden pole (Illustration 8A). The wooden handle is fashioned from center stems (garrocha) of plants proximate to the ejidos such as sotol and granjeno (Celtis spinosa). It generally measures 0.5 to 3 m long, the greater length reflecting the need to reach cogollos of the lofty Yucca carnerosana. The metal ring, 15 cm in length and 10 to 25 cm in diameter, is usually purchased from nearby urban communities. It is hammered into one end of the handle and fastened with nails. A less common type of cogollero is constructed of wood and wire. One end of the wooden pole is forked, and wire strands are used to connect the extremities of the bifurcation. This produces the "closed ring" essential to proper operation of the cogollero. The oaxaca (Illustration 8B) is a bowl-shaped basket that serves as a container for cogollos. Its frame normally consists of four pieces of granjeno: a top U-shaped segment connected to both
ends of a straight back-piece, and two curving base poles that intersect and are nailed to the top parts. A webbing of ixtle rope is used to cover the frame, and an attached leather strap serves as a shoulder harness. Basket capacities vary from 5 to 30 kg, with the norm being 15 kg. A oaxaca with a 15 kg capacity can hold approximately 75 to 100 cogollos. The tallador is a blunt-edged knife used to separate fiber from the leaves (pencas or hojas) that form the cogollo (Illustration 8C). The knife consists of a circular handle 10 to 15 cm long made of mesquite or other readily available woody plant material. The handle is split to accommodate insertion of the 35 to 40 cm long iron
blade, which is commercially produced. The blade is secured by tightly winding wire strands around the bisected handle. A tallador blade is straight for two-thirds of its length but thereafter gradually tapers until, at its very end, an upward or "reverse-curve" hook appears. The hook permits the implement to be firmly secured at the base of a tree, bush, or other ground support for the shredding operation. Bancos and bolillos (Illustration 8D, 8E) are the least complex and most varied of the ixtlero's tool complex. The banco is a piece of wood of variable length and width against which the fiber-containing leaf is placed prior
to being shredded. A standard banco is a piece of granjeno 45 cm long, 6 cm wide, and 4 cm high. Extraction of ixtle from pencas of lechuguilla and palma samandoca is facilitated by use of the bolillo. A conventionally shaped bolillo resembles a miniature bowling pin. It has a maximum length of 15 cm and a bulbous end diameter of 10 to 15 cm. As with the other tools employed by ixtleros, the bolillo is made from the woody material of locally available plants. During decortication, the basal portion of each cogollo leaf is secured around the wide end of the bolillo prior to shredding the narrower end of the leaf. The newly expressed fiber is then wrapped around the neck of the bolillo while the broader section of the leaf is rasped.

The Daily Round

The daily round of ixtle-related activities commences at an early hour. By 7:30 a.m. ixtleros have departed their homes and are engaged in the collection of cogollos. The distance traveled between homestead and work zone varies from less than one kilometer to as many as 20 kilometers, depending upon the anticipated duration of the collecting period, the mode of transportation, and most significantly, the availability of exploitable plants.¹

For most collectors the journey to work and return home occurs on the same day. The field day commences at 7:30 a.m., and usually terminates between 3 and 5 p.m. This 8 or 10-hour work day, and the ixtlero's desire to return home before nightfall, impose certain limitations on the maximum range of daily travel. However, it is not uncommon for gatherers, either alone or in pairs, to remain in the campo for three to four days at a time, and I have been informed that men will occasionally stay in the surrounding mountains collecting fiber for as long as
two or three weeks. The ixtleros of Independencia ejido, Coahuila typify this time-distance relationship. Most gather fiber from within a 5 to 6 km radius of the village, and return home by nightfall (Illustration 9). Only those who venture into mountains such as the Sierra de Narigua remain away from Independencia for more than a day.

Transportation between homestead and the field is most commonly provided by burro. The use of this dependable animal affords the opportunity to maximize the limits over which ixtle can be collected. Individuals who traverse the distance between settlement and field on foot find their activity sphere considerably more restricted.

The availability of cogollos is the most significant factor affecting the ixtlero's work range. Most talladores travel farther afield to gather fiber today than they did ten years ago. In environs proximate to ixtlero settlements conversion of the campo to dryland agriculture has depleted or completely eliminated stands of Agave lecheguilla and Yucca carnerosana and effected an outward extension of the collecting area. Overexploitation also contributes to this pattern. Intensive exploitation frequently takes the form of repeated cuttings of immature cogollos from the same plant, critically lowering its resistance to water-deficit conditions, and making it particularly susceptible during prolonged periods of drought (Coe, 1962:328). During a drought these are the first plants to succumb, a stage preceded by the shriveling up of leaves that change from a dark green to light green or yellow color, and progressively bend inward toward the plant center (personal interview with Jorge S. Marroquín, May 17, 1976). As ixtleros have traveled farther to gather cogollos the attendant increase in transport
DISTANCE TO WORK FOR THE IXTLEROS OF INDEPENDENCIA
Illustration 9

Source: CETENAL Carta Topográfica, General Cepeda, 1972.
time has, in some instances, curtailed the amount of time devoted to
the decortication of fiber.

Site Selection

Within the ejido, sites selected for harvesting cogollos are a
matter of personal choice by campesinos. Densities of lechuguilla and
palma samandoca are greatest in areas generally unsuitable for agricul­
ture. Even when assigned to individual ejidatarios, these lands are
perceived as communal property and used for collection purposes by all
talladores in the ejido. Thus, ixtleros frequently return to the same
general locale to gather fiber, but this reflects the availability of
plants rather than decisions rendered by the comisario or ejido council
delegating specific locations to individual workers. In the ejidos
I visited, *Agave lecheguilla* and *Yucca carnerosana* were available in
great abundance beyond the immediate environs of the community, and
there was subsequently no need to ration the land on which they were
located. In fact, there is a noticeable absence of any awareness or
concern for conservation of the plants among ixtleros. They are
cognizant that these species have been abundant from time immemorial,
and they believe that this situation will persist into the future.
Reinforcing this belief is the fact that over a period of years both
lechuguilla and palma samandoca will reproduce numerous cogollos from
the same plant.

When an ixtlero departs his residence in search of cogollos, he
therefore seeks out a general area rather than a specific site. Once
he arrives at a locale where sufficient quantities of the plants are
in evidence he selects a spot where the vegetation provides a natural
shade, or where he can artificially create it by draping a shirt or ixtle sack (costal) over the protruding limb of a bush or small tree. After tethering his burro and depositing his provisions, he ventures afield with oaxaca and cogollero to commence the harvesting of cogollos.

Gathering Cogollos

At least one author (Cepeda, 1949:17) has contended that ixtleros select cogollos for cutting on the basis of sound. The cogollero is rapped against the center stem, and if the proper noise results, the bud is severed from the remainder of the plant. I have never observed this procedure in the field, and in numerous discussions with ixtleros no one has ever admitted to employing it. Ixtleros engage in their work in a methodical fashion, endeavoring to minimize their time in the field. Rather than take time to "sound" cogollos, they resort to a quick visual assessment of the center bud as they approach it, and this "look" suffices to let them know intuitively if it is ready to cut. A mature cogollo is comprised of tightly compacted leaves, terminates in a sharp spine, and has a dark green color. In both Agave lechuguilla and Yucca carnerosana the cogollos are spindle-shaped, tightly compacted agglomerations of the youngest and most tender leaves. The moisture in these leaves increases their pulp content (and hence tenderness), rendering them more susceptible to the process whereby ixtle can be extracted. The outer leaves, with a lower moisture content per unit area, and with less pulp, are too hard and firm to be scraped by hand.3

Collecting cogollos is a relatively simple procedure. The iron ring of the cogollero is placed over the centerstalk and given a quick forward-backward jerk (Plate 6). This breaks off the cogollo and
leaves behind a small inner nucleus, the cogollito, which forms the basis for a new growth. Generally speaking, the right hand is used to handle the cogollero while the harvested buds are held in the left. When the ixtlero has accumulated four or five plant centers, he transfers them to the oaxaca which is normally slung over his left shoulder (Plate 7). This procedure continues until the basket is full. The gathering of cogollos constitutes a minor part of the ixtleros work day. If center stems are readily available, a 10 kg oaxaca can be filled in fifteen minutes, a procedure that is repeated two to four more times during the course of the day.
Decortication of the Cogollos of Agave Lecheguilla

Cogollos of both *Agave lecheguilla* and *Yucca carnerosana* are collected in the manner described above, but thereafter the procedures and locales for decorticating the two differ. Lecheguilla leaves are shredded in the field without benefit of any prior treatment, while those of palma samandoca are transported back to ejidos, or individual farmsteads, to be "processed" prior to decortication. This difference is a function of the ease of separating the fiber from its leaves, which in turn is contingent upon differences in the moisture content of lecheguilla and palma samandoca leaves.

After gathering lechugilla cogollos, the ixtlero returns to the site where he initially deposited his provisions and commences to extract the fiber. During decortication the remaining implements in the ixtlero's equipment inventory are utilized. Taking advantage of the shade afforded by the arbor of natural vegetation or the draped costal,
the tallador positions himself by sitting down and spreading his legs (Plate 8). He then proceeds to fasten the hooked end of the tallador under a convenient root or other firmly grounded object (estaca). The banco is placed on the ground directly beneath the dull edge of the knife, so that by pressing downward on the handle of the tallador, the ixtlero is able to exert considerable pressure. Cogollos are removed from the basket and leaves are individually stripped. Each cogollo normally has 15 to 20 leaves long enough to provide marketable ixtle. As the pencas are peeled from the bud, it is reduced in size until a central core 15 to 20 cm long remains. This nucleus, small and difficult to clean, is considered waste and discarded.

Plate 8. Decortication of lechuguilla leaves - typical scene near Saltillo, Coahuila.
After stripping the outer leaves from the cogollo, some ixtleros remove the marginal barbs and terminal spine from each leaf. However, most disdain this procedure and commence rasping with the barbs and spine attached. Years of experience and a certain coarseness of hand seemingly makes these people immune to the painful irritation caused by the spines of agave leaves. Leaves are initially shredded individually. The convex base of each is placed around the broad end of the bolillo and inserted between the banco and the tallador. As the ixtlero applies pressure to the tallador with one hand, he simultaneously pulls the leaf toward him with the other hand, separating the leaf pulp from the fiber (Plate 9). He repeats this procedure, and in an equally

rapid manner inverts the leaf and runs it between the tallador and banco to remove pulp from the reverse side. Approximately half the penca is now a hank of moist fiber, or ixtle. The semi-cleaned leaf is set aside and the same procedure is repeated until another ten or fifteen leaves have been shredded. The unrasped, broad ends of these pencas are then fitted one into the other, the ixtle is wrapped around the neck of the bolillo, which serves as a handhold, and decortication is performed on the remaining portion of the leaf. Usually one or two sweeps on each side of the small end of a leaf suffices to separate the fiber from the pulp, but the broader and heavier base end of the peine requires as many as a half dozen pulls between the tallador and the banco. The residual mass of pulp and spines, which accumulates in front of the ixtlero as he extricates the fiber from its leaf, is known as guishe (shishi, xixi).

Depending upon plant availability, distance traveled, and worker efficiency, four to ten kilos of ixtle de lechuguilla can be collected by a single ixtlero during the course of an eight-hour field-work day. The characteristic color of freshly cleaned fiber is opaque white with a light-green tint. Occasionally, decortication is improperly or haphazardly done, and pulp remains attached to the fiber giving it a more pronounced green color. Fiber varies in length from 20 to 50 cm and is moist to the touch. As ixtle accumulates, it is neatly piled to one side of the worker, and at the end of the field day it is bundled together with loose strands of fiber.

Field work generally terminates around 3 p.m. If the ixtlero is returning to his settlement, the accumulated fiber is packed into the oaxaca alongside the work implements, and the basket is either slung
over the worker's shoulder or upon the back of a burro, if the latter is available (Plate 10). When the distance between work site and

Plate 10. Transportation of lechuguilla fiber from field to ejido. Independencia, Coahuila.

residence is not great, the ixtlero may return to his dwelling with the center stems unrasped. One or more baskets are filled with cogollos and carried back to the ejido or individual farmstead (Plate 11) where the ixtlero and his family scrape them at their leisure in the shade of their own homes. However, the transfer of lechuguilla centerstalks from field to hearth is the exception rather than the rule. Inasmuch
as the average fiber content of a lechuguilla leaf is only 11% by weight,\textsuperscript{5} and distances between collecting points and settlements generally exceed one kilometer, the carrying of five to thirty kilos of cogollos is a transport burden best obviated by extracting the ixtle in the field.

After returning to the settlement, ixtleros spread the fiber on the ground or any other available surface adjacent to their homes.
(Plate 12). The fiber is allowed to dry in the sun one or two hours.

Exposure to the sun results in the typically bleached appearance of ixtle de lechuguilla, making it readily distinguishable from the characteristic brownish tint of ixtle de palma. When dry, the fiber is bundled and carried by the ixtlero to the local ejido cooperative where it is exchanged for money, food staples, or a combination of the two.
Decortication of the Cogollos of Yucca Carnerosana

Cogollos of Yucca carnerosana are collected with the same implements and in the same manner as those of Agave lecheguilla (Plate 13).

Plate 13. Gathering the cogollo of Yucca carnerosana near Punta de Santa Elena, Coahuila.

Because of the low moisture content, however, leaves in palma saman-doca center stems are firm and very difficult to scrape by hand. Before decortication can occur, the cogollos are subjected to a steaming operation that increases moisture content, softens the pulp, and facilitates shredding. The steaming of cogollos takes place in ejido settlements, or immediately adjacent to isolated farmsteads scattered throughout the countryside. Rudimentary stone and earthen ovens called pailas are used to steam the cogollos. In those areas of the Zona Ixtlera where Yucca carnerosana is widespread, pailas are a common landscape feature in both ejido's and on individual homesteads.
The structural composition and capacity of pailas varies considerably within any given community. This heterogeneity is exemplified by the ejido of Punta de Santa Elena, situated approximately 80 km southwest of Saltillo City, in the state of Coahuila. Punta's population of 286 includes 73 ixtleros who collect both ixtle de palma and ixtle de lechuguilla. La Forestal annually purchases approximately four tons of lechuguilla fiber and six tons of palma samandoca fiber from Punta de Santa Elena (Secretaría de Agricultura y Ganadería, 1976a:1).

Scattered throughout Punta de Santa Elena are eight pailas. Despite structural differences and variations in capacity, they can be differentiated into two broad categories: Larger, more structurally sophisticated "communal" pailas, and smaller earthen pailas located in the yards of individual ixtleros (Plates 14 and 15). The large pailas number four and have capacities ranging from 150 to 600 kilos. Their construction is a cooperative venture and, upon completion, they are simultaneously used by two or more ixtleros. Major features of these large pailas include a sloping trench 1 to 1.5 m deep, a 200-300 liter capacity oil drum, and a circular masonry or adobe wall. Construction starts with excavation of a trench 2 m deep, 2 m wide, and 3 m long. A couple of meters from the back wall of the trench, a large slab of wood or a rail tie is inserted between the side walls of the trench some 60 cm above the floor. A masonry wall is constructed atop the wood/rail frame to ground level. A concrete slab floor is then laid flush to ground level with an aperture in the center large enough to accommodate the cylindrical drum. The latter is set into the concrete floor in such a fashion that its open end is even with the floor and its closed bottom is suspended 45 to 60 cm above the base level of
Plate 14. Large paila in Punta de Santa Elena.

Plate 15. Small paila (right foreground) in the campo southwest of Punta de Santa Elena.
the trench. Finally, a circular wall of adobe bricks or masonry is erected above and around the periphery of the concrete slab. Pailas with 200-300 kilo capacities normally have an interior diameter of 1.25 m, and masonry walls 75 cm high and 50 cm wide.

The smaller pailas of Punta de Santa Elena consist of 1 to 2 m deep excavations into which the 200-300 liter drums are placed. The top of the inserted drum is either laid flush with the ground or recessed 30 to 60 cm. When the can top is level with the adjacent surface, earthen embankments 30 to 90 cm high are built around it. After the drum is securely imbedded, a side trench is dug so that a gap 30 to 90 cm is left between the ground and the bottom of the drum. Small pailas account for only half of Punta de Santa Elena's total, but on individual farmsteads in the surrounding countryside they are the dominant type.

Pailas are made ready for the steaming of cogollos by filling the large drum with water and placing a few stout sticks across the open mouth of the can. The sticks prevent centerstalks from falling into the water-filled container below. The paila is, in effect, a furnace, and the requisite fuel, gathered from the countryside, includes decayed palma samandoca and palma china stems. Guapilla, a low-lying shrub widely distributed throughout the region, is commonly used as fuel to initiate burning. All of these incendiary materials are placed in the open pit beneath the drum.

Cogollos are placed inside the walled part of the paila at day's end. Generally speaking, a single day's collection suffices to fill the smaller pailas. However, two or three days of gathering are often required before the larger pailas are filled to capacity. In the
latter, cogollos are carefully arranged with their terminal spines facing center (Plate 16). By contrast, centerstalks are haphazardly deposited in the smaller pailas. Whatever the paila type, a layer of guishe is placed atop the center stems to retard moisture loss. The firewood assembled in the pit beneath is then set ablaze. A fire is thereafter maintained for a minimum of five to a maximum of twelve hours. During this period, additional fuel is shoved into the pit with the aid of a 2 to 3 m-long metal rod (atesador). Sustained burning boils water in the drum and the ensuing steam penetrates and softens the cogollos. The "tenderized" center stems are subsequently easier to shred. Firing also imparts to both the cogollos and the attendant ixtle de palma a markedly brownish-yellow tinge.

The steaming operation usually terminates before midnight, but cogollos are kept in the pailas overnight to cool off. Early the
following morning, they are removed and carried back to individual homesties for decortication. Both the tools and procedures used in extracting ixtle de palma are the same as those described for ixtle de lechuguilla. Differences that exist between the two are related to locale, family participation, and more subtly, work intensity. Unlike the field orientation of ixtle de lechuguilla scrapping, that of ixtle de palma occurs within the homestead of each ixtlero. As an activity proximate to the family hearth, the shredding of palma samandoca cogollos tends to involve almost every member of the ixtlero family. In Punta de Santa Elena, children six and seven years of age extract fiber. School-age children often work for an hour or two before they commence their studies. Ixtlero wives frequently devote time to decortication between domestic chores. One of the advantages of this broadly based family participation is that it permits the ixtlero to return to the field to gather additional quantities of fiber while his wife and children are engaged in the same activity at home.

Compared to the sustained work associated with the shredding of lechuguilla cogollos, the extraction of fiber from palma samandoca is pursued in a much more leisurely manner. Women and children work only when domestic or school activities are in abeyance. Ixtleros take extended rest periods, often gathering at the focal point of every ejido settlement, the community store (cooperativa), to exchange gossip and pass the time. This comparatively relaxed approach to the rasping of palma samandoca center stems results in a situation where two, three, or even four days are required to decorticate a paila full of cogollos.

Procedures employed after palma samandoca cogollos are rasped parallel those used for ixtle de lechuguilla (Plate 17). The freshly
Plate 17. Palma samandoca stages. From left to right: cogollos, leaves, guishe, cogollo cores (waste), and fiber.

extracted fiber of palma samandoca is spread to dry in the sun, bundled, and transported to the ejido cooperative for sale\(^6\) (Plate 18).

Plate 18. Ejido cooperative, Independencia, Coahuila.
Transactions at the Ejido Cooperative

The interaction between ixtleros and the ejido member responsible for receiving fiber at the cooperative (the coparario), is a multi-faceted one that transcends a simple cash exchange. In August, 1977, the fixed price paid at the cooperative per kilo of ixtle de lechuguilla and ixtle de palma was 9.00 and 4.50 pesos respectively. Ixtleros receive an additional 30 centavos for every kilo of ixtle de lechuguilla they sell at the cooperative. This is known as the remanente, and is, in effect, a bonus paid to the ixtlero at the end of each calendar year.

Every ixtlero carries with him a small green notebook into which the date and number of kilos of ixtle de lechuguilla he sells to the cooperative are recorded. The small, pocket-sized book is entitled, "Credencial - Aportaciones de Ixtle de Lechuguilla" (Credentials - Contributions of the Ixtle of Lechuguilla). It includes the name of the ixtlero as well as the name and registration number of his "Sociedad Cooperativa." On a separate page, the ixtlero is reminded of his obligation to sell ixtle to the cooperative only, and cautioned that failure to do so is prejudicial to both the ixtlero and the cooperative.

Entries are made in the notebook and initialed by the collecting agent after the fiber has been inspected and weighed. Ixtle may occasionally be less than acceptable due to improper cleaning or inadequate drying, conditions that hamper further refining. Although the "Credencial" notebook is quite explicit in cautioning ixtleros that fiber in any unsatisfactory state of preparation is subject to rejection, and hence no remuneration, I have never seen a coparario refuse ixtle at the cooperative.
Fiber is stored in the cooperative for periods ranging from one to two weeks, whereupon trucks from La Forestal collect and transfer it to regional warehouses for sorting and storage.

One of the most vexing problems associated with this study of the ixtleros relates to their average annual income. The sale of ixtle represents the single most important source of income for the majority of the inhabitants of the Zona Ixtlera, but despite the established prices paid per kilo of fiber and detailed records of the ixtle de lechuguilla collected annually by each ixtlero, it is exceedingly difficult to ascertain specific per capita incomes. The explanation for this is two-fold. First, no records are maintained of the kilos of ixtle de palma collected by each worker. The price paid per kilo for the fiber is so low that La Forestal deems a remanente superfluous (Personal interview with Quirino Orta, August 17, 1977). The quantity of ixtle de palma transferred from ejido cooperatives to La Forestal trucks is carefully recorded, but this represents a cumulative figure which is ineffectual in determining per capita specifics. Second, and more significantly, the most common transaction between ixtlero and coparario is not a straight fiber-for-peso exchange but rather a fiber-for-cash-and-goods transaction. A recurring cooperative scenario involves the exchange of fiber for goods such as rice, flour, beans, lard, detergent, and cigarettes. Thereafter, if the value of such commodities falls short of matching the sale value of ixtle, the balance is paid in pesos. Thus, an ixtlero who exchanges five kilos of ixtle de lechuguilla at the established rate of 9.00 pesos per kilo rarely departs the cooperative with 45 pesos in hand. More often than not, he leaves with a basket filled with a variety of goods and a small amount
of hard currency to show for a day's work. At times he may receive no cash at all. It is not uncommon for the ixtlero to purchase goods that have a total value greater than the sale price of the fiber. In such instances, the deficit is recorded in a notebook kept in the cooperative. Few members of the community are immune from these liabilities, and in some instances ixtlero's owe several hundred pesos to the cooperative.

Sales of Fiber Products by Ixtleros Outside the Ejidos

Although most of the fiber gathered by ixtleros is sold in local ejido cooperatives, small amounts are retained for home consumption and/or sale in surrounding towns and cities. The sale of ixtle brushes, rope, and body sponges is a common scene in the marketplaces of San Luis Potosí, Saltillo, Matehuala, Concepción del Oro, Tula, and numerous other urban communities throughout the Zona Ixtlera. Responsibility for selling these products is usually entrusted to the women and children of the ejido. They either sell their wares to permanent market vendors or dispose of the products themselves on sidewalks and streets adjoining the market (Plate 19). The quantity of goods sold directly by family members is small, and prices paid for the ixtle products they purvey are low. The most prevalent items are brushes and body sponges. The former sell for 3 or 4 per peso, the latter for 3 to 7 pesos apiece. Sales at the end of the day rarely exceed 20 or 30 pesos. Despite such minuscule totals the profits accruing from these exchanges provide an important source of supplementary income to the ixtlero family.
Plate 19. Selling of ixtle products at the marketplace in Saltillo, Coahuila.

The Gathering of Non-Ixtle Plants

Ixtleros gather a wide variety of uncultivated plants other than Agave lecheguilla and Yucca carnerosana. Two plants of international commercial import collected by a segment of the ixtlero population are candelilla, from which a hard white wax is derived, and guayule, a source of rubber. Young fruits of the nopal cardón have both subsistence and commercial value. In ixtlero settlements, they are despined, dis­sected, and cooked with a variety of condiments. In San Luis Potosí City and environs the fruit is processed and sold as a cheese, queso de tuna. Fruits of the garambullo plant (Myrtilocactus geometrizans) are con­sumed in the field or sold to surrounding urban communities where they are converted into a delightful tasting ice-cream. Flowers and fruits from palma china are eaten, and candy made from the heart of the biznaga (Echinocactus visnaga) is a highly prized treat. In the vicinity of
Tula and Jaumave, Tamaulipas, mesquite pods are gathered during summer months and made into flour cakes. Wild plants utilized for house and fence construction include mesquite, sotol, ocotillo (Fouquieria splendens), and coyonostle (Opuntia imbricata). Gobernadora (creosote bush) and hojasén (Flourensia cernua) have medicinal properties used by residents of the Zona Ixtlera. In their ecological study of the arid zones of northern Mexico, Marroquín and associates (1964:159-160) cite thirty-two uncultivated plants other than lechuguilla and palma saman-doca that are collected and utilized as food, drink, fiber, in construction, and as forage. Within the Zona Ixtlera each of these plants play an important role in the material culture of the ixtlero, but it is a role secondary to that of Agave lecheguilla and Yucca carnerosana.

Hunting and the Cultivation of Crops

During the course of a normal year, ixtleros devote most of their field-work time to gathering uncultivated plants. But they and their families engage in other economic activities as well, most notably hunting and the cultivation of crops. The year-round pursuit of fauna in the Zona Ixtlera is simultaneously a diversion from gathering and the source of much needed protein in the ixtlero diet. Commonly hunted animals include fox, deer, rabbits, prairie dogs, quail, and kangaroo rats. The latter are frequently offered for sale along the major thoroughfares of the region by ixtlero family members.

When rainfall occurs in sufficient quantities, ixtleros divert their attention from collecting fiber to cultivating crops. But water-deficit conditions, particularly in the more arid regions, severely
limit agricultural pursuits. A high percentage of land is unsuitable for cultivation due to the paucity of rainfall. Table 3, and Illustrations 10 and 11 show this situation. A land-use classification of twenty-three arbitrarily selected ejidos in Coahuila is included in Table 3. Of the total land surface of these communities (115,279 hectares), less than 1% is classified as riego (irrigated farming land); 5.4% is temporal (dryland farming land); 82.1% is agostadero (pasture land); and 11.9% is monte (woodland). Only 5.9% of the entire area is under cultivation. Illustrations 10 and 11 do not provide specific percentile figures for land classification, but they convey a strong visual impression of the relative paucity of farming lands in two typical ejidos of the Zona Ixtlera.

Rainfall variability imposes additional limitations on agriculture. Totals vary from year to year (Table 4) and there is no assurance as to when rain will fall during the course of a year. Most precipitation occurs during the high-sun period, but the rainy season may begin as early as May or as late as September. Pluvial vagaries have a bearing on the type of crops grown. If the rains commence from May to July, maize is planted; if they start later, beans are planted. If the rains occur as late as the middle of August or September, maize might still be planted for whatever fodder is produced (Hernández X., 1970:325).

On cultivated lands, the dominant type of farming practiced is "temporal," or dryland farming. To date, the Zona Ixtlera has not shared in the spectacular irrigation developments initiated in other regions of northern Mexico (e.g., La Laguna, Delicias, and Río Salado) by the Secretaría de Recursos Hidráulicos. Surface water is absent in
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<th>Total Area</th>
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<th>Temporal</th>
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<th>Monte</th>
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LAND USE IN THE EJIDO OF CUATRO DE MARZO, COAHUILA
Illustration 10

MUNICIPIO: PARRAS

- Railroad
- Highway

TOTAL SURFACE AREA
OF THE EJIDO: 31,680 hectares

SOURCE: Departamento de Asuntos Agrarios y Colonización, 1968.
LAND USE IN EJIDO EL MILAGRO DE GUADALUPE, SAN LUIS POTOSI
Illustration 11

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Source: Secretaría de Recursos Hidráulicos (SRH), 1976.
much of the region and irrigation facilities developed thus far have been sporadic and small-scale. The example of the ejido of Independencia, Coahuila, is typical. Water from check dams and diversion canals irrigates 216 hectares in the ejido, but this represents only 4% of Independencia's total land surface of 5,143 hectares (Table 3).

In the absence of surface water, subterranean aquifers are the major source of water in the Zona Ixtlera. In certain areas, however, much of this water contains salts that impede its use for certain activities. In the Zona Ixtlera of Zacatecas for example, only 30% of the area possesses well-drawn water of a "good" drinkable quality (Trujillo C., Lesser I., and Martínez Garza, 1976:7).^9

Despite the problems engendered by the limited and poorly distributed precipitation, ixtleros readily turn to agricultural pursuits. Working the land is a less physically demanding activity than gathering ixtle, and in those years when sufficient quantities of rain fall, agriculture is a more remunerative occupation. Most of the cultivable lands are individually farmed. Seeds are purchased in ejido cooperatives, and if the rainfall regime is normal, the fields are prepared and planted in May. Harvesting extends from September through November. Rainfall variability, coupled with a shortage of funds, limits the application of agricultural practices such as the use of fertilizers which would help to increase production. In fact, farming practices from beginning to end are rudimentary. Field preparation, planting, weeding and harvesting are all done by hand or with the aid of rented oxen.

Throughout the Zona Ixtlera, maize and beans are the most important cultigens, while wheat and barley are crops of secondary signifi-
cance. Crop yields vary greatly from year to year. During particularly dry periods, fields may not be sown at all, or else the planted seed fails to produce for lack of water. Most years, however, yield harvests. Average yields of maize and beans per hectare for ejidos cited in the Zona Ixtlera of San Luis Potosí were 383 kg and 137 kg respectively in 1960 (Alemán Alemán, 1966:99). For Independencia, in 1974, corresponding figures were 2,275 kg of maize and 910 kg of beans per hectare (Comisión Nacional Campesino, 1974:n.p.). While the veracity of these figures is suspect, they do convey some idea of crop-yield variability.

When crop yields are good, the available surplus is marketed, providing an income which supplements that derived from the sale of ixtle. However, these sales are generally small and would appear to be the exception rather than the rule. Most ejiditarios I spoke with had not sold any of their crops during the past few years.

Stockraising

The extensive grasslands and scrub vegetation of northern Mexico have supported livestock since the colonial period. One of the most visible features of the Zona Ixtlera's contemporary landscape are grazing animals. Of the livestock roaming the ejidos of north-central Mexico, the most ubiquitous is the goat. Ideally suited to the sparse vegetative cover of the northern drylands, the goat requires a minimum of care and provides maximum benefits, both local and commercial. Goat's milk, cheese, and meat are consumed in ixtlero communities. Roast kid (cabrito) is a local specialty served in restaurants throughout north-central Mexico, and it is not uncommon for ixtleros to carry
three or four bleating young goats to the nearest urban center where they either sell them in the marketplace or directly to dining establishments. Another minor source of income is derived from the sale of goat cheese (queso de cabra) in the same urban markets.
FOOTNOTES

Chapter III

1 A random sampling of 35 ixtlero communities revealed that the average distance-to-work for collectors was 6.9 km. The samples were drawn from information compiled by Quillares Lona, 1971.

2 The last time period would appear to be a thing of the past, for no ixtlero that I spoke to admitted to being away from home for more than three or four days at a time. All remembered "years ago" when they remained in the campo for lengthier periods, and most believed that it was a continuing practice, but "elsewhere."

3 Fiber has been extracted from the outer leaves of lechuguilla in the past. Now discontinued, this practice was last employed in a small area south of Torreón, Coahuila (Marroquín, _et al._, 1964:141-142).

4 The most commonplace spelling for this by-product of shredding is guishe. Some authors (e.g., Cepeda, 1949:21) use shishi, and the _Diccionario Rural de México_ (Islas Escárcega, 1961:156) refers to it as xixí.

5 Campa and Barragán, 1974:35. In addition to the 11% fiber content, leaves of _Agave lecheuguilla_ cogollos have the following composition: 54% guishe, 30% "waste," i.e., the discarded nucleus of the center-stalk, and 5% water, which evaporates during the extraction process.

6 The fiber of palma samandoca is considerably longer than that of lechuguilla, the average length being greater by 25 to 75 cms (González C. and Scheffey, 1964:52).

7 These prices have been in effect since December, 1976. Prior to that time the ixtlero received 6.60 pesos per kilo of lechuguilla and 2.90 pesos per kilo of palma samandoca fiber at the cooperative.

8 Alemán Alemán's (1966:99) study of 18 ejidos in the Zona Ixtlera of San Luis Potosí produces figures for cultivated land very similar to those of the ejidos in Table 3. For San Luis Potosí, 0% of ejido lands are classified as riego, 3.2% as temporal, 47% as agostadero, and 49.8% as cerril (wasteland).

9 Studies of subsoil water supplies and quality in the Zona Ixtlera of Zacatecas indicate that there is only one sizable area where the construction of pump irrigation facilities will result in new agricultural activities. This is the Bolson de Cedros, in the Mazapil Valley. Engineers estimate that 1,000 to 1,500 hectares of land can be converted to cropland via irrigation (Veytia Barba, 1974:3).
The well-being of most tallador families is heavily dependent upon
the exchange of ixtle for money and goods. But the significance of
Agave lecheguilla and Yucca carnerosana to inhabitants of the Zona
Ixtlera transcends a purely economic role. Different parts of both
plants are variously employed in the ejidos of north-central Mexico,
and their utilitarian value is evident in the material culture of the
tallador and his family. By utilizing these and other plants native
to the region, ixtleros perpetuate a tradition that long antedates the
arrival of the Spanish in the New World.

The Historical Geography of Ixtle: The Archaic Period

In contrast to the detailed accounts of Mesoamerican civilizations,
the amount of cultural-historical information for northern Mexico is
much less. Many elements of the way of life of the peoples who in-
habited the area during both pre- and post-Conquest times remain little
known. The aboriginal population, scant to begin with, was greatly
reduced by disease and fighting after the Spanish arrived. Ethno-
graphic accounts and archival sources are therefore scarce and super-
ficial. Consequently, many aspects of the material culture and socio-
religious organization of the indigenous peoples can only be inferred
by piecing together the limited information available or utilizing the
technique of ethnographic analogy. Nevertheless, the archaeological
record indicates that agave fiber was used in north-central Mexico, perhaps as early as 8080 B.P. (Crane and Griffin, 1958:1120). Artifacts from cave sites in central Coahuila show evidence of a continuous cultural tradition of approximately 10,000 years (Taylor, 1966:61-62). This cultural continuum belonged to what has been called the "Desert Culture" (Coe, 1962:44). Within this continuum, three chronologically separable complexes can be distinguished. The first of these, the Ciénegas complex, is known from three sites: Frightful Cave, Fat Burro Cave, and Nopal Shelter (Taylor, 1966:62; 1972:170). All three excavations are located in canyons that ring the Cuatro Ciénagas Basin in central Coahuila. At Frightful Cave, 24 km southeast of the city of Cuatro Ciénagas, an agave scuffer-sandal with a radiocarbon date of 8080±450 B.P. has been removed from the bottom level of the deposit (Crane and Griffin, 1958:1120).

The Coahuila complex was the major cultural matrix in central and northern Coahuila, and is known in sites extending from the Rio Grande to the northern edges of the Laguna District, and from the front ranges of the Sierra Madre Oriental on the east to the Coahuila-Chihuahua border on the west (Taylor, 1966:63). The earliest dates range between 7600 and 7300 B.C.; the latest radiocarbon date is A.D. 185±250, from the top level of Frightful Cave, the site which provides the most realistic picture of aboriginal culture in ancient Coahuila (Crane and Griffin, 1958:1121). In the Coahuila complex, three major types of material are found: wood, plant fiber, and stone. The ratio of stone to wood to fiber at Frightful Cave is approximately 1:6:26, these figures representing the average numbers of artifacts of the respective materials per cubic meter of deposit excavated at the site (Taylor,
1966:67). Of the wooden artifacts found in association with the Coahuila complex, the so-called "burial sticks" are of special significance. Found only in burial sites, they range from 420 to 1,390 mm in length, and are generally made of the flowering stalk of Agave lecheguilla (?) or Yucca (sp.) (?) (Taylor, 1966:73). The most abundant material in the Coahuila complex is fiber. Twisted fiber cordage, primarily of Agave lecheguilla, is the most commonplace fiber product at the cave sites, but sandals made of ixtle de lechuguilla are also numerous, especially at Frightful Cave (Taylor, 1966:73-74). Agave lecheguilla spines used as scarifiers and tattooers have also been discovered at sites in the Coahuila complex (Taylor, 1972:171).

As indicated above, the Coahuila complex extended over a large portion of north-central Mexico, encompassing what is today the core of the Zona Ixtlera. Although archaeological evidence for the utilization of lechuguilla exists for only a few sites in Central Coahuila, it is not unreasonable to infer that both Agave lecheguilla and Yucca carnerosana were being exploited for similar purposes throughout the northern region. In all probability other properties of these plants, e.g., the fruits, rootstock, and guishe, were being used by the aboriginal peoples of the area, perhaps as early as 8,000-10,000 B.P.

Man-Plant Relationships During the Immediate Pre- and Post-Conquest Period

When the Spanish arrived in Mexico, the lands lying to the north of the Mesoamerican civilizations were inhabited by bands of Indians collectively referred to as "Chichimeca." The word Chichimeca is roughly translatable as "dirty, uncivilized dog" (Powell, 1945:318), and it reflected the condescending attitude held by the Aztec and
Tarascan peoples toward the Indians who roamed the northern drylands. It was an appellation quickly adopted by the Spanish, who also perceived these nomads as little more than "wild barbarians."

Although the term "Chichimeca" was applied collectively to the northern tribesmen, there were in fact a number of independent groups located north of the Mesoamerican civilizations. During the fifteenth and sixteenth centuries, four large groups, or "nations," dominated: the Pames, Guamares, Zacatecos, and Guachichiles (Illustration 12).

Lifestyles varied little from tribe to tribe and nation to nation in the northern drylands. Every group relied heavily on hunting and gathering for their livelihood, and the mobility engendered by this type of subsistence economy doubtless led to similarities in socio-political organization, religious ceremonies, and world view. Beyond this, the "pristine" culture of these people can only be inferred. Pre-Conquest documents detailing their material and non-material culture are limited, and Spanish influence, most notably the introduction of European diseases, made an impress on the Chichimeca long before direct contact occurred between the two groups. Thus, early Spanish accounts of the northern nomads were in fact descriptions of a people already altered by external influences.

Information for the immediate post-contact period is likewise limited. The mobility of the Indians, coupled with their rapidly declining numbers, stymied the accumulation of detailed ethnographic accounts. Consequently, many aspects of the sixteenth century Chichimeca lifestyle remain little known. Nonetheless, Spanish accounts make it clear that locally available plants, including *Agave lecheguilla*
THE INDIAN "NATIONS" OF SIXTEENTH CENTURY NORTHERN MEXICO
Illustration 12

SOURCE: Powell, 1952:34.
and Yucca carnerosana, continued as important components of the Indians' material culture.

In both hunting and warfare, the principal weapon of the Chichimeca was the bow and arrow. The bow was made of cottonwood, willow, mesquite or juniper. The arrow, two-thirds as long as the bow, was constructed of reed or lechuguilla. Major tribal groups in northern Chihuahua, including the Chisos and Conchos, reputedly made their arrows of lechuguilla centerstalks. The Salineros and Tobosos bands of the Greater Bolsón de Mapimi region also used lechuguilla arrows (Griffen, 1969:106). Bow strings were made of twisted Agave lecheguilla fiber (Mason, 1893:645).

Most Chichimecas depended on caves, or crude thatch huts (jacales), for shelter. By the end of the sixteenth century, however, more substantive structures, perhaps using palma samandoca trunks in their construction, were extant. One Spanish chronicler of the time commented on the native dwellings of the north as follows:

"Las casas que habitan todos los indios de estos reinos son en tres maneras: unas son de gente muy pobre y agreste, que son fabricados de solo paja a manera de tugurios; otras son fabricadas de palizada y embarradas de barro; otras son las mejores, que son do adobe cubiertas de vigas." (Mota y Escobar, c.1605, 1940:33)

Lechuguilla was an important source of nutrition among the Chichimeca. During winter months, cogollos of Agave lecheguilla were boiled and served as a common staple, mezcal (Léon, 1649:20). The Coahuileños were reported to use agua miel from the maguey plant, and lechuguilla and maguey were cited for the Parras area (Griffen, 1969:110). Other parts of both lechuguilla and palma samandoca were undoubtedly used
during the sixteenth century, but the limited and sketchy accounts of the time fail to reveal them. In that region of Mexico known as the Zona Ixtlera, the Indians who were the original inhabitants are today almost non-existent. During the Colonial period warfare and diseases ravaged the aboriginal population, and in succeeding generations miscegenation has further reduced the Indian element. Native traditions remain however—traditions adopted and perpetuated by a largely mestizo population. One of the most widespread and salient of these traditions is the collection of wild plants and their use for local ends. The utilization of *Agave lecheguilla* and *Yucca carnerosana* in contemporary ixtlero communities in effect emulates a folk tradition that traces its roots back to pre-Conquest times.

**Present-Day Subsistence Utilization of the Plants**

**Fiber**

Ixtle fiber is the most commonly used part of *Agave lecheguilla* and *Yucca carnerosana* in tallador communities. Use of the fiber affects the daily life of every family member; from an infant sleeping in his ixtle-constructed crib, to a woman who scrubs utensils with an ixtle brush, to male members of the ejido whose favorite athletic pastime, volleyball, is dependent on a net held up with ixtle rope. Of the numerous uses of ixtle, the most ubiquitous is its incorporation into cordage. Ixtle rope (*mecate, soga, or riata*) of varying dimensions is employed as clothesline, saddle cinches, carrying harnesses, bridles, and tethers for horses and burros. Other uses include the fabrication of brushes, brooms, baskets, and an assortment of children's para-
Collectively, these items constitute important elements of the ixtleros material culture.

Although both ixtle de lechuguilla and ixtle de palma are utilized in the fabrication of cordage, the campesinos who fashion the coarse fiber into rope prefer lechuguilla. They claim it is easier to work and has greater resistance than ixtle de palma, a fact substantiated by tensile strength tests conducted in laboratory-controlled situations.

The operation by which lechuguilla fiber is converted into rope is a simple one, but it requires the efforts of two people. One person sits in front of a "Y"-shaped wooden frame implanted in the ground. Lodged between the forked ends of the "Y" is a metal spindle secured by means of bolts or pegs attached to ends which protrude through, and are located on the outside of, the frame. The individual seated beside this apparatus entwines a small length of ixtle rope around the spindle and sets it in motion by rapidly working the rope back and forth with his hands (Plate 20). Fiber destined to become rope is initially prepared by sorting the strands and shaking out particles of undesirable dirt and dried leaf pulp. It is then consolidated into loose bundles from which a few threads are tied to the bolted end of the spindle. As the spindle is rotated, the second worker walks backward, slowly releasing small amounts of fiber from the ixtle bundle he carries in his hands (Plate 21). The gyrating spindle unites the loose strands into a slender rope of increasing length. After this initial filament is created, the procedure for making rope of a greater thickness varies. One method involves doubling and re-doubling the original strand until the desired width is achieved. More common is the practice of making
Plate 20. Initial stage in the making of ixtle rope. Ejido Independencia, Coahuila

Plate 21. Loose ixtle bundle being converted into rope in Independencia.
distinct multiple threads and thereafter fashioning them together. After the initial strand is completed, it is detached from the bolted end of the spindle and tied to the base of the "Y" frame. The procedure for making the first line is then repeated three or four additional times. All the strands are reattached to the bolt and the rotating spindle integrates them into a single unit. The final step in the conversion of fiber into cordage occurs when the two workers stand opposite each other with the finished product stretched between them. They rapidly twirl the rope and pull it taut to strengthen the linkages of the multiple strands (Plate 22).  

Plate 22. Final stage in the making of ixtle rope. Independencia.

The conversion of ixtle fiber into cordage is normally done late in the day, after the collectors have returned from the field, and when there is sufficient humidity in the air to make the fiber more flexible. The entire operation requires little time. In 20 minutes a 1/2 kilo bundle of ixtle can be transformed into rope 5.5 m long and 5 cm in
Ixtle rope is much in evidence in ixtlero settlements. It is used to hold, carry, support, and bind objects ranging from burros to babies. It is equally valuable when used in combination with other materials. One of the most important work implements, the oaxaca, or carrying basket, is composed of a ixtle mesh wrapped around a wooden frame (Plate 23).

Plate 23. Oaxaca composed of ixtle mesh. Punta de Santa Elena, Coahuila.

Ixtle is also used in the fabrication of brushes of many different sizes and shapes. These brushes, called peines, serve a dual role in the livelihood of the ixtlero and his family. Within the settlements, they are employed for a variety of practical purposes. As a salable commodity in the marketplaces of surrounding towns and cities they provide a source of supplemental income, albeit a small one, to the ixtlero family. In both countryside and city, peines are conventionally used as
kitchen utensil cleaners, pain brushes, floor scrubbers, and curry combs for animals.

A peine is made by initially sorting out a small quantity of ixtle and doubling it into a compact unit (Plate 24). A slender rope is wrapped around the middle of the fiber bundle to compact it further. The most common method for making the rope taut is to fasten one end of it around a fixed object and exert pressure by pulling against the object (Plate 25). Loose strands of ixtle are severed with a machete, making the brush ends even. A peine can be fashioned by a single ixtlero in less than 30 minutes. It normally lasts for one year. Although they assume many different sizes, the dimensions of a standard peine are 15 cm in length and width (Plate 26). Peines with 15 cm diameters can be easily gripped and manipulated by hand.
Plate 25. Fashioning a peine.

The incorporation of ixtle fiber into rope, and its conversion into a diverse array of brush-types, is commonplace throughout the Zona Ixtlera. Less frequent is utilization of the fiber as a scrub brush (estropajo) used with soap to cleanse the human body. Estropajos are loose strands of ixtle de lechuguilla kneaded into hand-sized circular pads (Plate 27). Although they require only 15 to 30 seconds to produce, use of the estropajo varies considerably between and within ixtlero settlements. In some ejidos they are employed by most or all of the community members as a cleansing aid. In other settlements the residents have no recollection of their use, or they have recently been substituted for by less abrasive items such as the sponge. Despite obvious cost advantages and its extreme simplicity, one of the factors mitigating against a more extensive use of the estropajo is its rustic crudeness. It is frequently superseded in use by more expensive and less efficient cleaning agents merely because they connote a measure of

Plate 27. Estropajo made of ixtle.
"progress."

The Rootstock

Many parts of Agave lecheguilla and Yucca carnerosana other than their fiber find practical applications in ixtlero communities. The rootstock of Agave lecheguilla contains sapogenins, substances which emulsify grease. When the rootstock is placed in water and agitated, a soapy foam is produced that is used for a variety of cleansing purposes, the most common of which is the washing of human hair. Rootstock soap does an efficient cleaning job on clothes, preserving their color, softness and pliability. Nevertheless, in none of the ejidos that I visited was the soap used for this purpose. Older women in the communities retained memories of days past when rootstock soap was used to wash fabrics, but in recent years commercial detergents have become the preferred cleansing agent.

Among ixtleros the rootstock of Agave lecheguilla is called amole. Saponins necessary for cleaning purposes are found only in the amoles of living plants. Plants selected for this property are kicked or dug out of the ground, and a few basal leaves are separated from the rootstock prior to its being severed from the remainder of the plant (Plate 28). The freshly decapitated amole is cleaned by removing smaller peripheral roots, soil, and other extraneous matter from it. Ixtleros may collect as many as half a dozen amoles in this manner and transport them back to their residence at the conclusion of the field day.

Extracting the saponaceous properties of the rootstock is a simple procedure. It is fragmented by crushing it with a heavy blunt object such as a large stone (Plate 29). Segments of the white fleshy interior
Plate 28. *Agave lecheguilla* with exposed rootstock.

Plate 29. Preparation of lechuguilla amole prior to its immersion in water. Punta de Santa Elena.
are placed in a container of water and soaked for approximately five minutes. The water is then agitated with a stick and a soapy lather forms (Plate 30). Stirring continues for another five to ten minutes, whereupon the mixture is ready for use as a hair, body, or clothes cleaner. Ejido members claim that this soapy solution retains its potency as a cleaning agent for up to two weeks, or eight to ten washings, whichever comes first, but I have never seen a mixture used more than once. Rootstocks collected for this purpose constitute a very minor percentage of the Agave lecheguilla plants available to ixtlero communities, and because these plants are found in abundance throughout

Plate 30. Soapy solution derived from the amole of Agave Lecheguilla.
the region villagers exhibit little concern for conserving the soapy solution derived from a single rootstock.

Although the saponaceous properties of the lechuguilla amole are utilized primarily in washing hair, the degree to which they are employed for this purpose varies from community to community. In some ejidos, no other cleansing agent is used. In others, the amole solution has been superseded by commercially produced soaps such as Camay. Overall, its use is most prevalent today in the poorest ejidos, or in those farthest removed from outside contacts.

Despite its use as a piscicide in other regions of Mexico (Pennington, 1963:105), the rootstock of *Agave lecheguilla* does not appear to be used for fish stupefaction in the Zona Ixtlera. The most vital prerequisite for an amole piscicide, stationary pools or slowly moving water, is among the scarcest of natural resources throughout the area—a scarcity reflected in the near absence of fish in the ixtlero diet. When available in sufficient quantities, water is used as nourishment for foraging ejido animals. The introduction of agave piscicides to watering holes would only enhance the possibility of poisoning valuable livestock.

**Leaves**

Yet another part of *Agave lecheguilla* that has utilitarian value for the contemporary inhabitants of north-central Mexico is the plant leaf. Lechuguilla leaves contain the same saponaceous properties found in the rootstock of the plant, and they therefore possess similar cleansing capabilities. Saponins are concentrated in the leaf pulp. During decortication the primary goal of the tallador is to extract
and accumulate the commercially redeemable ixtle. But in the process of separating fiber from the leaf, a sizable quantity of residual material, guishe, is also amassed (Plate 31). Guishe is composed of fleshy leaf pulp and loose border spines. This combination of saponaceous leaf pulp and abrasive spines makes guishe an efficient cleansing agent, and its use as a detergent is widespread throughout the Zona Ixtlera. Guishe finds particular application in the washing of kitchen utensils, where its abilities to eradicate dirt are on a par with those of commercially manufactured soaps. Small amounts of it are combined with water to scrub pots, pans, and dishes (Plates 32 and 33).
Plate 32. Soapy solution created by mixing guishe with water.

Plate 33. Guishe solution used to clean dishes. San Luis Potosi campo.
Decortication of both *Agave lecheguilla* and *Yucca carnerosana* leaves produces guishe, but the lechuguilla by-product is much preferred. An absence of lateral spines on palma samandoca leaves reduces the abrasive ability, and hence cleaning efficiency, of guishe derived from this plant. More importantly, the boiling of palma samandoca cogollos reduces the potency of the leaf saponins and renders the guishe less effective as a detergent. Moreover, boiling imparts to the leaf fabric a brown color that makes palma samandoca guishe as dirty in appearance as the utensils it is supposed to clean.

As with amole, the utilization of guishe varies widely among the ixtleros. In numerous communities, detergents purchased in stores have completely supplanted it. Conversely, in more remote and poverty-ridden communities, guishe remains the paramount product for washing kitchen implements.

Guishe has other uses in ixtlero settlements. In those ejidos where *Yucca carnerosana* cogollos are collected and stored in pailas for steaming, guishe is piled atop the centerstalks to retard the loss of moisture. The same guishe is used repeatedly as a cover for successive quantities of palma samandoca cogollos. Dryed guishe also serves as a fuel to initiate and sustain the fire in the pit of the paila.

**Fruit and Flowers**

As indicated in an earlier section of this chapter, inhabitants of the Zona Ixtlera have long exploited the nutritive properties of both *Agave lecheguilla* and *Yucca carnerosana*. Of the plant parts used for food by contemporary ixtleros, only the flower buds (*chevitos*, or more
commonly dátiles) are important. Pale green dátiles occur by the hundreds along the upper half of the flower stalk of both lechuguilla and palma samandoca (Plate 34). They have a maximum length of 3 cm and are

Plate 34. Dátiles on an Agave lechuguilla flower stalk.

composed of two parts: a smaller and thinner basal pedicel which joins the dátil to the flower stalk, and a fleshy, bulbous end. Only the latter portion of the dátil is edible, and prior to its consumption the pedicel is detached and discarded.

Dátiles are commonly eaten raw in the field. In the kitchen, they are used in combination with different vegetables to make salads, or mixed and cooked with such ixtlero staples as beans and tortillas. Irrespective of the method of preparation, they have a waxy non-descript taste.

Dátiles also serve as animal forage, although the elevations above the ground at which they are normally found negate their widespread exploitation for this purpose. They do, however, assume greater
significance as forage in times of severe drought when more commonly browsed plants are in short supply or unavailable.

Lechuguilla and palma samandoca dátiles mature into clusters of white or greenish-white flowers. The flowers of both plants are fleshy and edible, but they are not, to my knowledge, used for sustenance by residents of the Zona Ixtlera. Wandering livestock do feed on the flower clusters when accessible.

The tall center stem (garrocha) of Agave lecheguilla has a nutritive value that is sporadically exploited by the tallador in the field. When the lechuguilla cogollo is left uncut, it grows into a dátil-bearing flower stalk 1.5 to 3 m high (Plate 35). Shortly thereafter,
the dátiles blossom into large cream-white flower clusters and the plant dies. As the plant matures, the garrocha not only increases in height, but the succulent interior pulp hardens and assumes wood-like properties. During the incipient years of the plant's growth, the tender pulp is chewed much the same as sugar cane, and its juicy sweetness is quite tasty. The edible pulp is readily exposed by stripping away the integument that surrounds it with a machete or sharp-edged knife. After the garrocha has attained a height of approximately 1 m, the reduced water content per unit volume results in a transformation of the fleshy pulp into a dryer and harder core. At this point, the value of the flower stalk as a source of nutrition ceases. *Yucca carnerosana* flower stalks do not appear to be used for this purpose. Their height above the ground makes them difficult to reach and effectively negates their exploitation.

The roasting and consumption of *Agave lecheguilla* amoles and leaves appears to be a practice alien to contemporary inhabitants of the Zona Ixtlera. No tallador with whom I spoke admitted using either the rootstock or the leaves of the plant for food, and no one recollected his immediate ancestors ever having done so. This pre-Conquest use of the plant does persist elsewhere in Mexico however. Pennington (1963:130-131) has reported utilization of the roasted meaty pulp of young lecheguilla leaves as a foodstuff among present-day Tarahumars in Chihuahua state.

**Trunks**

Residence in an ixtlero community quickly reveals the many ways in which its members utilize different components of *Agave lecheguilla* and
Yucca carnerosana. Use of these plants is nowhere more visible than in the dwelling and ancillary enclosures of the Zona Ixtlera. Standing structures are conspicuous elements of the cultural landscape, and both lechuguilla and palma samandoca are significant constituents of many rural structures. Certain house types make liberal use of the lechuguilla flowerstalk and the stem of palma samandoca in wall and roof construction. Outbuildings are also constructed of these and other locally available plants. The fences and stockades that incorporate homes and outbuildings into discrete residential units frequently comprise many different species of Yucca, including Yucca carnerosana.

Of the two plants, Yucca carnerosana has the greater potential for construction purposes. Lechuguilla lacks a trunk above the ground and, consequently, the only part of the plant capable of being used for buildings and fences is the tall flower stalk. But sustained cutting of the cogollos from which the flower stalk grows prohibits development of the center stem. In contrast to lechuguilla, palma samandoca has a simple, or rarely branched, stem that attains heights of 1.5 to 6 m and a diameter of 15 to 25 cm. These stems, in combination with the trunks of other arborescent species of Yucca (most notably Yucca filifera), are important building materials in certain house types, outbuildings, fences and stockades.

Throughout the Zona Ixtlera, the predominant rural house type is the flat-roofed adobe dwelling. As building material the only contribution made by lechuguilla or palma samandoca to this type of structure is in the roof. Adobe roofs are constructed of horizontal wooden beams over which lengths of hard mesquite wood, called latias or tabletas, are diagonally placed (West, 1974:114). One of the more common types
of latia is the centerstem of the sotol plant. Of less significance, but nonetheless employed for the same purpose, is the Agave lecheguilla garrocha.

Small, crudely built jacales utilizing palma samandoca stems as a basic building material are found throughout north-central Mexico. These rudimentary structures are most evident in the poorer and more isolated ejidos of the region, and in the surrounding countryside where single farmsteads prevail. In many ejidos, the more substantial adobe structures are located close to the settlement center, and the less sophisticated jacales are situated on the periphery of the community. Location of the two house types vis-à-vis the church, school, cooperative store, and volleyball court, which collectively form the focal point of every ejido, would appear to be indicative of the economic status of the people who reside therein. Jacales may serve as temporary dwellings for newly married couples; later, when the couple has acquired sufficient funds, the jacal is supplanted as a residence unit by the more prestigious flat-roofed adobe house type (West, 1974:124).

The jacal is essentially a rectangular one-room structure whose composition closely reflects the availability of local plant materials (Plate 36). Two of the major constituents of jacal walls are palma samandoca and palma china trunks, flower stalks of lechuguilla and sotol are used in roof construction, and a variety of other plants, including gobernadora and ocotillo serve as building materials.

Jacal construction commences with excavation of a shallow trench whose dimensions coincide with the desired circumference of the house. Palma samandoca and palma china trunks, wooden beams, and loose boards are placed upright in the hole and secured by tamping earth at their
Plate 36. Jacal constructed of local plant materials, including *Yucca carnerosana* trunks, Coahuila state.

base. The wall of vertical Yucca stems and wooden boards is linked together and reinforced by nailing or wiring slender wooden crosspieces to the structure (Plate 37). Sotol flower stalks are usually employed for this purpose. When completed, the walls of a jacal exhibit a modicum of uniformity. The stems and boards of a single wall, laid parallel to one another, are rarely parallel. Rather, they have a tendency to skew in different directions. This not only results in height discrepancies at the walls' apex, but tends to convey a strong impression of structural impermanence. Furthermore, walls are rarely the same height and the roof that is subsequently laid across them often slants in more than one direction.

With one notable exception, the construction and composition of jacal roofs parallels that of the flat-roofed adobe house type. In contrast to the horizontal wooden beam or hewn logs that span the wall
tops of adobe homes, the initial roof support of many jacales consists of palma samandoca and palma china trunks. Thereafter, the roof is completed in much the same fashion as that of the adobe house type: latias, including flower stalks of lechuguilla, are laid diagonally across the support beams and a layer of mortar, sod, or a mud-grass mixture is placed atop the latticework frame.

Jacales generally measure 3 to 4.5 m long and wide, and are 1.5 to 2 m high. As single-unit dwellings they frequently serve simultaneously as kitchen, bedroom, living room, and storage area. However, with the construction of additional jacales in the same family compound, these functions tend to become segregated. New jacales are for the most
part discrete units. The rudimentary construction and structural instability of jacales obviates additions to the original structure. It is common, therefore, to see three, four, or more jacales in a single farmstead, each serving a different function.

One of the most widespread features of the Zona Ixtlera landscape is the walled enclosure. Stockades are used to insure privacy and contain livestock. Materials employed for fence walls run the gamut from living columnar cactus to yucca stems to any available thorny bush or shrub, and a single fence is often a composite of many different plants (Plate 38). In those areas of north-central Mexico where *Yucca carnerosana* is commonplace, the plant's trunk is a significant constituent in fence construction. Erection of a stockade using palma *samandoca* stems involves a work sequence that parallels the one employed

Plate 38. Walled enclosure using *Yucca carnerosana* trunks, Punta de Santa Elena.
in the building of a jacal. A hole 20 cm deep is dug and the stems are placed in it. The vertical trunks are secured by piling small earthen mounds at their base, and a wooden cross-piece is wired to each of the parallel trunks, binding the disparate parts into a single, reinforced unit. The finished product may lack aesthetic appeal, but is is quite functional.
FOOTNOTES

Chapter IV

1 Much of the material dealing with the pre-Conquest agave artifacts of northern Mexico is taken from W. W. Taylor, "Archaic Cultures Adjacent to the Northeastern Frontiers of Mesoamerica," in Archaeological Frontiers and External Connections, Volume 4 in the Handbook of Middle American Indians, G. F. Ekholm and Gordon R. Willey (Volume editors), pp. 59-94.

2 The Indians were adept with the bow, which they preferred to make of mesquite root, and on which they used a bow-string of twisted Agave lecheguilla fiber (Taylor, 1972:173).

3 Kelley (1956:139) has detailed four cultural complexes and their associated settlement patterns in prehistoric north-central Mexico, but no specific mention is made of either lechuguilla or palma samandoca. Alessio Robles (1938:40) refers to a cave site on the eastern flank of the Sierra del Carmen in Coahuila where mummified corpses were covered with "tejidos de lechuguilla y provistos de sandalias de palma."

4 Powell (1952:32-54) has pieced together information from various sixteenth century Spanish chroniclers of the Chichimeca and reconstructed their culture. Using the same approach, Griffen (1969:104-137) provides a general ethnography of the Greater Bolsón de Mapimí area in eastern Chihuahua.

5 The term jacal (from Nahua xacalli; xamitl meaning adobe or sand, and calli meaning house) originally referred to a dwelling having adobe walls and a thatch roof. In many parts of Mexico, the term applies to vertical log or stick construction (Winberry, 1971:45).

6 In a brief pamphlet entitled Historia de San Luis Potosí Cabrera Ipiña (1968:23) commented on Chichimeca dwellings as follows: "their houses were jacales made of the leaves of maguey......and were supported by thick poles of lechuguilla......"

7 The breaking point per metric-gram for ixtle de lechuguilla is 15.402 kg, for ixtle de palma, 7.760 kg. (Mesa A. and Villanueva V., 1948:220).

8 Lanks (1938:191-192) briefly describes the procedures involved in making rope from "wild maguey" among the Otomí Indians of the Mesquital Valley in Hidalgo state Mexico. The procedures are remarkably similar to the ones described herein. The fiber is derived from a "wild agave called lechuguilla, or in Otomí tzitá," (Lanks, 1938:186). Granberg (1970:14-16) details the stages whereby the Otomí extract the fiber "ixtle" from a "maguey" plant and spin it into a variety of useful items, most notably the ayate, or carrying cloth. He does not use the word "lechuguilla" however. Neither Lanks nor Granberg designate the botanical nomenclature for the "magueys" they describe, but the plants discussed are not Agave lecheguilla since the range of this species does
not extend as far south as the state of Hidalgo. The "lechuguilla" mentioned by Lanks probably refers to *Agave filifera* or *Agave weberi*, species common to Hidalgo and environs.

Sapogenin concentrations are found in many species of *Agave* as well as in numerous other plants of the Zona Ixtlera. The explanation for this seems to be due to genetic factors rather than climatological causes. Nevertheless, sapogenins appear to be broadly coincidental with climates having marked dry seasons. This notion is supported by the scarcity of sapogenins among mesophytes and their absence from hydrophytes (Correll, Schubert, Gentry and Hawley, 1955:327). For a detailed chemical analysis of the saponin found in *Agave lecheguilla* see Johns, Chernoff, and Viehoever, 1922:335-347.

Pennington (1957:96; 1963:212) reported use of the saponaceous properties of many plants, including *Agave lecheguilla* by the Tarahumar people of western Chihuahua. Young roots of *Agave lecheguilla*, *A. Patonii*, and *A. Schottii* (collectively known as soko) are crushed, soaked, and smeared on blankets or cotton clothing which are then immersed in a pool of water for several hours. The articles are thereafter rinsed and dried in the sun.

*Agave lecheguilla* Torrey was commonly referred to as "lechuguilla" or "amole de lechuguilla" at the turn of the century in north-central Mexico (Johns, Chernoff, and Viehoever, 1922:335). Rivera (1943:25-28) traced the origin of the word "amole" back to the Aztec "amulli" (atl = water, mulli = to thicken) and suggests that as a generic term it referred to any plant used by the ancient Mexicans which possessed saponins and emitted soaplike properties when mixed with water. The *Diccionario Rural De México* (Islas Escárcega, 1961:13) applies the word to plants whose roots and bulbs have saponaceous properties and are used as a substitute for soap.

During the latter part of the nineteenth century the cleansing ability of *guishe* in Mexico and the southwestern United States was such that Newberry (1887:43) reported, "the most effective soap-plant of this region is the lechuguilla, of which the parenchyma of the leaves is thought by the inhabitants of the country where it grows to be better than the best soap for washing."
While exploitation of Agave lecheguilla and Yucca carnerosana is a centuries long tradition in north-central Mexico it was not until the colonial period that fiber from these plants was used for commercial purposes, and a coordinated system for collecting, processing, and the exportation of ixtle has only been established during this century. Since 1940, a federation of ixtlero cooperatives, organized under the title of La Forestal, F.C.L., has had a monopoly over the purchase of ixtle de lechuguilla and ixtle de palma from talladores. La Forestal also controls the processing of fiber and the export of ixtle and ixtle products to domestic and international markets.

Spanish Settlement and Economic Endeavors During the Sixteenth Century

North-central Mexico remained an alien and forbidding land to the Spaniards for many years after they asserted their hegemony over the Aztecs. Until the early 1540s, the vast region lying between the Sierras and north of a line extending from Queretaro to Guadalajara remained beyond the pale of Iberia control. Spanish enthusiasm for pushing north beyond the traditional frontiers of the sedentary Indian agriculturalists was dampened by the apparent paucity of mineral wealth in the northern deserts and steppes, as well as by the presence of the Chichimeca, an aggressive, warlike people who roamed the territory and strongly resisted attempts to subdue them. Furthermore,
their mobility in an arid land of great size and rugged topography made them difficult to incorporate into a system of controlled sedentary activity.

The conquest of the north commenced during 1541-42 when Spanish cattlemen and friars pushed north and east from Guadalajara and settled along the southern fringes of the Chichimeca domain. Concurrently, military and prospecting forays into the north-central plateau brought the Spaniards into contact with the wandering natives. As Iberian influence spread west from Querétaro, north from Michoacán, and northeast from Guadalajara during the first years of the decade, a new province "of the Chichimeca" came officially into being (Powell, 1952:4). Spanish advances into this province were sporadic and tentative until 1546, when rich, silver-bearing ore deposits were discovered at Zacatecas. The Zacatecas lode became the catalyst for sustained Spanish expansion into Chichimeca territory, an expansion that ultimately resulted in the subjugation and near annihilation of the indigenous peoples. Silver discoveries continued into the early years of the eighteenth century and the "Silver Belt" that developed in the steppes of northwestern and north-central Mexico during this period became a major contributor to the coffers of the Spanish crown.

In their quest for precious metals the Spanish also ventured north-eastward into the more arid regions of the Mesa del Norte, into what today constitutes the Zona Ixtlera. Here they encountered the Guachichiles, whose ferocity and elusiveness stymied permanent Spanish settlement north of Zacatecas to Saltillo and east to the edge of the plateau until the early 1560s. Only after the Spaniards defeated an allied force of Chichimeca tribes in 1561 were permanent settlements
-established at Mazapil (1568), Saltillo (1577), San Luis Potosí (1592), and Monterrey (1596).

The development of *real de minas* during the sixteenth century was accompanied by the establishment of cattle ranches and grain farms. The large labor force required to work the mines was sustained by foodstuffs and other products supplied by local ranchers and farmers. Demands for animals and animal products in the mines, coupled with the excellent pasture lands that fringed the Sierras, provided a special impetus to development of the range-cattle industry. The mining community and the stock ranch evolved as economically interdependent and geographically proximate units, and they combined to form the ranch-mine settlement complex that prevails to this day throughout northern Mexico (West, 1949:57).

The discovery of silver at Zacatecas thus initiated a chain of events that had profound repercussions for the frontier region of northern New Spain. By the end of the century, Spanish colonization had deeply penetrated the region and permanent settlements had been established throughout the southern drylands of the Mesa del Norte, in the grass-covered basins of the eastern and western Sierras, and in the coastal plains of northeastern Mexico. These colonization efforts did not come easily. The Chichimeca fiercely resisted the invaders from the south and a "guerra a fuego y a sangre" ("war by fire and blood") raged for most of the latter half of the century, slowing colonization efforts, disrupting travel and trade, and frequently transforming new settlements into ghost towns. However, by 1700 A.D. the Chichimeca, reduced in numbers by years of conflict, and pacified via a "peace by purchase" program, had been effectively and permanently subdued.
throughout most of the Mesa del Norte.¹

One can only speculate as to the utilization of ixtle for commercial purposes during this initial period of Spanish settlement in northern New Spain. Culture contact between Spaniards and Chichimecas engendered modifications in both peoples. The Spanish drive northward during the sixteenth century introduced a host of culture traits and trait complexes that had a profound impress on the aboriginal inhabitants. The implementation of Spanish society via mines, missions, and ranches effected a number of new conditions to which Indian ways of life were forced to accommodate because the stability of the natives' adjustment to pre-contact conditions had been disturbed (Griffen, 1969:152).

The adjustments and selective adoptions that followed contact were by no means restricted to the Indians. Spanish frontiersmen were obliged to adapt to native societies. The Iberian invaders, confronted with an alien environment, integrated certain culture traits borrowed from the Chichimeca into their social system. One such material item may have been ixtle fiber. Uncertainty as to when the Spanish first used ixtle reflects the lack of substantive historical materials documenting this event, a difficulty exacerbated by the confusion vis-à-vis plants and plant nomenclature that existed at the time. As Mesa A. and Villanueva V. (1948:45) state:

"muy pocas noticias se tienen respecto de la explotación de los ixtles de palma y lechuguilla en pasadas épocas y las referencias escritas, que se encuentran muy dispersas, relativas a la época precolonial son muy vagas y en muchas ocasiones no dicen si se trata del ixtle de palma, del de lechuguilla o del que también se elabora con las hojas del maguey pulquero o de otros agaves, lo cual impide conocer la importancia de la explotación de aquellas fibras."

Seventeenth Century to the End of the Colonial Period (1821)

Spanish control of northern New Spain was consolidated during the seventeenth century, although Indian groups continued to plague Iberian communities for many years thereafter. The mines, ranches, and missions that were the cutting edge of Spanish settlement during the 1500s persisted as dominant landholding units into the 1600s and for the balance of the colonial period. Despite a mining depression in certain areas of the north, the extraction of metallic ores continued as an important economic activity and production from the Silver Belt contributed significantly to Spain's wealth. Herds of cattle and sheep proliferated, and livestock-related activities expanded in number and scope. Concomitant with this growth was the evolution of larger landholding units. The seventeenth century witnessed the emergence and florescence of the hacienda as the typical and predominant landholding unit in the vast expanse of northern Mexico (Chevalier, 1963:Chapter 5).²

The establishment of mining communities and haciendas during the colonial period effected a dramatic transformation in the economic base of the north. The nomadic hunting and gathering economy of the indigenous Chichimecas was supplanted by a sedentary livelihood that relied on a complex of different resources. Subsurface mineral deposits were exploited for the first time, and previously neglected vegetation became the basis for the rapid expansion of a viable grazing economy. But many resources exploited during the pre-Conquest era continued in use throughout the colonial period. Included in this category were ixtle de lechuguilla and ixtle de palma. By 1741, ixtle had found widespread application in Spanish settlements throughout northern Mexico, although
its utilization was limited to commonplace, indispensible items (Mesa A. and Villanueva V., 1948:45-46). Quantities of ixtle gathered at this time could not have been great. During the mid-eighteenth century, the municipios where ixtle was collected were sparsely inhabited, and the small, isolated communities scattered throughout the region were constantly harassed by roving bands of Indians. Indian attacks were so persistent that ixtle gathering, a field-oriented operation, was a hazardous venture, and the amount of fiber collected was doubtlessly small.

The Nineteenth Century

Ixtle first appears as a marketable commodity during the nineteenth century, in association with the haciendas of the region. During this century, livestock raising remained the principal activity of these vast estates, leaving little time for ancillary pursuits. Nevertheless, ixtle emerged as a notable item of international trade by 1900. A growing overseas demand for fiber spurred hacendados throughout north-central Mexico to purchase both ixtle de lechuguilla and ixtle de palma from their estate laborers, or acasillados. Ixtle was stored in estate warehouses, sorted, classified on the basis of fiber length, and shipped to foreign markets where it was converted into brushes and rope. Marketing at the local level was tightly controlled by the hacendados. Estate workers were assigned specific weekly quotas of fiber, the quotas varying in accordance with the exigencies of the hacendado (De la Cerda, 1967:260). The system for collecting, processing, and exporting ixtle was undertaken by hacendados independently of one another. Individual enterprise prevailed largely because livestock raising remained
the major activity throughout the Mesa del Norte, and its success negated any concern with coordinating or organizing the production and sale of a product that played a secondary role in the region's economy. But even as an ancillary activity, ixtle's growing marketability was evident, as Table 5 attests.

Table 5

Exports of Ixtle - July 1, 1877 to June 30, 1896

<table>
<thead>
<tr>
<th>Five-Year Period</th>
<th>Weight in Kilograms</th>
<th>Value in Mexican Currency</th>
</tr>
</thead>
<tbody>
<tr>
<td>1877 - 1882</td>
<td>2,882,359</td>
<td>$353,902</td>
</tr>
<tr>
<td>1882 - 1887</td>
<td>4,958,959</td>
<td>$515,272</td>
</tr>
<tr>
<td>1887 - 1892</td>
<td>6,148,576</td>
<td>$644,877</td>
</tr>
<tr>
<td>1892 - 1896</td>
<td>5,873,115</td>
<td>$523,640</td>
</tr>
</tbody>
</table>

19 Year Total   93,441,931  $9,664,865
19 Year Averages 4,917,996  $508,677

Source: Romero, 1898:164.

An 1899 account of lechuguilla's distribution, commercial significance, and the means by which it was transferred from field to its port of embarkation, Tampico, reads:

"These plants grow wild in the greatest abundance on limestone mountains and adjacent valleys near Victoria, Tamaulipas, to the Mexican National Railroad, in San Luis Potosí, north to near Saltillo, Coahuila. From within this area many millions of pounds are exported (via Tampico) each year, nearly the entire product going to the United States."
The ixtle fiber shipped from Tampico is produced mainly in the region about the valley of Jaumave and valley of Tula, in western Tamaulipas and the adjacent part of eastern San Luis Potosí. The production of this fiber is the main industry of a considerable area, with the towns of Jaumave and Tula as the centers. The fiber from the Jaumave district is shipped by pack animals to the town of Victoria, on the Monterrey and Gulf Railroad, and thence by rail to Tampico. The Tula Valley outlet is sent to Cenito, on the Mexican Central Railroad, in eastern San Luis Potosí, and sent by rail thence to Tampico. Wagon roads lead out from Tula to the railroads, and the State government has had a large force of convicts working for a number of years building a finely constructed road from Victoria across the mountains to Jaumave (E.W. Nelson, quoted by Rose, 1899:243, Illustration 13).

By the end of the century, a number of northern Mexican cities were exporting ixtle to foreign markets. Included among these were Tampico, Saltillo, Monterrey, San Luis Potosí, Victoria, Porfirio Díaz, and Matamoras. During this period the Gulf coast port city of Tampico emerged as the most important embarkation point for ixtle, despite the fact that no fiber was produced from the tropical lowlands immediately surrounding it. Tampico was the only major port situated near the ixtle-producing area however, and its relative proximity to eastern United States and European markets gave it a locational, and hence cost, advantage over Mexico's inland cities. As the nations leading exporter of ixtle Tampico and the fiber became synonymous, so that by 1900 ixtle was commonly referred to as "Tampico fiber."

During the latter years of the nineteenth century, the major importer of ixtle was the United States. Between 1884 and 1898, the U.S. imported 70,000 tons of the fiber from Mexico (United States Department of the Treasury, 1896, II:1159; 1897, I:535; 1898, I:617). For the year 1897-1898, the dollar value of ixtle, as declared for
LECHUGUILLA'S TRANSFER FROM FIELD TO TAMPICO, 1899
Illustration 13

SOURCE: Rose, 1899; 243.
shipment to the U.S., emanated from: Tampico, $62,002; Saltillo, $45,476; Monterrey, $35,659; San Luis Potosí, $14,425; Victoria, $4,221; Porfirio Díaz, $1,913; Matamoros, $583 (Rose, 1899:244).

**Historical Background to Twentieth Century Changes in the Commercial Fortunes of Ixtle**

One of the most significant and far-reaching events of twentieth century Mexico has been the Mexican Revolution. The upheaval that took place in the country between 1910 and 1930 was fundamentally an agrarian revolution that sought elimination of inequities in land ownership and an end to hacienda-associated evils such as debt peonage. Nowhere were inequities of land proprietorship more blatant than in the states that today constitute the Zona Ixtlera. In 1923, after the Revolution but prior to the large-scale dissolution of estates, haciendas in Coahuila, Nuevo León, San Luis Potosí, Tamaulipas, and Zacatecas accounted for only 9.6% of all rural properties, yet hacienda-controlled land represented nearly 70% of the total land in rural property holdings (Tannenbaum, 1929:91-92, 484, 490). During 1916, the Mexican government began to implement legislation designed to break up the haciendas and redistribute land to the rural proletariat. Lands were allotted to the peasantry as communal property and under this system the landholding community, or ejido, re-emerged as a significant mode of land ownership throughout the country.

Despite the Revolution and the agrarian reform programs it spawned, the system for collecting, storing, and exporting ixtle in northern Mexico remained much the same as it had during the pre-Revolution years. Hacendados continued to act independently of one another, but collectively they retained monopolistic control over all phases of commercial
ixtles production. During the 1920s, when dissolution of the haciendas was intensified, this situation was altered, but not markedly. Although the pace of land expropriation quickened during this decade, many of the large estates in the Mesa del Norte remained unaffected by land reform. Livestock ranching had persisted as the dominant economic activity into the twentieth century, and measured against the limited carrying capacity of the northern desert scrub and semiarid grassland, a viable grazing economy could only be sustained on large units of land.

On haciendas that remained unaltered by land expropriation the hacendado continued to control the plant resources from which ixtle was extracted. In areas of the north where estates were dismembered, the hacendados lost control over both the plant resources and the labor required to exploit them. Consequently, a new group of middlemen emerged throughout the Zona Ixtlera. These intermediaries, often ex-hacendados, invariably ejido storekeepers, purchased ixtle from campesinos and sold it to extant hacendados who retained facilities to store the fiber and the overseas contacts requisite for its export.

In the wake of the Revolution, the relationship between hacendado and the labor force that collected ixtle was markedly altered. Prior to 1910, the peons who comprised the hacienda labor force were of two general types: the resident peon, or peón acasillado, and the non-resident peon, or peón alquilado. The peón acasillado formed the nucleus of the estate work force, and was bound to the hacienda by being in a state of perpetual indebtedness to the hacendado. Debt peonage was insured by extending credit or advancing payments to the peon that he was unable to repay because of the low remuneration he received for
his labors (Simpson, 1937:39, Whetten, 1948:102, McBride, 1923:30-31). By ending the debt peonage system, the Revolution irrevocably changed the hacendado-peon relationship. Deprived of a captive labor force, the estate owner found himself bidding for the services of a newly emancipated class of rural laborers, many of whom were now landholders in their own right.

In the years following the Revolution, hacendados continued to maintain monopolistic control over the storage, processing, and export of ixtle, but fiber collecting became increasingly associated with ejidatarios and communal lands. The ejidatario-ixtle link was forged during the 1920s because of the granting of lands to the rural peasantry. The ejidos that began to appear on the landscape of northern Mexico after 1916 were frequently located in areas with limited agricultural potential. Barely able to eke out a livelihood from the arid and semi-arid lands of the Mesa del Norte, communal residents turned to the gathering of ixtle. It was an occupation with which they were familiar, and one that provided a steady, albeit low, source of income or goods. But the campesinos lacked the funds, organization, and business contacts necessary to sell their product directly to foreign buyers. They were therefore committed to dealing with hacendados who had survived the Revolution with their estates intact or with intermediaries who acquired the fiber in ejido or town stores and thereafter transferred it to the hacendados. Throughout most of the region, a barter system prevailed within which the ixtleros exchanged fiber for foodstuffs or other indispensable items. Cash payments were restricted to only a few locales, most notably in the state of Tamaulipas (Mesa A. and Villanueva V., 1948:47).
At the same time that the Revolution was effecting changes in land
tenure and relationships between hacendados and peons within Mexico,
international events were having profound repercussions on ixtle's
marketability. World War I engulfed much of the world between 1914 and
1918, severely disrupting international trade patterns and ushering in
an era of wildly fluctuating demands and prices for many products, in­
cluding ixtle. Prior to World War I, Europe had been a major market
for ixtle. During the war, however, as continental factories were de­
stroyed or cut off from Mexican suppliers, European fiber demands de­
clined drastically. In an attempt to counteract this loss, Mexican
entrepreneurs increased exports of ixtle to the United States. But
supply quickly exceeded demand and manufacturing firms north of the
border, confronted with inventory surpluses, curtailed their imports of
the fiber. This action further diminished the already constricted mar­
ket for ixtle and initiated a period during which prices for the fiber
were sharply reduced. This situation persisted until the cessation of
the war. Thereafter, as European industry recovered and trade links be­
tween the continent and the balance of the world were restored, ixtle
re-emerged as a significant item of international trade. The large
quantities of fiber that had accumulated in Mexican and United States
warehouses during the War were rapidly absorbed by overseas enterprises,
and prices paid for ixtle took a sharp turn upward, attaining their
highest levels in 1926-1927. This post-war boom was a short-lived one,
however. The era of large overseas demands, high market prices, and
big profits terminated with the onset of the world-wide depression of
the 1930s. The Depression ushered in a complex of adverse economic
conditions that closely emulated those of World War I. Prices plum­
meted as international market demands for ixtle declined. Depressed markets and large inventories combined to drive U.S. and European importers to the verge of bankruptcy. In Mexico, hacendados and storekeepers sharply reduced their purchases of fiber from ixtleros, aggravating the already poverty-stricken conditions of rural residents in the northern drylands. The impact of the Depression on ixtles production and export represented one phase of the ongoing "boom or bust" cycle that has characterized the fibers commercial history during this century. This cycle continued after the Depression, and into the 1940's, as Illustration 14 demonstrates, and it persists to the present day.

Coincident with the economic difficulties engendered by the Depression was the social upheaval that continued as a legacy of the Agrarian Revolution. Land redistribution accelerated during the 1930s, and relationships between fiber gatherers and buyers continued to be altered. In the absence of any formal controls over ixtle procurements or exports, competition between hacendados intensified. In an attempt to eliminate such competition and the inconsistencies it fostered, Mexican and United States businessmen began to envision formation or an organization that would unite the different groups associated with ixtle and establish guidelines for its production and sale. A precedent for this idea had been established as early as 1917 when the Mexican Constitution was promulgated. Article 28 of the constitution, the "Ley de Sociedades Cooperativas, La Forestal y de Caza y Pesca," stipulated the conditions necessary for a rational exploitation of native resources such as ixtle de lechuguilla and ixtle de palma, and outlined the duties of those organizations entrusted with the responsibility for
EXPORTS OF LECHUGUILA, 1934 - 1946
THOUSANDS OF TONS
Illustration 14

procuring these plant products. During the ensuing decade, the government sporadically attempted to implement the provisions of Article 28. Hacendados and storekeepers were encouraged to unite and coordinate purchasing procedures and prices. Under the auspices of the Secretaría de Industria, Comercio y Trabajo, ixtleros were organized into community cooperatives. But the realities of the time nullified such efforts. The sheer expanse of area from which the fiber was collected, coupled with a widely dispersed gathering population, a continued predilection among buyers to pursue an independent course, and a governmental concern with more pressing matters, effectively prevented efforts to combine the disparate forces affiliated with the exploitation and sale of ixtle. Thus, despite an awareness of the need to provide an organizational framework for the ixtle industry dating back to 1917, little was accomplished along these lines during the boom years of the 1920s.

**Formation of La Nacional Ixtleña**

In 1931, at the height of the Depression, a movement was initiated that eventually culminated in an organizational framework which has, in modified form, persisted to the present day. The catalyst for this movement was the E.B. and A.C. Whiting Company, a Burlington, Vermont textile and brush-manufacturing firm that had a strong, vested interest in ixtle fiber. At the onset of the Depression, the Whiting Company was the single largest importer of ixtle in the world (personal correspondence from Everett C. Bailey, October 8, 1976). During 1931, the company embarked on a campaign to expand its share of the export market, a goal that Whiting officials believed could only be attained through
unification of the numerous independent Mexican sellers into a single organization. In January and February the president of the company, Thomas A. Unsworth, traveled to Mexico and, in a series of talks with businessmen and landholders in Saltillo, San Luis Potosí, Monterrey, and Mexico City, proffered the idea of a cooperative association of Mexican ixtle sellers. Unsworth's promise of financial backing for such an organization and the prospects for gaining exclusive control over the sale of ixtle prompted a dozen of the largest hacendados and businessmen to pool their resources and form "La Nacional Ixtlera, S.C.L." (Sociedad Cooperativa Limitada) on May 24, 1932 in Saltillo.

The specific goal of La Nacional Ixtlera was to organize the production and export of ixtle de lechuguilla under a single cooperative structure. By doing so, the organization sought to stabilize production, regulate prices, and eliminate the ruinous competition that had characterized the sale of ixtle up to 1931. It was envisioned that standardization and stabilization would ultimately result in higher prices, and that everyone associated with ixtle, including the talladores, would benefit.⁵

The stability of La Nacional Ixtlera was assured when it entered into contractual agreements with the two largest purchasers of ixtle, the Whiting Company and the A. and L. Mayer Company of Hamburg, Germany. A key stipulation in these contracts was that the two companies would purchase ixtle only from La Nacional Ixtlera. Within Mexico, the federal government enacted legislation that further strengthened the organization at the expense of its competitors.⁶ In October, 1932, the government raised the duty on the exportation of ixtle, at the same time providing a subsidy to La Nacional Ixtlera to cover the additional ex-
penses of the import tax (De la Cerda, 1967:265, Beltran, 1964:46). In succeeding years, the government continued to raise simultaneously the export tax and subsidize La Nacional Ixtlera, in effect creating a situation where it became the only organization that could afford to ship the fiber to foreign markets.

The privileged position accorded to La Nacional Ixtlera by the Mexican government was a consequence of the organization's ability to convince the nation's politicians that by having exclusive control over the production and sale of ixtle prices on the international market would rise, benefiting the country, the company, and the campesinos. With respect to the latter, Article 2 of the La Nacional Ixtlera's constitution stipulated that 25% of the commercial value of ixtle would be distributed to ixtleros.

La Nacional Ixtlera controlled Mexico's ixtle industry from June, 1932 to August, 1941. During this period, the first coordinated system for collecting, transporting, and exporting ixtle was put into operation. A hierarchy of fiber-collecting agencies was established, a fiber-classification system was inaugurated, credit was extended to collectors via a "Banco Ixtlero," and prices paid to the campesinos for their product were standardized. La Nacional Ixtlera also succeeded magnificently in achieving one of its major goals, that of raising the market price for ixtle. Between 1931 and 1941, the sale price of ixtle increased approximately 400% over the 1929 value (Quillares Lona, 1971: 124).

By 1940, however, charges of mismanagement of funds prompted a federal investigation of La Nacional Ixtlera. The investigation revealed that despite a large increase in the value of ixtle, and the
profits this increment generated, the economic position of the ixtlero remained much the same as it had a decade earlier. Prices paid to collectors for their fiber remained low, and the 25% of the commercial value of ixtle promised the campesinos never reached them. Conversely, huge profits were reaped by the hacendados and businessmen who controlled La Nacional Ixtlera. By stockpiling ixtle in their warehouses, they managed to drive its price up, thus becoming the chief beneficiaries of the subsequent profits. This combination of income inequities and the failure of La Nacional Ixtlera to successfully meet the goals for which it was established prompted the government to act, and in August, 1941, the organization was dissolved.

La Forestal, F.C.L.

Abolition of La Nacional Ixtlera in no way diminished ixtle's marketability. Consequently, the government encouraged talladores to organize their own sociedades cooperativas for the sale of ixtle. In contrast to La Nacional Ixtlera, which had been organized by hacendados and administered from the top down, these new cooperatives were viewed as grass roots organizations that would truly benefit the ixtleros.

The idea for locally developed and oriented cooperatives dated back to 1939 and originated not with the government but among the campesinos themselves. Disenchanted with socio-economic conditions in northern Mexico, a coalition of ixtleros and candelilleros met in Saltillo during October, 1939, and organized a civil association entitled the "Frente Campesino de Productores de Ixtles y Cera de Candelilla, A.C." A second ixtlero congress in Monterrey attracted thousands of collectors from Nuevo León, Coahuila, Tamaulipas, San Luis Potosí, and Zacatecas.
At both meetings, congress representatives cited a long list of grievances, including allegations of improprieties against La Nacional Ixtlera. Among the goals sought by the coalition was the organization of cooperative societies at the ejido level (sociedades cooperativas ejidales) charged with the responsibility of selling fiber in common. This objective was brought to the personal attention of President Lázaro Cárdenas via a dramatic "walk" from Laredo to Mexico City in 1940. Cárdenas, sympathetic to campesino demands, encouraged the idea of local cooperatives and by presidential decree created an agency to administer them, "La Forestal, F.C.L." (Federación de Cooperativas Limitadas), on March 23, 1940. On November 21 of the same year, representatives from 79 ejido cooperatives met in Saltillo and drafted a constitution for the newly established organization. As stipulated in Clause 4a of the constitution, the primary objectives of La Forestal included:

1. To coordinate and watch over the activities of the cooperatives
2. To sell in common all of the forest products of the cooperatives
3. To develop in common goods and services
4. To eliminate itinerant merchants, replacing them with cooperatives that will distribute articles of prime necessity
5. To promote industrialization of the prime materials produced by cooperatives
6. To represent and defend the interests of the cooperatives

Cooperatives were to be financed through the contributions of its members, all of whom were ejidatarios. Affairs of the cooperatives were vested in two councils: one of administration and one of vigilance. Each cooperative designated one of its members a cooperador, i.e., a community member entrusted with the responsibility of managing the ejido store and recording the quantities of fiber sold at the store (Alemán Alemán, 1966:101-102).

La Forestal commenced operations on August 23, 1941. From that time to the present, it has had a monopoly over the purchase and sale of ixtle, much the same as its predecessor, La Nacional Ixtlera, had. However, a major difference between the two organizations is that La Nacional Ixtlera was a private monopoly of buyers, sellers, and hacendados, while La Forestal is a monopoly of the ixtleros themselves.

Since its inception, La Forestal has grown on many fronts. Originally comprised of 79 cooperatives, the organization is currently affiliated with 1,761 communities located in Coahuila, Nuevo León, San Luis Potosí, Tamaulipas, and Zacatecas. The area within these five states where ixtle is collected and sold to La Forestal is known as the Zona Ixtlera (Illustration 1). By its own estimate, La Forestal claims that the Zona Ixtlera encompasses twenty million hectares, or one-tenth of Mexico's land area, and that over 100,000 ixtleros are gathering and selling ixtle within this region. The hierarchy of collecting agencies initiated during the 1930s by La Nacional Ixtlera has been refined and expanded by La Forestal. Each of the ejidos affiliated with the organization has its own collection center, usually a cooperative store jointly constructed by La Forestal and CONASUPO (Compañía Nacional de
Subsistencias Populares). A fleet of over one hundred La Forestal trucks periodically collects the fiber from each ejido and transports it to one of thirty regional agencias recopiladoras where it is stored before being carried by the same La Forestal vehicles to one of four La Forestal-operated factories. In the factories, the fiber is semi-processed and shipped by rail or truck to Mexican ports for export to overseas markets (personal interview with José Bernardo Solís Robledo, May 25, 1976; La Forestal, 1974:5).

The Contemporary Sale of Ixtle

Ixtle remains an important item of international commerce because the fiber possesses particular qualitative aspects of resiliency, texture and water absorbency that make it a superior fiber for some applications and indispensable for others. Its most important uses today are in power driven industrial wheels or cylinder brushes for a variety of buffing or cleaning uses in such places as steel mills and other metal fabricating applications. It has not been satisfactorily replaced in either industrial or home type rotary floor scrubbers and polishers, and is still widely used in its pure state, or in combination with horsehair, in floor sweeps, counter dusters, calcimine brushes, roofing brushes, pastry brushes and to some degree in scrub brushes and bowl brushes. Most brush manufacturers of household, maintenance or industrial brushes (but not manufacturers of personal brushes, artist brushes or paintbrushes) use some quantities of ixtle fiber in certain applications or in parallel brush lines to similar brushes made from plastic fibers. In the United States and Canada these manufacturers are widely dispersed from the Maritime Provinces
to Tampa, Florida, and from Manchester, New Hampshire to Los Angeles, California.

La Forestal's exclusive control of the ixtle industry insures that figures cited for purchases and exports are a fairly accurate barometer of the industry's status. Table 6 indicates the quantity of ixtle de lechuguilla and ixtle de palma collected by La Forestal from 1967 to 1975, and Illustrations 15 and 16 depict changes in production of the two fibers during the same period. Table 7 lists production by fiber in each of the five states of the Zona Ixtlera.

Fiber is collected from the ejido cooperatives by La Forestal trucks at intervals of one to two weeks. Prior to transfer from cooperative to truck, the fiber is weighed and the amount recorded by both the cooperador and driver. Payment is made by check: 9.10 pesos per kilo of ixtle de lechuguilla, 4.60 pesos per kilo of ixtle de palma. At day's end, La Forestal vehicles unload their contents at one of the thirty regional collection centers, or agencias recopiladoras (Appendix III).

At most recopiladoras, ixtle is bundled into bales of 120 kilos and stored for shipment. At the recopiladores in Tamaulipas (Tula, Jaumave, and Miquihuana), lechuguilla fiber is extra long, and it is subsequently hand-sorted and classified into four categories on the basis of length. Selecto (#1) is the "Jaumave type" fiber, longer (43-46+ cm) and smoother than the remainder. Ixtle classified as #2, #3, and #4 corresponds to decreasing fiber length: #2 - 33-36 cm; #3 - 23-31 cm; #4 - less than 23 cm. The sorted fiber is baled and placed in storage. La Forestal trucks transport the baled fiber from the agencias recopiladoras to one of the company-operated factories.
TABLE 6

Lechuguilla and Palma Samandoca Fiber Collected
By La Forestal, 1967 - 1975

<table>
<thead>
<tr>
<th>Year</th>
<th>Lechuguilla Kilos</th>
<th>Palma Samandoca Kilos</th>
</tr>
</thead>
<tbody>
<tr>
<td>1967</td>
<td>14,356,000</td>
<td>10,212,000</td>
</tr>
<tr>
<td>1968</td>
<td>12,138,000</td>
<td>6,665,000</td>
</tr>
<tr>
<td>1969</td>
<td>12,207,000</td>
<td>6,827,000</td>
</tr>
<tr>
<td>1970</td>
<td>10,282,000</td>
<td>7,142,000</td>
</tr>
<tr>
<td>1971</td>
<td>8,628,328</td>
<td>5,561,960</td>
</tr>
<tr>
<td>1972</td>
<td>7,256,967</td>
<td>4,551,115</td>
</tr>
<tr>
<td>1973</td>
<td>8,722,371</td>
<td>3,512,182</td>
</tr>
<tr>
<td>1974</td>
<td>13,225,163</td>
<td>5,220,088</td>
</tr>
<tr>
<td>1975</td>
<td>12,409,944</td>
<td>3,532,534</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td><strong>99,225,773</strong></td>
<td><strong>53,223,879</strong></td>
</tr>
</tbody>
</table>


TABLE 7

Production of Lechuguilla and Palma Fiber
By State - 1975

<table>
<thead>
<tr>
<th>State</th>
<th>Lechuguilla Kilos</th>
<th>Palma Samandoca Kilos</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coahuila</td>
<td>3,751,450</td>
<td>2,371,555</td>
</tr>
<tr>
<td>Nuevo León</td>
<td>2,113,620</td>
<td>442,576</td>
</tr>
<tr>
<td>San Luis Potosí</td>
<td>4,557,130</td>
<td>439,030</td>
</tr>
<tr>
<td>Tamaulipas</td>
<td>1,566,092</td>
<td>36,035</td>
</tr>
<tr>
<td>Zacatecas</td>
<td>421,652</td>
<td>243,338</td>
</tr>
</tbody>
</table>

at Monterrey, Matehuala, San Luis Potosí, or Saltillo. All four factories process ixtle de lechuguilla, but only the Saltillo plant manufactures goods made of ixtle de palma. This emphasis on lechuguilla reflects the international market orientation of the fiber. All lechuguilla fiber processed by La Forestal is shipped to foreign buyers. Conversely, the market for ixtle de palma products is strictly internal. The bulk of the palma samandoca fiber is converted into sacks that are sold to Mexican buyers. Sack capacities vary from 50 to 90 kilos and are most commonly employed to hold agricultural commodities.

Prior to being exported, lechuguilla fiber is subjected to a number of industrial processes. It is sorted and classified by length, cleaned, carded, mixed, cut into designated lengths, tinted, cylindrically wrapped, and packed into 25-kilo boxes. During the manufacturing process, approximately 8% of the fiber becomes waste material, or maraña. Maraña is sold to local buyers who use it to stuff pillows, mattresses, and car seats (personal interview with Luis F. Sosa Cerón, May 27, 1976).

In addition to the La Forestal factories, there are two fábricas particulares, i.e., privately owned and operated manufacturing establishments that process and export ixtle de lechuguilla. These factories, located in Saltillo and Santa Catarina, a Monterrey suburb, purchase lechuguilla fiber from La Forestal after it has been cleaned, classified and bundled. Fibras Saltillo, S.A. annually purchases in excess of 110,000 tons of ixtle at 9.50 pesos per kilo (the rate as of August, 1976). In preparing the fiber for export, the company engages in the same industrial sequence for semi-processing the product as La Forestal.
La Forestal and the privately owned factories do not compete for the same international markets. By mutual consent, the private firms have agreed to restrict their markets to the United States while La Forestal sends its fiber to the remainder of the world. In 1973 the combined exports from La Forestal and the private firms exceeded 6 million kilos (Table 8).

Table 8
Exports of Ixtle de Lechuguilla, 1973

<table>
<thead>
<tr>
<th>Country</th>
<th>Kilos</th>
<th>Value in Pesos</th>
</tr>
</thead>
<tbody>
<tr>
<td>Argentian</td>
<td>18,768</td>
<td>82,800</td>
</tr>
<tr>
<td>Australia</td>
<td>7,904</td>
<td>105,138</td>
</tr>
<tr>
<td>Belgium-Luxembourg</td>
<td>6,864</td>
<td>104,958</td>
</tr>
<tr>
<td>Brazil</td>
<td>26,520</td>
<td>117,000</td>
</tr>
<tr>
<td>Chile</td>
<td>7,507</td>
<td>34,825</td>
</tr>
<tr>
<td>Colombia</td>
<td>1,664</td>
<td>12,800</td>
</tr>
<tr>
<td>Italy</td>
<td>2,080</td>
<td>16,000</td>
</tr>
<tr>
<td>Japan</td>
<td>46,816</td>
<td>325,850</td>
</tr>
<tr>
<td>Low Countries</td>
<td>138,324</td>
<td>1,846,534</td>
</tr>
<tr>
<td>Peru</td>
<td>1,040</td>
<td>8,000</td>
</tr>
<tr>
<td>Philippines</td>
<td>1,040</td>
<td>8,000</td>
</tr>
<tr>
<td>Switzerland</td>
<td>1,296,649</td>
<td>7,850,797</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>114,760</td>
<td>682,000</td>
</tr>
<tr>
<td>United States</td>
<td>4,452,394</td>
<td>54,501,136</td>
</tr>
<tr>
<td>Uruguay</td>
<td>969</td>
<td>4,275</td>
</tr>
<tr>
<td>Venezuela</td>
<td>3,080</td>
<td>17,000</td>
</tr>
<tr>
<td>Totals</td>
<td>6,216,379</td>
<td>65,717,113</td>
</tr>
</tbody>
</table>

Source: Secretaría de Industria y Comercio, 1974:691.

The United States is by far the single most important buyer of ixtle de lechuguilla. Fibras Saltillo exports most of its product to the eastern seaboard, while the Ixtlera de Santa Catarina factory has most of its outlets in the western United States. Of the buyers in the U.S.A.,
the E.W. and A.C. Whiting Company remains the largest, importing approximately 40% to 50% of the fiber annually sold in the country (personal correspondence from Everett C. Baily, October 8, 1976).
Apache and other Indian bands continued to raid as far south as Saltillo and Mazaptl until the middle of the nineteenth century.

The term "hacienda" denotes the large-scale private landholding which dominated the Mexican landscape prior to 1910. A distinction is made between the hacienda and the smaller rural private property ("rancho") on the basis of size. Haciendas were classified as holdings of more than 1,000 hectares, ranchos were units of 1,000 hectares or less (McBride, 1923:82). Other salient characteristics of the hacienda included: absentee ownership, a large resident labor force, an administrator, and extensive agriculture. For a more comprehensive description of the hacienda and its characteristics, see Whetten, 1948:90-107.

Under terms of the agrarian reform program, three types of land grants were made to the campesinos: restitution, dotation, and amplification. Villages that had title to lands illegally acquired by haciendas had those lands returned via restitution. Dotation involved out-right grants of land to villages that lacked proof of title of previous possession. Amplification was a land grant given for the purpose of enlarging existing village holdings when it could be shown that land already owned was insufficient to support village needs. Of the three land grant types, dotation was by far the most important means by which lands were dispensed. Between 1916 and 1944, 79% of the land distributed in the land reform program was in the form of dotation (Whetten, 1948:129-130).

Much of the information included in this section is a synthesis of material included in Mesa A. and Villanueva V. (1948:48-56).

La Nacional Ixtlera concerned itself only with ixtle de lechuguilla because it had unique properties for which other fibers could not substitute. Mexico was also the lone producer of lechuguilla fiber in the world and the organization that controlled its production and sale could establish prices without fear of competition.

The hacendados and businessmen who formed La Nacional Ixtlera constituted but a small percentage of those who sold ixtle. Many hacendados continued to operate independently and did not associate with La Nacional Ixtlera.

The remanente de tallador was paid to the ixtlero at a rate of two centavos per kilogram for second-class fiber, and two and one-half centavos per kilogram for first-class fiber (Quillares Lona, 1971:129).
During the last years of its existence over 12,000 tons of ixtle were stored in the warehouses of La Nacional Ixtlera in Tampico, Saltillo, San Luis Potosí, and other major cities located in or near areas of ixtle production.

Candelillero is the name applied to a campesino who gathers wax from the candelilla plant.

Unlike La Nacional Ixtlera, La Forestal purchases ixtle de palma as well as ixtle de lechuguilla. The organization charged with responsibility for overseeing ixtle de palma's production, Comité Distribuidor y Exportador de Ixtle de Palma, was disbanded in 1942 and its duties were transferred to La Forestal.
CHAPTER VI

POVERTY AND ITS RESOLUTION
IN THE ZONA IXTLERA

Measures of Poverty

During the current decade, numerous government reports and scholarly articles have detailed the socio-economic conditions of the campesinos who live in Mexico's drylands. These studies reflect a growing concern about a physical milieu that encompasses a large segment of the republic's land area, and includes a sizable percentage of its population.1

The Zona Ixtlera accounts for approximately 50% of Mexico's arid and semi-arid regime. Rural inhabitants of the region have traditionally been sustained by native plants. But the meagerness of products obtained from these resources has led to impoverished living conditions, a situation little alleviated by ancillary economic pursuits such as crop cultivation and stock-raising. While no comprehensive study of socio-economic conditions exists for the Zona Ixtlera as a discrete entity, reports on specific administrative units within the region are extant. A recurring theme in these reports is poverty. Whether measured in terms of per capita income, material well-being, or health and education facilities, campesinos in the Zona Ixtlera are among the most indigent Mexicans.

One general measure of conditions in certain of the municipios in the Zona Ixtlera is indicated in Table 9. Criteria used to ascertain "conditions of life" included: population engaged in primary activities; per capita consumption of meat, eggs, and milk; income per capita; number of rooms per residential unit; residences with electricity; and

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TABLE 9

"Conditions of Life" in Major Ixtle-Producing Municipios of the Zona Ixtlera

<table>
<thead>
<tr>
<th>State</th>
<th>Municipios</th>
<th>Municipios&lt;sup&gt;a&lt;/sup&gt; Classified</th>
<th>Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Most Abject</td>
<td>Very Low</td>
</tr>
<tr>
<td>Coahuila</td>
<td>6</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>Nuevo León</td>
<td>6</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>San Luis P.</td>
<td>11</td>
<td>10</td>
<td>1</td>
</tr>
<tr>
<td>Tamaulipas</td>
<td>5</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>Zacatecas</td>
<td>4</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>Totals</td>
<td>32</td>
<td>30</td>
<td>1</td>
</tr>
</tbody>
</table>

Percent of Total Ranked
---
---
3% 30% 50% 13% 3%

Source: Saeb Camarca and Cabrera, 1973:15-25. The authors utilized information from Mexico's Ninth General Census of Population (1970) to categorize 368 municipios in 16 states and one territory in the arid zones of the nation.

literacy (Saeb Camarco and Cabrera, 1973:5-6). No specific quantitative breakdown is provided to differentiate the categories used. Nevertheless, while Table 9 fails to elucidate the specifics of poverty, it does indicate that the standard of living among residents of the Zona Ixtlera is exceedingly low. Twenty-five of the thirty municipios (83%) rate below average in terms of income, diet, education, and shelter. The lone municipio ranked above average is Saltillo, an anomaly explained by the presence of Saltillo City, the political, economic, and cultural center of Coahuila state.

Studies of individual states within the Zona Ixtlera, while limited, corroborate the above. A 1974 report by the Instituto Mexicano del Seguro Social (IMSS) of eight municipios in Nuevo León (Illustration 17) details the economic plight of the ixtlero. In 1970 these municipios had a combined population of 123,141, or 7.2% of the state's total population. Of the 22,270 heads of families, the livelihood of approximately one half (11,000) depended almost exclusively on income derived from the sale of lechuguilla and palma samandoca. Another 6,000 families gathered and sold ixtle, but supplemented their income through the sale of agricultural commodities. Thus, for over three-quarters (76.4%) of the families in the eight municipios under consideration, the sale of ixtle constituted the single most important source of remuneration.

Family income ranks among the lowest in Mexico. Table 10 lists income distribution for the eight municipios of Nuevo León's Zona Ixtlera. Eighty-three per cent of the gainfully employed population had monthly incomes of less than 500 pesos (approximately $24 U.S.), 13% averaged less than 1,499 pesos per month ($69 U.S.), and only 4% earned in excess of 1,500 pesos per month. The 500 pesos per month translates into a
MUNICIPIOS INCLUDED IN THE IMSS STUDY OF NUEVO LEÓN'S ZONA IXTLERA

Illustration 17

COAHUILA

SAN LUIS POTOSÍ

TAMAULIPAS

1 - Mina
2 - Rayones
3 - Iturbide
4 - Galeana
5 - Aramberri
6 - Doctor Arroyo
7 - Zaragoza
8 - Mier Y Noriega

ZONA IXTLERA MUNICIPIOS NOT INCLUDED IN IMSS STUDY

A - García
B - Santa Catarina
TABLE 10

Income Distribution in the Zona Ixtlera
of Nuevo León, by Municipio - 1970

<table>
<thead>
<tr>
<th>Municipio</th>
<th>0-499</th>
<th>500-1499</th>
<th>1500-2499</th>
<th>2500-4599</th>
<th>5000+</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr. Arroyo</td>
<td>8,679</td>
<td>687</td>
<td>220</td>
<td>59</td>
<td>39</td>
<td>9,684</td>
</tr>
<tr>
<td>Zaragoza</td>
<td>1,103</td>
<td>219</td>
<td>25</td>
<td>9</td>
<td>4</td>
<td>1,360</td>
</tr>
<tr>
<td>Mier y Nor.</td>
<td>1,689</td>
<td>105</td>
<td>20</td>
<td>6</td>
<td>10</td>
<td>1,827</td>
</tr>
<tr>
<td>Galeana</td>
<td>6,512</td>
<td>1,678</td>
<td>279</td>
<td>88</td>
<td>70</td>
<td>8,627</td>
</tr>
<tr>
<td>Aramberri</td>
<td>3,053</td>
<td>346</td>
<td>76</td>
<td>22</td>
<td>14</td>
<td>3,511</td>
</tr>
<tr>
<td>Iturbide</td>
<td>621</td>
<td>201</td>
<td>19</td>
<td>11</td>
<td>5</td>
<td>857</td>
</tr>
<tr>
<td>Rayones</td>
<td>792</td>
<td>149</td>
<td>17</td>
<td>8</td>
<td>8</td>
<td>974</td>
</tr>
<tr>
<td>Mina</td>
<td>581</td>
<td>221</td>
<td>4</td>
<td>4</td>
<td>1</td>
<td>811</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>23,027</td>
<td>3,606</td>
<td>660</td>
<td>207</td>
<td>151</td>
<td>27,651</td>
</tr>
</tbody>
</table>

Source: Instituto Mexicano del Seguro Social, 1974:11.
pre-devaluation total of U.S. $480.00 annually.

One of the clearest insights into the economic situation in the Zona Ixtlera is provided by a comparison of ixtlero incomes with those of Mexicans whose livelihood is wholly dependent upon agriculture or other non-gathering activities. Alemán Alemán's socio-economic profile of one hundred ejidos in San Luis Potosí is notable in that it provides the basis for such a comparison. Ejidos are grouped into six regional units, each with a particular economic orientation. The number of ejidos and predominant economic activities for the six regions are cited in Table 11.

Region three is of particular interest because it coincides with the Zona Ixtlera of San Luis Potosí. Arable land is limited in this region. The eighteen ejidos under consideration have a combined total of 102,836 hectares, of which only 3.2% (3,345 ha) is classified as "temporal" (dryland farming). Pasturelands account for 47.0% (48,277 ha) of the area, and nearly one-half of the ejido lands, 49.8% (51,214 ha) are designated "cerril" (wasteland) (Alemán Alemán, 1966:98). In the absence of large amounts of cultivable land, the campesinos of northeastern San Luis Potosí have turned to the gathering and sale of wild plant products such as ixtle. Although difficult to ascertain with exactitude, ixtle's contribution to the economic livelihood of the area's rural populace can be approximated by interpreting the data in Table 12. Of the combined annual income for the families cited in the table, 86% was generated within the communities in which the families resided. The single most important commodity sold by campesinos in the ejidos of northeastern San Luis Potosí is ixtle. It is not unreasonable to assume that income that accrues to the ixtlero consti-
# TABLE 11

Regions and Economic Orientation in the State of San Luis Potosí

<table>
<thead>
<tr>
<th>Region</th>
<th>Number of Ejidos</th>
<th>Economic Orientation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Ejidos in areas bordering the state capital</td>
<td>16</td>
<td>Located in the immediate economic hinterland of San Luis Potosí, these ejidos have close trade links with the capital</td>
</tr>
<tr>
<td>2. Ejidos of the Northwest</td>
<td>12</td>
<td>Livestock raising, particularly smaller livestock, e.g., sheep and goats</td>
</tr>
<tr>
<td>3. Ejidos of the Northeast</td>
<td>18</td>
<td>The &quot;Zona Ixtlera&quot; of San Luis Potosí. Sale of ixtle is the single most important source of income</td>
</tr>
<tr>
<td>4. Ejidos in the center of the state</td>
<td>19</td>
<td>Diversified agriculture</td>
</tr>
<tr>
<td>5. Ejidos in the northern Huasteca region</td>
<td>11</td>
<td>Cattle-raising and sugar cane production</td>
</tr>
<tr>
<td>6. Ejidos in the southern Huasteca region</td>
<td>24</td>
<td>Horticulture (fruits) and cattle-raising</td>
</tr>
</tbody>
</table>

TABLE 12 - ANNUAL FAMILY AND PER CAPITA INCOME OF FAMILIES IN NORTHEASTERN SAN LUIS POTOSI

<table>
<thead>
<tr>
<th>Ejido</th>
<th>Municipio</th>
<th>Num. of families investigated</th>
<th>Total pop. of the families studied</th>
<th>Ave. family size</th>
<th>Yearly family income in ejido</th>
<th>Family income obtained from inside the ejido</th>
<th>Total Annual Family Income</th>
<th>Average Annual Income per Family</th>
<th>Ave. annual Income per Family Member</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arroyito del Agua</td>
<td>Matehuala</td>
<td>11</td>
<td>63</td>
<td>5.7</td>
<td>24,009</td>
<td>22,568</td>
<td>1,441</td>
<td>2,182</td>
<td>381</td>
</tr>
<tr>
<td>La Caja</td>
<td>Matehuala</td>
<td>8</td>
<td>49</td>
<td>6.1</td>
<td>17,637</td>
<td>16,226</td>
<td>1,411</td>
<td>2,231</td>
<td>460</td>
</tr>
<tr>
<td>El Cuarejo Cedral</td>
<td>Cedral</td>
<td>7</td>
<td>45</td>
<td>6.4</td>
<td>17,893</td>
<td>16,640</td>
<td>1,253</td>
<td>2,555</td>
<td>398</td>
</tr>
<tr>
<td>Encarnación de Abajo</td>
<td>Matehuala</td>
<td>8</td>
<td>41</td>
<td>5.1</td>
<td>22,542</td>
<td>16,005</td>
<td>6,537</td>
<td>2,818</td>
<td>550</td>
</tr>
<tr>
<td>La Gavía</td>
<td>Matehuala</td>
<td>3</td>
<td>32</td>
<td>10.6</td>
<td>13,156</td>
<td>9,474</td>
<td>3,682</td>
<td>4,385</td>
<td>411</td>
</tr>
<tr>
<td>El Milagro</td>
<td>Guadalcázar</td>
<td>10</td>
<td>80</td>
<td>8.0</td>
<td>29,283</td>
<td>17,277</td>
<td>12,006</td>
<td>2,928</td>
<td>366</td>
</tr>
<tr>
<td>Norias del Refugio</td>
<td>Guadalcázar</td>
<td>9</td>
<td>49</td>
<td>5.3</td>
<td>17,675</td>
<td>16,801</td>
<td>874</td>
<td>1,969</td>
<td>360</td>
</tr>
<tr>
<td>Palo Blanco V. de Gpe.</td>
<td>Matehuala</td>
<td>8</td>
<td>58</td>
<td>7.3</td>
<td>23,798</td>
<td>21,140</td>
<td>2,658</td>
<td>2,974</td>
<td>410</td>
</tr>
<tr>
<td>Pastoriza</td>
<td>Matehuala</td>
<td>9</td>
<td>47</td>
<td>5.2</td>
<td>22,038</td>
<td>18,392</td>
<td>3,646</td>
<td>2,449</td>
<td>469</td>
</tr>
<tr>
<td>La Pólvora Guadalcázar</td>
<td>8</td>
<td>44</td>
<td>5.5</td>
<td>17,377</td>
<td>14,597</td>
<td>2,780</td>
<td>2,172</td>
<td>396</td>
<td></td>
</tr>
<tr>
<td>Santa Rosa V. de Gpe.</td>
<td>Guadalcázar</td>
<td>4</td>
<td>26</td>
<td>6.5</td>
<td>8,640</td>
<td>8,035</td>
<td>605</td>
<td>2,160</td>
<td>332</td>
</tr>
<tr>
<td>Santa Teresa</td>
<td>V. de Gpe.</td>
<td>4</td>
<td>28</td>
<td>7.0</td>
<td>8,852</td>
<td>8,746</td>
<td>101</td>
<td>2,213</td>
<td>316</td>
</tr>
<tr>
<td>San Antonio de los Castillos V. de Gpe.</td>
<td>3</td>
<td>23</td>
<td>7.6</td>
<td>7,526</td>
<td>7,300</td>
<td>226</td>
<td>2,509</td>
<td>327</td>
<td></td>
</tr>
<tr>
<td>San Francisco</td>
<td>Matehuala</td>
<td>7</td>
<td>50</td>
<td>7.1</td>
<td>17,324</td>
<td>15,418</td>
<td>1,906</td>
<td>2,475</td>
<td>346</td>
</tr>
<tr>
<td>San José de la Peña</td>
<td>Matehuala</td>
<td>2</td>
<td>21</td>
<td>10.5</td>
<td>5,230</td>
<td>4,289</td>
<td>941</td>
<td>2,615</td>
<td>249</td>
</tr>
<tr>
<td>San Juan de los Guajes</td>
<td>Matehuala</td>
<td>8</td>
<td>38</td>
<td>4.8</td>
<td>18,254</td>
<td>16,246</td>
<td>2,008</td>
<td>2,282</td>
<td>480</td>
</tr>
<tr>
<td>Ejido</td>
<td>Municipio</td>
<td>Num. of families investigated</td>
<td>Total pop. of the families studied</td>
<td>Ave. family size</td>
<td>Yearly family income in ejido</td>
<td>Income in Pesos</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>------------------</td>
<td>---------------</td>
<td>------------------------------</td>
<td>-----------------------------------</td>
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<td>-------------------------------</td>
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<td>------------------------------</td>
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<td>------------------------</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Family income obtained from inside the ejido</td>
<td>Total Annual Family Income</td>
<td>Average Annual Income Per Family</td>
<td>Ave. annual Income per Family Member</td>
<td></td>
</tr>
<tr>
<td>San Juan sin Agua</td>
<td>Guadalcázar</td>
<td>6</td>
<td>40</td>
<td>6.7</td>
<td>13,803</td>
<td>13,803</td>
<td>----</td>
<td>2,300</td>
<td>345</td>
</tr>
<tr>
<td>Tanque Nuevo</td>
<td>Cedral</td>
<td>3</td>
<td>13</td>
<td>4.3</td>
<td>7,888</td>
<td>7,494</td>
<td>394</td>
<td>2,629</td>
<td>607</td>
</tr>
<tr>
<td><strong>TOTALS</strong></td>
<td></td>
<td><strong>118</strong></td>
<td><strong>747</strong></td>
<td><strong>6.3</strong></td>
<td><strong>292,925</strong></td>
<td><strong>250,451</strong></td>
<td><strong>42,474</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>PERCENTAGES AND AVERAGES</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>86%</td>
<td>14%</td>
<td>2,482</td>
</tr>
</tbody>
</table>

tutes most, if not all, of the 86%, a figure six times greater than that of monies derived from extra-ejido sources. The disposable income of rural families in the region is therefore primarily a function of the quantity of ixtle they sell during the course of a year. This income compares unfavorably with the remuneration derived from the agriculture, livestock raising, and other economic pursuits dominant in the remaining regions of San Luis Potosí (Table 13).

Table 13

Annual Family and Per Capita Incomes in San Luis Potosí, by Regions

<table>
<thead>
<tr>
<th>Region</th>
<th>Average Per Family</th>
<th>Average Per Capita</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Northeast (Zona Ixtlera)</td>
<td>2,482</td>
<td>392</td>
</tr>
<tr>
<td>2. State Capital area</td>
<td>3,630</td>
<td>481</td>
</tr>
<tr>
<td>3. Northwest</td>
<td>3,152</td>
<td>453</td>
</tr>
<tr>
<td>4. Central Area</td>
<td>5,293</td>
<td>953</td>
</tr>
<tr>
<td>5. Northern Huasteca</td>
<td>8,832</td>
<td>1,497</td>
</tr>
<tr>
<td>6. Southern Huasteca</td>
<td>4,449</td>
<td>711</td>
</tr>
</tbody>
</table>

Source: Aleman Aleman, 1966:70, 87, 111, 127, 143, 163.

The figures cited in preceding pages bear testimony to ixtlero impoverishment. But quantitative measures alone fail to convey effectively the harsh realities of day-to-day living in the ejidos of the Zona Ixtlera. Material culture, reflecting the absence of any significant disposable income, is humble and repetitive. As indicated previously, the typical ixtlero dwelling is a single-story, adobe structure with an earthen floor and flat-roof. On the periphery of
many ejidos, and widely dispersed throughout the surrounding countryside, are the crudely constructed jacales. Space is at a premium in both house types. The typical adobe dwelling has two rooms: a kitchen (*cocina*), and a combination bedroom-living room-storage room. Ixtlero families are large and residential crowding is common. On occasion I have shared the same 3 by 5 meter bedroom with three adults, four children, and assorted livestock.

In both the flat-roofed adobe and jacale house types, windows are few, or altogether lacking, and doors are crudely fashioned of loosely-fitted planks. Furniture is limited and unadorned. Indoor plumbing is absent. Electricity is available but its use is generally restricted to a single naked light bulb in each room of the house. Cooking is done over small pits located on a raised platform of adobe or fired brick.

The ixtlero diet is predictable and monotonous. Tortillas, beans, and chile are served at almost every meal. When not eaten alone or in combination with each other, these staples form the main ingredients of more complex meals, e.g., *meega* (day-old tortillas mixed with onions, tomatoes, and sausage), *chicales* (a spicy soup of maize kernels and barley leaves), or *blanquito* (a mixture of goat cheese, chile, and tomatoes). Eggs are periodically served but meat and milk are notable for their near-absence in the ixtlero diet. On rare occasions, a calf or kid is slaughtered in the ejido and small amounts of meat are distributed to village members.

Health problems in the Zona Ixtlera are among the most serious in all of Mexico. Malnutrition is commonplace. Many families eat two or less meals a day, and these are rarely nutritionally balanced.
Water is a limited resource in the drylands of north-central Mexico and its availability and quality affect the salubrity of the rural populace. The few surface streams and artificial reservoirs are shared by humans and animals, and water is often contaminated. In the general absence of surface water, wells are the major source of drinking water. (agua potable). But during lengthy periods of drought the water table drops and village residents are compelled to either seek water elsewhere or conserve locally available supplies. Under such circumstances the limited water from whatever source is recycled, and less essential water needs (e.g., personal hygiene and clothes-washing) are disdained. Sanitary conditions deteriorate and the possibilities for disease are enhanced.

Ixtleros are plaqued with a host of physical maladies. Measles, parasitosis, whooping cough, bronchitus, and typhus are common (Campos Rocha, 1961:34). Tuberculosis is especially prevalent. Additionally, certain ailments are endemic to the Zona Ixtlera. Caustic substances in Agave lecheguilla leaves cause skin irritation, and an illness referred to as "mal de ixtlero," whose symptoms include a painful back, fatigue, and loss of appetite, is widespread among ixtle collectors (Seguridad y Solidaridad Social, 1975:19). 7 The gravity of illness in ixtlero communities is exacerbated by the absence of resident medical personnel and facilities. During 1970, for example, Cedral and Villa de Guadalupe, two of the major ixtle-producing municipios in San Luis Potosí, had a combined population of 25,000 and no doctors (Partido Revolucionario Institucional, 1976:49).

A random sampling of fiber-producing municipios reveals that in 1970 the literacy rate among ixtleros was 70% (Secretaría de Industria
It is difficult to test the validity of this figure, but personal experience leads me to suspect that it may be too high. Primary schools (grades one through six) exist in most ixtlero communities, but the learning process is hampered by the economic realities of the Zona Ixtlera. Attendance is often only one-third to one-half of official enrollment. Absenteeism is most pronounced during April and May when adults work the agricultural plots and children become full-time surrogate gatherers. By the age of eight or nine, most ixtlero children are considerably more adept at defibering lechuguilla and palma samandoca leaves than they are at reading and writing. Many never complete their primary education because of the exigencies of day-to-day living, and fewer still pass on to secondary school.

By most socio-economic criteria, ixtleros rank among the poorest people in Mexico. Residents of the Zona Ixtlera are undernourished, poorly educated, inadequately housed, and lacking in basic medical services. Most ixtleros live in communities far removed from major highways and urban centers. Their sole link to the "outside" world is invariably a third-class, dirt or gravel road (brecha) that is bone-jarring to travel during dry periods and impassable when infrequent rains occur. To the outsider, residence in an ixtlero community conveys an inescapable sense of isolation. The vastness of the surrounding drylands envelops one during the day and imputes a pervasive sense of desolation at night. It is doubtless this sense of isolation, of being frozen in time and space, that contributes to the exodus of many young people from the ejidos.
While ixtleros are confronted with numerous social problems, it is their economic plight that is most readily apparent. Even a casual visitor to an ixtlero community cannot remain oblivious to the flimsily constructed homes, the shabby attire, and the other elements of a material culture that visibly attest to the indigence of the population. During extended drought periods, the poverty of these people is manifest beyond the confines of their community by the presence of women and children begging alongside the major highways of north-central Mexico.

The Government Response to Indigence in the Zona Ixtlera

Living conditions in the Zona Ixtlera have not gone unnoticed by either individual researchers or the Mexican government. During the 1960's, publications with titles such as Hambre and Problemas de las Zonas Ixtleras, deplored the ixtlero's low standard of living. In recent years, government concern for depressed regions such as the Zona Ixtlera has resulted in the creation of agencies and programs designed to promote economic and social development in these areas. Particularly notable because of its relevance to the Zona Ixtlera is the creation of the Comisión Nacional de las Zonas Aridas (CONAZA) in December, 1970. CONAZA is charged with the responsibility of compiling and evaluating information pertinent to Mexico's arid zones, inventorying its natural and human resources, and, in conjunction with other government agencies, initiating and implementing programs that will improve socio-economic conditions in the region (Comisión Nacional de las Zonas Aridas, 1974:1).  

CONAZA's development projects are divided into three broad categories: infrastructure, social development, and productive businesses.
Under the rubric of the last-named category, projects designed to improve or maximize utilization of arid zone resources have been initiated with the ultimate goal of raising income levels among dryland inhabitants. Experiments with high-yielding varieties of dryland crops, water conservation, pasture improvement, and the utilization of uncultivated desert plants are conducted in four field camps under the guidance of personnel from the Universidad Autónoma Agraria "Antonio Narro" (UAAAN), located at Buenavista, Coahuila.

CONAZA's task is a demanding one. It has been charged with the responsibility of resolving the entire spectrum of social and economic ills in the arid zones of the nation. Thus far, the commission has directed its efforts toward the accumulation of data gleaned from the experimental projects conducted at the field camps.

CONAZA represents a comprehensive attempt to confront the problem of Mexico's arid zones, of which the Zona Ixtlera constitutes a sizable portion. Other government agencies, private companies, and individual citizens are dealing with specific social and economic issues relevant to the Zona Ixtlera. IMSS has constructed medical facilities in the region designed for the express purpose of ministering to ixtlero health needs. Under its "Programa Solidaridad Social - Plan Ixtlero," seven hospital-clinics were constructed between 1971 and 1976, and two others are nearing completion. The hospital-clinics are modern, fully-staffed units that provide the entire range of essential medical services, including surgery, pre- and post-natal care, and dental work. Medicine and health-care services are free to ixtlero families whose head contributes 10 working days a year to public work projects (La Forestal, 1976:168).
Education in the Zona Ixtlera has not been neglected. During 1975, 130 primary schools were in various stages of construction in ejidos of the Zona Ixtlera. Additionally, the Secretaría de Educación Pública (SEP) recently initiated a series of vocational-technical programs in rural secondary schools. Students are trained to live and work in the countryside for three years at the Escuela Tecnología Agropecuario (ETA), and an additional two years at a Centro de Estudio Tecnología-Agropecuario (CETA) (personal interview with Manual Laborde, May 17, 1976). The ETA-CETA program is designed to return trained youths to their native rural habitats where they can transmit the latest in modern agricultural techniques to their families and neighbors.

Government efforts to alleviate deficiencies in physical infrastructure are visible throughout the region. Under the auspices of the Secretaría de Obras Públicas (SOP), nearly 7,000 km of new roads were constructed in the Zona Ixtlera between 1971 and 1975 (La Forestal, F.C.L., 1976:179). SOP has also been active in the construction of hundreds of small dams and catchment basins in the area. Public works constructed by the Comisión Constructora e Ingeniería Sanitaria (CCIS) of the Secretaría de Salubridad y Asistencia provide the bulk of drinkable water in ixtlero settlements. Other CCIS projects include the construction of community laundries and baths. Conspicuous by its modern appearance is the local cooperative, the economic and social center of every ejido. La Forestal and CONASUPO had jointly erected 115 of these stores by 1971. Four years later, 700 were in operation (La Forestal, F.C.L., 1975:n.p.). The Instituto Nacional Para el Desarrollo de la Comunidad Rural y de la Vivienda Popular (INDECO) has been active in ejido construction on two fronts. Under its "Planix"
or "Plan Nacional Ixtlero," 70 "centros comunales ixtleros" (ixtlero community centers) were either completed or under construction as of August, 1975 (Instituto Nacional Para el Desarrollo de la Comunidad Rural y de la Vivienda Popular, 1975:63). The community center is envisioned as a multi-functional structure that will provide the catalyst for greater ejido cooperation and organization. A second INDECO project involves the construction or restoration of individual dwelling units. This project is part of INDECO's "vivienda campesino" that is national in scope, and urban as well as rural. In the ejidos of the Zona Ixtlera, INDECO supplies technical information and building materials for the erection or rehabilitation of adobe homes. Labor is provided by the ixtleros. Whether new or rebuilt, the homes are easy to identify. They are invariably white-washed cement blocks that stand in marked contrast to the typical drab-brown adobe. The "viviendas campesino" program in the Zona Ixtlera has been sporadically applied to date. Numerous ejidos in Coahuila have not been touched by the project, while in the municipio of Tula, Tamaulipas, 479 units have been built or restored in only eight ejidos (personal interview with Arturo Carlos Sepúlveda, June 17, 1976).

Many government agencies and private companies are actively engaged in attempts to alleviate the economic woes of the Zona Ixtlera. In fact, within the context of "socio-economic" development, it is the ixtlero's economic plight that has attracted the greatest attention. Most government and private planners have concluded that the social fabric of the people can only improve if it is preceded by a higher standard of living. In concert with this philosophy, there currently exists a plethora of development schemes on drafting tables or in the
experimental stage. There is a recurring theme in these projects, i.e.,
that the economic development of the Zona Ixtlera is predicated upon
a more extensive and efficient utilization of existing dryland re-
sources. In the field camps of CONAZA - UAAAN and other organiza-
tions, attempts to maximize the use of arid and semi-arid lands have
been directed along four major lines of inquiry: (1) control of water
for the irrigation of arid lands, (2) the transfer of lands to dryland
agriculture, (3) the gathering of useful products from native vegetation,
and (4) production of livestock (Hernández X., 1970:319). Most of the
work has been concentrated on uncultivated plant production. The abun-
dance of native vegetation, its minimal exploitation to date, and the
commercial success of ixtle, candelilla, and nopal cardón, has provoked
an intense interest in developing the economic potential of these plants.
CONAZA has experimented with palma china, palma pita (Yucca treculeana),
nopal cardón, garambullo, and cortadillo (Nolina microcarpa); and INIF
and ITESM have conducted field studies on an equally wide array of wild
plant species. In some instances, the plants have been cultivated and
tested under controlled conditions.

The work on palma china is particularly noteworthy because many
anticipate that its exploitation will provide a viable source of income
for the campesinos of the region. A high cellulose content in the
plant's trunk and the potential it offered as a paper source initially
attracted the attention of researchers to palma china. (Hernandez
Corzo, 1955:186). Recently, the nutritional and medicinal properties
of the dátil have generated enough interest to warrant the construction
of pilot factories by both CONAZA and INDECO. At the CONAZA plants
in Saltillo, Coahuila, and Galeana, Nuevo León, steroids used in drug
manufacture are extracted from dátiles and processed. The steroids have a potential use in contraceptives and as hormone-like drugs. INDECO's experimental plant in Mazapil, Zacatecas, was scheduled to commence operations in January, 1977. Dátiles of palma china and palma samandoca will be processed and converted into domestic cattle feed and/or molasses destined for foreign markets. INDECO anticipates that similar operations will commence throughout the Zona Ixtleri in the near future. Each will serve as an economic focal point to which ixtleros will transport and sell the dátiles they have collected.

The palma china programs seek to raise the ixtlero's standard of living by offering a more lucrative alternative to ixtle-gathering. CONAZA estimates that a single factory operating at capacity will generate a demand for 900 full-time dátil collectors, and that employment will increase ten fold if the exploitation of palma china is maximized throughout the Zona Ixtleri (Centro Nacional de Investigación para el Desarrollo de Zonas Aridas, 1972:66). During the four-month harvest period, an estimated six million pesos will be paid to the harvesters (Canales, 1973:4).

Many other plants are envisioned as having new or accelerated commercial uses that will ameliorate ixtlero living standards. An industrial plant established at El Catorce, near San Luis Potosí City, is manufacturing floorboards made from mezquite (Hernández X., 1970:336). Mezquite also produces a gum comparable to "goma arábiga," and its fruit averages 30% glucose, making it potentially useful as a cattle feed, or in the preparation of ethylene alcohol (Medellín-Leal, n.d.:2). Experiments conducted by the National School of Chemical
Sciences at the Universidad Nacional Autonoma de Mexico (UNAM) demonstrate that nopal, source of the well-known queso de tuna, has the potential to produce alcohol of a reasonable quality. Both *Agave lecheguilla* and *Yucca carnerosana* have a commercial potential beyond that of the fiber they produce. An experimental CNIZA project ("Proyecto Prefabricados") has verified the feasibility of converting dead trunks of palma samandoca and other plentiful yucca species into wall panels, acoustical ceilings, room dividers, and ornamental objects. The conversion process, which can be effected by campesinos within their own communities, involves the reduction of plant trunks to sawdust and the subsequent placement of a saw-dust latex mixture into molds.16 *Agave lecheguilla* contains chemical substances of the steroid group that can be used in the manufacture of hormone-like drugs. The juice and pulpy parts of lechuguilla leaves supply the steroid smilagenin which can be converted into cortisone and used in the treatment of rheumatic, arthritic, and other types of ailments. Another new drug that can be fabricated from the lechuguilla steroid is halotestin. It shows promise in treating diseases of older people involving unsatisfactory protein metabolism (Anon., 1957:7). Aside from the humanitarian benefits to be gained from the exploitation of lechuguilla for drug purposes, using the plant for its steroid content is much more lucrative economically than using it as a source of fiber. An anonymous author of the mid-1950's compared the commercial value of fiber and steroids and concluded:
"A ton of freshly harvested lechuguilla leaves may yield as much as 200 pounds of fiber, worth $20 or possibly more. But the same amount of the green plant can supply 7 to 8 pounds of steroid chemicals, and at the estimated value of $25 a pound they would be worth $175 to $200."
(Anon., 1957:7)

Despite the medicinal and economic advantages associated with exploiting lechuguilla for its steroid content, no practical measures to do so have ever been initiated.

Most suggestions for raising the living standards of inhabitants in the Zona Ixtlera have emphasized the development, utilization, or more efficient exploitation of the plant resource base. Fewer studies and pilot programs explore the potential for increasing animal quality and productivity in the region. It is ironic that despite the long history of animal husbandry in northern Mexico, the scrub vegetation and semi-arid grasslands of the Zona Ixtlera support a low-yielding livestock population marked by a preponderance of goats and an absence of modern scientific techniques. Thus far, attempts to alleviate these conditions have focused on range improvement and controlled grazing practices. Studies on the yields and nutritional value of forage crops are being conducted in the field camps of CONAZA, INIF, and ITESM. CONAZA has also embarked on a "Programa Caprino" in seven ixtlero ejidos with the goal of maximizing the output of goat products via a system of fencing and regulated grazing (personal interview with José Luis Hernández Padilla and Víctor Samuel Peña Olvera, July 14, 1976)."
The research with goats reflects the dominance of this animal throughout the Zona Ixtlera.\textsuperscript{18} Current demands for cabrito in marketplaces such as Monterrey and Saltillo provide a profitable outlet for ixtleros. Efficient methods of range and animal management can only enhance the economic position of the rural campesino.

One of the most heavily publicized development programs for the Zona Ixtlera is La Forestal's "Programa Cunicultura." This project has a two-fold purpose: ejido-raised rabbits will add protein to the ixtlero diet and concomitantly generate income via their sale to ixtlero-operated restaurants. The program commenced in 1971 with 100 New Zealand White rabbits. By 1975, 70,000 rabbits were being raised in 320 "Centros Cunicolas Ejidales," slaughterhouses in Castaños, Coahuila, and Dr. Arroyo, Nuevo León, and a scientific breeding farm in Saltillo were in operation, courses in rabbit-raising were being conducted in ixtlero communities, ejido workshops in tanning and producing artistic items had been established, and the restaurant "El Conejo Ixtlero," located near the city of Matehuala, had opened for business (La Forestal, F.C.L., 1975:n.p.). A second restaurant commenced operating near the city of Arteaga, Coahuila in mid-1976. On April 20 of the same year, president-elect José López Portillo dedicated the cornerstone of a building devoted to rabbit research on the campus of UAAAN.
1 Depending on the criteria employed, 40% (Comisión Nacional de las Zonas Aridas, n.d.:1) to over 80% (García Quintero, 1955:43) of Mexico's national territory is classified as arid and semi-arid. Despite adverse environmental conditions, these zones support approximately one-half of the nation's inhabitants (Beltrán, 1964b:421).

2 The population of the eight municipios in 1973 was 130,412, a per annum growth rate of 2.0%. By contrast, the annual population growth rate for the nation was 3.5% between 1970 and 1975.

3 The 3.2% of arable land in the ejidos of the Zona Ixtlera region is the lowest of the six regions. Percentages of cultivable land in ejidos of the remaining regions are: state capital area, 15.0%; the northwest, 7.3%; the central region, 19.3%; northern Huasteca, 21.0%; southern Huasteca, 30.7% (Alemán Alemán, 1966:64, 80, 122, 138, 154).

4 A thorough description of the form and function of this house-type is provided by West (1974:111-132).

5 During 1976 the Departamento de Nutrición of the Dirección General de Servicios Coordinados de Salud Pública conducted a survey of nutrition in Coahuila. Five "geoeconomic" zones were delimited in the state. Zone I includes the municipios of Arteaga, General Cepeda, Parras, Ramos Arizpe, and Saltillo, and is coincident with the core of Coahuila's Zona Ixtlera. According to the study, the habitual fare of residents in Zone I includes: breakfast - eggs, beans, tortillas, cookies, and coffee or tea; lunch - soup, chile, beans, tortillas, and coffee; supper - eggs, beans tortillas, and coffee or tea (Departamento de Nutrición, 1977:n.p.).

6 The frequency of meat consumption varies considerably from ejido to ejido in the Zona Ixtlera. I have lived in ejidos where meat was served an average of one to two times per week. De la Cerda's (1964:183) study of El Tajín (in the municipio of Dr. Arroyo, Nuevo León) revealed that community members eat meat only twice a year. In Alemán Alemán's work in San Luis Potosí, less than 1% of the families in the Zona Ixtlera ate meat as much as three times a week, and over 91% of the families did not consume meat at all. The intake of other protein sources was equally low: milk and eggs were absent from the weekly diets of 63% and 62% of the families respectively (Alemán Alemán, 1966:114-115).
A major by-line from the same publication reads: "El Drama del Ixtlero...Miseria, Ignorancia y Enfermedades Diezman al Campesino del Desierto" (p. 18).

For an impassioned description of ixtlero living conditions see Antonio Andrade, El Desierto Mexicano, n.d.:50-58.

In Mexico "illiteracy" is the inability to read or write Spanish. The standard minimum age for tabulating illiteracy was 10 from 1910 to 1930, and 6 thereafter (Wilkie, 1970:207). Information was obtained for eleven of the thirty-two major ixtle-producing municipios. The municipios, and their respective literacy rates: in San Luis Potosí, Catorce, 69.1%; Cedral, 67.9%; Ciudad de Maiz, 74.1% and Moctezuma, 65.0%; in Nuevo León, Dr. Arroyo, 70.7%; Tula, Tamaulipas, 75.6%; Saltillo, Coahuila, 88.1%; and in Zacatecas, Concepción del Oro, 57.4%; El Salvador, 68.6%; Melchor Ocampo, 72.7%; and Mazapil, 77.0%.

CONAZA's formation by no means heralded a sudden awareness of Mexico's arid zones. In fact, the problems and prospects of this vast region were the subject of publications and symposia for many years prior to 1970. Particularly notable are the monographs of the Instituto Mexicano de Recursos Naturales Renovables in 1955 and 1964, and the International Symposium on Increasing Food Production in Arid Lands convened in Monterrey in April, 1968, under the auspices of the International Center for Arid and Semi-Arid Land Studies.

The experimental field stations are located in Matehuala, San Luis Potosí; Mazapil, Zacatecas; Ocampo, Coahuila; and Cuencamé, Durango. CONAZA's affiliation with UAAAN dates back to the fall of 1971 when the Centro Nacional de Investigación Para el Desarrollo de Zonas Aridas (CNIZA) was organized as the investigative field branch of CONAZA and headquartered at the Escuela Superior de Agricultura "Antonio Narro," a branch campus of the University of Coahuila located near Saltillo. When Antonio Narro became autonomous in 1975, CNIZA was incorporated into the UAAAN structure and its title was dropped. Antonio Narro remains a major source of information for both the arid zones and the Zona Ixtlera. Many of its personnel have worked among the ixtleros, and since 1974 it has housed the Centro de Informacion para Zonas Aridas (CIZA).

Of the 41% of Mexico's national territory classified as "zonas aridas" by CONAZA, approximately one-third is commercially exploited for ixtle and candelilla (Comisión Nacional de las Zonas Aridas, n.d.:4).

The cost of building a dwelling varies from 12,000 to 15,000 pesos. Restoration expenses range from 6,000 to 7,000 pesos. In either case, the cost to the ixtlero is considerably less because he provides the labor (personal interview with Carlos Sánchez Morales, June 22, 1976).
A great deal of literature has appeared in recent years espousing this approach as a solution to the economic malaise of the region. See, for example, Borja L. and Castro, 1965; Canales, 1973; Galván, 1973; Giner Márquez, 1972; Hernández X., 1970; and Medellín-Leal, n.d.

In addition to the CONAZA - UAAAN camps, experimental stations located in or near the Zona Ixtlera are operated by the Instituto Nacional de Investigaciones Forestales (INIF) at La Sauceda, Ramos Arizpe, Coahuila, and El Cedral in San Luis Potosí state, and the Instituto Tecnológico y Estudios Superiores de Monterrey (ITESM) in the municipios of Apodaca, Nuevo León.

A 1964 inventory of native vegetation in north-central Mexico includes information on the total area occupied and the area exploited for several uncultivated plants. Included among the more significant economic species are:

<table>
<thead>
<tr>
<th>Species</th>
<th>Area in Km²</th>
<th>% of E/O</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nopal for forage</td>
<td>232,984</td>
<td>19.3</td>
</tr>
<tr>
<td>Candelilla</td>
<td>82,850</td>
<td>56.9</td>
</tr>
<tr>
<td>Yucca carnerosana</td>
<td>61,185</td>
<td>51.03</td>
</tr>
<tr>
<td>Agave lecheguilla</td>
<td>142,115</td>
<td>28.8</td>
</tr>
<tr>
<td>Opuntia streptacantha</td>
<td>38,335</td>
<td>49.3</td>
</tr>
<tr>
<td>Opuntia lecuotricha</td>
<td>52,750</td>
<td>12.4</td>
</tr>
<tr>
<td>Totals</td>
<td>610,219</td>
<td>31.1</td>
</tr>
</tbody>
</table>


The idea of using yucca trunks as prefabricated or ornamental material originated with Professor Arturo Fuentes Morales, a scientist and inventor who has worked among the ixtleros for many years. Professor Morales believes that the sawdust by-product has numerous utilitarian applications, including its use as a sole for the ubiquitous Mexican huarache (personal interview with Arturo Fuentes Morales, April 22, 1976).

The ejidos are located in the San Luis Potosí municipios of Matehuala, Cedral, and Villa de Guadalupe.

In 1960, goats outnumbered cows 2 to 1 and sheep 3 to 1 in the states of Nuevo León, San Luis Potosí, Coahuila, Tamaulipas, and Zacatecas (Secretaría de Industria y Comercio, 1965: various pages).
CHAPTER VII

SUMMARY AND CONCLUSIONS

The foregoing study has examined man-plant relationships and attendant socio-economic conditions in the Zona Ixtlera of north-central Mexico. Rural inhabitants of this arid and semi-arid environment have traditionally been sustained by wild vegetation native to the region. In contemporary ixtlero communities, plants and plant derivatives are an integral part of day-to-day living. They furnish food, drink and fiber to the populace, and are commonly used as construction materials, soap substitutes, and medicines. Additionally, the products of certain uncultivated dryland plants transcend local use and reach national and international markets. Extra-regional demands have fostered the commercial exploitation of candellila, guayule, lechuguilla and palma samandoca, and simultaneously provided campesinos with an important source of remuneration.

Of the plants indigenous to north-central Mexico, _Agave lecheguilla_ and _Yucca carnerosana_ are the foremost with respect to their utilitarian value and commercial significance. Derivatives of these two plants form an important part of ixtlero material culture, and money from the sale of lechuguilla and palma samandoca fiber is the single most important source of an ixtleros income. Indeed, the appellation "ixtlero" reflects the intimate bond that exists between campesino and the plants that produce ixtle fiber.
This study has focused on the Zona Ixtlera, an institutionally defined region that encompasses twenty million hectares in parts of the states of Coahuila, Nuevo León, San Luis Potosí, Tamaulipas, and Zacatecas. Within this area, as many as 125,000 ixtlero families collect and sell ixtle to La Forestal. While the gathering of ixtle is a folk tradition of long standing, the ixtlero-La Forestal association dates back only to 1941. Nevertheless, this relationship has had significant ramifications for contemporary socio-economic conditions in the Zona Ixtlera. La Forestal's absolute monopoly of ixtle purchase, processing, and export, insures that the economic orbit of the ixtlero is a closely circumscribed one. Water-deficit conditions in the Zona Ixtlera limit agriculture and restrict the number of viable income-generating options open to the ixtlero. In lieu of alternative economic pursuits, the ixtlero turns to the one constant in his environment, the gathering of ixtle, and in the absence of an open-market system, he is restricted to dealing with La Forestal. Ixtleros are subsequently functionally dependent upon La Forestal for a considerable part of their economic well-being. La Forestal in turn owes its continued existence to Mexican government subsidies and overseas market demands for ixtle. Economic linkages exist, therefore, between ixtleros and La Forestal, and La Forestal and foreign buyers, and decisions rendered by the latter have profound repercussions on the former. This "ripple" effect exemplifies the anthropological concept of a "complex society" in which smaller units are functionally dependent upon larger systems. In this case, the international market for ixtle acts as a catalyst for the continued operation of La Forestal, and ultimately, for a perpetuation
of the gathering economy in the Zona Ixtlera. Thus, in addition to the environmental conditions that reduce his income options, the ixtlero continues in the gathering tradition of his forebears because he is locked into a network of economic linkages that places a commercial value on the fiber extracted from lechuguilla and palma samandoca. The gathering of these and other plants may persist for yet another reason. As more than one government or university official stated to me, "es todo lo que saben" ("it is all they know").

Living in an ixtlero community quickly reveals the persistent association that exists between ixtleros and the plants lechuguilla and palma samandoca. The time devoted to gathering ixtle, the implements used to collect the fiber, and the material culture of community residents, are all visible manifestations of the deeply ingrained bond between man and these plants. Also visible is the poverty of the rural populace. Residents of the Zona Ixtlera are sustained by the drylands they live in, availing themselves of native vegetation and animal resources, and supplementing these by means of a limited livestock production and agriculture that is at best speculative, at worst a total loss. The meagerness of the products obtained results in the extremely poor living conditions so typical of the region. Recent government efforts have ameliorated this situation, but living standards remain low, health and education facilities continue sub-par, and physical infrastructure is such that accessibility to ixtlero communities is difficult.

Numerous factors enter into any assessment of future socio-economic conditions in the Zona Ixtlera. If one subscribes to the idea
that ixtle will continue as a major source of income for its rural residents, then the availability of lechuguilla and palma samandoca, and projected market demands for the fiber they produce, must be considered. To date, no comprehensive survey of wild plant resources in the Zona Ixtlera per se has been carried out. During the early 1960's, however, the Instituto Nacional de Investigaciones Forestales (INIF) was charged with the responsibility of conducting an inventory of useful species of native vegetation, their abundance, and distribution in the arid areas of Chihuahua, Coahuila, Durango, Zacatecas, San Luis Potosí, and Nuevo León. The inventory revealed that of the area occupied by *Agave lecheguilla* (142,115 km$^2$), only 28.8% (41,035 km$^2$) was being harvested. Slightly more than one-half (31,420 of 61,185 km$^2$, or 51.3%) of the available stands of *Yucca carnerosana* were being exploited (Marroquín, et al., 1964:162). These figures indicate that large untapped areas remain for the areal expansion of lechuguilla and palma samandoca harvesting. In areas of the Zona Ixtlera where the plants are already collected for commercial purposes, there does not appear to be any significant over-exploitation of the resource base. In fact, cutting the lechuguilla cogollo prolongs the life of the plant, and removing the centerstalks of both lechuguilla and palma samandoca is tantamount to pruning the plants. Instances of plant reduction do exist. The areal expansion of cultivable lands has frequently eliminated plants proximate to ixtlero settlements. Excessive browsing during periods of severe drought has likewise effected destruction of the vegetation in certain locales. Nevertheless, neither plant is in imminent danger of extinction. In the survey of native plant resources conducted by INIF, the investigators conclude that conservation measures for lechuguilla
are unnecessary because of the plant's rapid regenerative capabilities and the large areas over which it remains unexploited (Marroquín, et al., 1964:143).¹ INIF researchers do suggest that a program of artificial reproduction and controlled cutting of the slower-reproducing palma samandoca be initiated.

Although there is little concern about the future availability of Agave lecheguilla and Yucca carnerosana, the domestic and foreign market for ixtle in forthcoming decades is questionable. Ixtle's commercial history has been characterized by dramatic year-to-year fluctuations in production and export. Wars, depressions, government policies, and cartels have all effected irregularities in the industry at one time or another. Currently, synthetic fibers such as nylon offer increasingly strong competition for ixtle and other natural fibers. Plastic fiber substitutes have cost and productivity savings over ixtle in many applications. The increased automation of brush-making equipment operating at high speeds has also been detrimental to ixtle's utilization in that the relative uniformity of plastic fibers presents fewer production problems than their natural fiber equivalents. A final factor accounting for the heavy substitution of plastic fibers for natural fibers such as ixtle, has been the climatic, political, and economic variables in the countries of origin of natural fibers, and the attendant disruption of supply and quality occasionally encountered by brush manufacturers. Plastic-fiber substitutes for ixtle have made particularly strong inroads in the United States, long the world's leading importer of ixtle. The E.B. and A.C. Whiting Company of Burlington, Vermont, the major importer of the fiber into the United States, reported that its market, by weight, for ixtle is less than 20% of what it was
twenty-five to thirty years ago when there were no satisfactory alternatives to ixtle for a wide variety of industrial, household, and maintenance brushes (personal correspondence from Everett C. Bailey, October 8, 1976). The trend toward synthetic fibers in the United States and other international markets is reflected by the decline of ixtle de lechuguilla exports in recent years. Between 1960-1965, Mexico annually produced an average of 14,580 tons of ixtle de lechuguilla. For the 1966-1970 period, the yearly average declined to 12,067 tons (Banco Nacional de Comercio Exterior, S.A., 1971:545-546).

The domestic market for ixtle de palma has also experienced a decline in recent years. Within Mexico, ixtle de palma has commonly been used in the fabrication of rope, sacks of various capacities, and a diverse array of household items, including floor and place mats, and baby cradles. During the past decade, both natural and synthetic fibers have emerged as successful rivals of ixtle in the manufacture of these items. Cotton has supplanted ixtle in the manufacture of numerous cloth-like products, and the lower-priced, better quality hennequin is increasingly being substituted for ixtle in the making of sacks. Modern techniques in transporting and storing agricultural commodities are also adversely affecting the use of ixtle de palma. Ixtle sacks used as containers for rice, wheat, coffee, and a host of other foodstuffs, are being supplanted by tank trucks and storage silos (Banco de Comercio, S.A., 1969:40; 1970a:41-42.

Despite the contraction of domestic and foreign markets during the past few years, there are those who view the commercial future of ixtle with optimism. Authorities at both La Forestal and Fibras Saltillo believe that the market for ixtle will expand in coming years.
Fibras Saltillo confidently anticipates a growth rate of 25% in the next five years. These aspirations are predicated on the conviction that ixtle offers unique properties of strength and resistance to friction that insure its continued use in the manufacture of brushes. There is also a commonly held belief among La Forestal and Fibras Saltillo personnel that increasing fuel costs will eventually have an adverse effect on the synthetic industry, resulting in a revived interest in natural fiber production.

Even those who view the future market for ixtle with optimism concede that the campesinos who gather the fiber must turn to other economic pursuits to elevate their standard of living. The rash of development projects initiated in the Zona Ixtlera during the past ten years attests to a tacit recognition by government and private planners that the economic well-being of ixtleros does not lie with the gathering and sale of ixtle. But the Mexican government's approach to developing the Zona Ixtlera is disturbing on three counts. First, a comprehensive scientific inventory of the Zona Ixtlera's native resources is lacking. No survey of the region's flora, fauna, soil, hydrology, or mineral content exists per se. Consequently, without an adequate understanding of the Zona Ixtlera's resource base, planning programs cannot be effectively implemented. The recently created (1976) Natural Resources Department at the Universidad Autónoma Agraria Antonio Narro (UAAAN), near Saltillo, Coahuila, is in the incipient stages of formulating procedures for conducting comprehensive ecosystem studies of arid and semi-arid regions (Armijo T., Nava C., and Gasto C., 1976). Once developed, this type of study should be applied to the Zona Ixtlera. Second, a coordinated development plan for the Zona Ixtlera as a whole
does not exist. The number of government agencies that have embarked on projects in the region is impressive, but all too often they work independently of one another. INDECO, IMSS, CONASUPO, SEP, FONAFE, INIF, and La Forestal are all government-affiliated or sponsored organizations operating in the Zona Ixtlera, yet the degree of interaction between these agencies is minimal. Each pursues its own pet project, largely ignorant of what the others are doing. What is lacking is a single agency to coordinate the activities of these organizations. By so doing, a "Zona Ixtlera Regional Planning Commission" could effectively administer programs in an even-handed manner, curtail the unnecessary duplication of costs and services, and facilitate socio-economic developments in the region. 2 Perhaps formation of the Fondo Nacional de Fomento Ejidal (FONAFE) to coordinate efforts to improve conditions among the rural populace of the Zona Ixtlera and other northern drylands, represents a step in this direction. 3 Finally, government plans to develop the Zona Ixtlera often consist of little more than substituting the gathering of one native plant for another. Campesinos who harvest and sell ixtle lead a marginal economic existence. One can only conjecture how the collection and sale of palma china dátiles or other wild plants that are currently the focus of government development plans will markedly improve their standard of living.

Mexico's long and important tradition of desert-plant use remains deeply entrenched in the Zona Ixtlera. It is a tradition that is being perpetuated by government subsidization and tenuous international demands for ixtle. So long as desert plants and their derivatives provide an adequate income for those who gather and sell them, it is an occupation that should be continued. But in the Zona Ixtlera extant plant
resources cannot adequately sustain the burgeoning rural populace. Projects designed to perpetuate a gathering economy in the region tend to ignore this reality. Furthermore, they are oblivious to many of the social conditions that have fostered or exacerbated economic problems. In fact, economic conditions in the Zona Ixtlera can improve only if they are preceded by some significant social changes, the most fundamental of which has to do with population control. The Zona Ixtlera is a naturally adverse environment with a limited human carrying capacity. Population densities throughout most of the region are already too high, vis-à-vis the resource base, and additional increments will only place greater stress on the fragile ecosystem and further reduce living standards. In an environment in which the margin of tolerance is so finite that any error may have disastrous consequences, it becomes imperative to implement a program for regulating population. Certain self-regulating factors are already operating. Like their compatriots in other regions of Mexico, ixtleros are abandoning the countryside and moving to urban centers in search of a better life. Saltillo, San Luis Potosí, and other large cities in the Zona Ixtlera, or on its periphery, have grown rapidly in recent years as a consequence of in-migration, and this trend will no doubt continue in the future. Aside from the naturally occurring rural to urban migration, the government may have to institute, or at least encourage, family-planning programs in rural areas. In view of the strong Roman Catholic orientation of Mexico's campesinos, this will be no small task.

The dispersal of population in the Zona Ixtlera is yet another problem that will have to be resolved before meaningful economic development can take place. The very nature of a gathering economy
demands scattered populations, but provision of basic services to rural residents is severely hampered by this pattern of ixtlero settlement. Services could be more effectively provided and socio-economic developments facilitated if the number of communities was reduced and the population resettled into larger rural villages. In effect, such a resettlement scheme would employ a regional-planning strategy known as "growth pole," in which certain communities are selected as investment focal points on the basis of their potential for economic development.

One can speculate that social change must precede economic developments in the Zona Ixtlera if meaningful improvements in living conditions are to occur. But the direction economic development ultimately takes remains to be seen. Government officials and extension agents who work among the ixtleros concur that economic conditions in the Zona Ixtlera are bad, and that alternatives to the gathering and sale of ixtle must be initiated and promoted. The ixtleros themselves are receptive to change and have willingly accepted new ideas in the past. Yet they continue to gather fiber, and they continue to live an impoverished existence as a consequence of their gathering economy. In doing so, they emulate their forebears and perpetuate a centuries-long folk tradition. This time-honored and deeply-ingrained bond between man and plant resources in the Zona Ixtlera, sustained by the Mexican government, is destined to continue into the foreseeable future.
FOOTNOTES
Chapter VII

1 At least one authority on Mexico's dryland vegetation, botanist Jerzy Rzedowski (1973:6), has suggested that lechuguilla be cultivated. Rzedowski believes that the controlled planting and mechanical harvesting of ixtle will produce a more abundant and better-quality fiber.

2 The only comprehensive development scheme for the Zona Ixtlera to date is the Centro de Investigaciones Económicas plan for rehabilitating the Zona Ixtlera of Nuevo León (1963). Agricultural, horticultural, irrigation, stock-raising, and industrial projects are proffered for each of three regions included in the Zona Ixtlera of the state. Developmental stages and a cost analysis are also included.

3 FONAFE was created in 1972. It is financed from the sale of candelilla, guayule, and ixtle.
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Smith, Huron H.

Sorre, Max.

Squier, E. G.

Standley, Paul C.
Steward, J. H.  

Stretta, E. J. F., and P. A. Mosino A.  

Takáki, Francisco.  

Tamayo, Jorge L.  

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PERSONAL CORRESPONDENCE

### Communities, Ejidatarios, and Ixtle Production in the Zona Ixtlera of Coahuila

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<tr>
<th>Municipio</th>
<th>Communitites</th>
<th>Ejidatarios dedicated to Ixt.-Lech</th>
<th>Ejidatarios dedicated to Ixt.-Palma</th>
<th>Production 1968 kg</th>
<th>Production 1972 kg</th>
<th>Municipio Prod. Per km²</th>
<th>Area km²</th>
<th>1968</th>
<th>1972</th>
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<tbody>
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<td>Arteaga</td>
<td>36</td>
<td>13</td>
<td>20</td>
<td>234</td>
<td>660</td>
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<td>102,429</td>
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<tr>
<td>Castaños</td>
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<td>2</td>
<td>13</td>
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<td>453</td>
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<td>General Cepeda</td>
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<td>1,772</td>
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<td>40</td>
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<td>102</td>
<td>42</td>
<td>50</td>
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<td>132</td>
<td>1,273,580</td>
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<td>60</td>
<td>75</td>
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<td>NI</td>
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<td>79</td>
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<td>San Pedro</td>
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<td>52,100</td>
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<td>Cuatrociénegas</td>
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<td>NI</td>
<td>0</td>
<td>170</td>
<td>0</td>
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<tr>
<td>Ocampo</td>
<td>NI</td>
<td>NI</td>
<td>NI</td>
<td>0</td>
<td>163</td>
<td>60,000</td>
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<tr>
<td>Totals</td>
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<td>188</td>
<td>238</td>
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<td>6,493,011</td>
<td>3,532,241</td>
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<td></td>
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</tbody>
</table>

3: Quillares Lona, 1971. Also includes one community each in the municipios of Monclova and Progresso.
5: Quillares Lona, 1971. Figures are for "Annual Production of Ixtle."
6: Comisión Nacional de las Zonas Aridas, 1975. Figures are for "Production of Lechuguilla and Palma."
7: NI - No Information
# APPENDIX I - B

Communities, Ejidatarios, and Ixtle Production in the Zona Ixtlera of Nuevo León

<table>
<thead>
<tr>
<th>Munícipios</th>
<th>Communities</th>
<th>La Forestal</th>
<th>CONAZA</th>
<th>Q.L.</th>
<th>Ejidatarios dedicated</th>
<th>Production</th>
<th>Municipio Prod. Per</th>
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<tr>
<td></td>
<td></td>
<td>1</td>
<td>^2</td>
<td></td>
<td>Ixt.-Lech</td>
<td>Ixt.-Palma</td>
<td>1968</td>
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<tr>
<td>Aramberri</td>
<td>51</td>
<td>33</td>
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<td>898</td>
<td>730,463</td>
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<td>94</td>
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<td>4,254,470</td>
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<td>3,627,350</td>
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<td>125</td>
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<td>118,200</td>
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<td>164.4</td>
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<td>13</td>
<td>941</td>
<td>611</td>
<td>428,300</td>
<td>1,168</td>
<td>366.5</td>
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<td>Mina</td>
<td>22</td>
<td>9</td>
<td>228</td>
<td>50</td>
<td>145,483</td>
<td>3,916</td>
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<td>255</td>
<td>0</td>
<td>124,692</td>
<td>672</td>
<td>185.6</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>--</td>
<td>--</td>
</tr>
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<td>Villa de García</td>
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<td>400</td>
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<td>392,726</td>
<td>853</td>
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<td>Zaragoza</td>
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<td>NI</td>
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<td>7,457</td>
<td>8,420,879</td>
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^1 La Forestal, F.C.L., 1976.
^3 Quillares Lona, 1971. Also includes one community in the municipio of Hidalgo.
^4 Quillares Lona, 1971.
^5 Quillares Lona, 1971. Figures are for "Annual Production of Ixtle."
^6 Comisión Nacional de las Zonas Aridas, 1975. Figures are for "Production of Lechuguilla and Palma."
^7 NI - No Information.
## APPENDIX I - C

Communities, Ejidatarios, and Ixtle Production in the Zona Ixtlera of San Luis Potosí

<table>
<thead>
<tr>
<th>Municipios</th>
<th>Communities</th>
<th>Ejidatarios dedicated to</th>
<th>Production kg</th>
<th>Municipio Prod. Per Area km²</th>
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<tbody>
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<td>Catorce</td>
<td>22</td>
<td>22</td>
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<td>Cedral</td>
<td>28</td>
<td>28</td>
<td>22</td>
<td>1,406</td>
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<td>13</td>
<td>13</td>
<td>13</td>
<td>919</td>
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<td>Charcas</td>
<td>58</td>
<td>62</td>
<td>14</td>
<td>735</td>
</tr>
<tr>
<td>Guadalcázar</td>
<td>38</td>
<td>38</td>
<td>38</td>
<td>3,339</td>
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<tr>
<td>Matehuala</td>
<td>45</td>
<td>45</td>
<td>30</td>
<td>1,960</td>
</tr>
<tr>
<td>Vanegas</td>
<td>19</td>
<td>19</td>
<td>18</td>
<td>1,139</td>
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<td>Venado</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>348</td>
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<td>V. de Guadalupe</td>
<td>31</td>
<td>33</td>
<td>20</td>
<td>1,669</td>
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<td>V. de la Paz</td>
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<td>5</td>
<td>5</td>
<td>220</td>
</tr>
<tr>
<td>V. de Hidalgo</td>
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<td>5</td>
<td>6</td>
<td>746</td>
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<td>Cerritos</td>
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<td>0</td>
<td>0</td>
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<td>Totals</td>
<td>269</td>
<td>275</td>
<td>182</td>
<td>13,712</td>
</tr>
</tbody>
</table>

---

1.*La Forestal, F.C.L., 1976.*

2.*Comisión Nacional de las Zonas Aridas, 1975.*

3.*Quillares Lona, 1971. Also includes two communities in the municipio of Villa de Ramos and one in the municipio of Moctezuma.*

4.*Quillares Lona, 1971.*

5.*Quillares Lona, 1971. Figures are for "Annual Production of Ixtle."

6.*Comisión Nacional de las Zonas Aridas, 1975. Figures are for "Production of Lechuguilla and Palma."

Also includes Moctezuma, 12,202 kg.
## APPENDIX I - D

Communities, Ejidatarios, and Ixtle Production in the Zona Ixtlera of Tamaulipas

<table>
<thead>
<tr>
<th>Municipios</th>
<th>Communities</th>
<th>Ejidatarios dedicated to Ixt.-Lech</th>
<th>Ejidatarios dedicated to Ixt.-Palma</th>
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<td>La Forestal</td>
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<td>Q.L. 3</td>
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<td>Bustamante</td>
<td>27</td>
<td>27</td>
<td>17</td>
</tr>
<tr>
<td>Jaumave</td>
<td>39</td>
<td>39</td>
<td>32</td>
</tr>
<tr>
<td>Miquihuan</td>
<td>NI 7</td>
<td>9</td>
<td>7</td>
</tr>
<tr>
<td>Palmillas</td>
<td>NI 1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Tula</td>
<td>NI 37</td>
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<td>Totals</td>
<td>66</td>
<td>113</td>
<td>81</td>
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</table>

1La Forestal, F.C.L., 1976.
3Quillares Lona, 1971. Includes one community in the municipio of Victoria.
4Quillares Lona, 1971.
5Quillares Lona, 1971. Figures for "Annual Production of Ixtle."
6Comisión Nacional de las Zonas Aridas, 1975. Figures are for "Production of Lechuguilla and Palma."
APPENDIX I - E

Communities, Ejidatarios, and Ixtle Production in the Zona Ixtlera of Zacatecas

<table>
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<th>Municipios</th>
<th>La Forestal</th>
<th>CONAZA</th>
<th>Q.L.</th>
<th>Communities</th>
<th>Ejidatarios dedicated to</th>
<th>Production kg</th>
<th>Municipio Prod. Per km²</th>
<th>1968</th>
<th>1972</th>
<th>Area km²</th>
<th>1968</th>
<th>1972</th>
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<tr>
<td>Con. del Oro</td>
<td>NI 7</td>
<td>22</td>
<td>18</td>
<td>1,226</td>
<td>729</td>
<td>743,780</td>
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<td>373.6</td>
<td>361.5</td>
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<tr>
<td>Melchor Ocampo</td>
<td>NI 4</td>
<td>12</td>
<td>390</td>
<td>386</td>
<td>763,512</td>
<td>1,382</td>
<td>552.5</td>
<td>94.5</td>
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<td>850.5</td>
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## APPENDIX II

### MUNICIPIO AND STATE PRODUCTION OF IXTLE IN THE ZONA IXTLERA, 1970 and 1973

#### 1970

<table>
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<tr>
<th>State</th>
<th>Municipio</th>
<th>Ixtle de Palma kg</th>
<th>Ixtle de Lechuguilla kg</th>
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<td>Coahuila</td>
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<td>7,000</td>
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<td>14,040</td>
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<td>Cuatrociénergas</td>
<td>36,000</td>
<td>None</td>
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<td></td>
<td>General Cepeda</td>
<td>30,000</td>
<td>341,355</td>
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<td></td>
<td>Ocampo</td>
<td>59,200</td>
<td>1,150</td>
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<td>Parras</td>
<td>612,722</td>
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<td>Ramos Arizpe</td>
<td>10,000</td>
<td>590,000</td>
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<td></td>
<td>Saltillo</td>
<td>429,247</td>
<td>467,347</td>
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<td>San Pedro</td>
<td>144,400</td>
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<td></td>
<td>Torreón</td>
<td>None</td>
<td>12,000</td>
</tr>
<tr>
<td></td>
<td>Viesca</td>
<td>30,000</td>
<td>2,200</td>
</tr>
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<td></td>
<td><strong>Totals</strong></td>
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<td><strong>2,055,340</strong></td>
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<td>306,625</td>
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<td>Doctor Arroyo</td>
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<td>387,848</td>
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<td>Galeana</td>
<td>131,200</td>
<td>92,000</td>
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<td>García</td>
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<td>Gen. Zaragoza</td>
<td>2,330</td>
<td>18,710</td>
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<td>Mier y Noriega</td>
<td>1,528</td>
<td>28,874</td>
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<td>Mina</td>
<td>None</td>
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<td>Santiago</td>
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<td>Ixtle de Lechuguilla kg</td>
</tr>
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<td>--------------------</td>
<td>-------------------</td>
<td>-------------------------</td>
</tr>
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<td>Tamasopo</td>
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<td>Tampacan</td>
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<td>None</td>
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<td>El Salvador</td>
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\(^1\)Secretaría de Industria y Comercio, 1975: Table 13.
### 1973

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<th>State</th>
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<th>Fibras Palmas(^3)</th>
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<td>Galeana</td>
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<td>García</td>
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<td>Gen. Zaragoza</td>
<td>None</td>
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</tr>
<tr>
<td></td>
<td>Mier y Noriega</td>
<td>175,000</td>
<td>150,000</td>
</tr>
<tr>
<td></td>
<td>Mina</td>
<td>None</td>
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<td>Matehuala</td>
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<td>Vanegas</td>
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<td>V. de Guadalupe</td>
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<td><strong>Totals</strong></td>
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<td>Jaumave</td>
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<td>300,000</td>
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<tr>
<td></td>
<td>Miquihuana</td>
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<td>200,000</td>
</tr>
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<td>Nuevo Morelos</td>
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<td></td>
<td>Tula</td>
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<td><strong>Totals</strong></td>
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<td><strong>800,000</strong></td>
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<td><strong>7,300,133</strong></td>
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\(^3\)For Nuevo León, San Luis Potosí, and Zacatecas the title used is "Fibras Palma Barreta."
## APPENDIX III

### AGENCIAS RECOFILADORAS IN THE ZONA IXTLEA

<table>
<thead>
<tr>
<th>State</th>
<th>Location of the Agencia Recopiladora</th>
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<tbody>
<tr>
<td>Coahuila</td>
<td>1. Bahan</td>
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<tr>
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<td>2. Castaños</td>
</tr>
<tr>
<td></td>
<td>3. Frausto</td>
</tr>
<tr>
<td></td>
<td>4. General Cepeda</td>
</tr>
<tr>
<td></td>
<td>5. Ocampo</td>
</tr>
<tr>
<td></td>
<td>6. Paredon</td>
</tr>
<tr>
<td></td>
<td>7. Parras</td>
</tr>
<tr>
<td></td>
<td>8. Saltillo</td>
</tr>
<tr>
<td>Nuevo León</td>
<td>1. Aramberri</td>
</tr>
<tr>
<td></td>
<td>2. Ascención</td>
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<tr>
<td></td>
<td>3. Doctor Arroyo</td>
</tr>
<tr>
<td></td>
<td>4. Galeana</td>
</tr>
<tr>
<td></td>
<td>5. La Huasteca</td>
</tr>
<tr>
<td></td>
<td>6. Mier y Noriega</td>
</tr>
<tr>
<td></td>
<td>7. Mina</td>
</tr>
<tr>
<td></td>
<td>8. Rayones</td>
</tr>
<tr>
<td></td>
<td>9. Rinconada</td>
</tr>
<tr>
<td></td>
<td>10. Villa de García</td>
</tr>
<tr>
<td></td>
<td>11. Zaragoza</td>
</tr>
<tr>
<td>San Luis Potosí</td>
<td>1. Catorce</td>
</tr>
<tr>
<td></td>
<td>2. Cedral</td>
</tr>
<tr>
<td></td>
<td>3. Charcas</td>
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<td>6. Vanegas</td>
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<td></td>
<td>7. Villa de Guadalupe</td>
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<tr>
<td>Tamaulipas</td>
<td>1. Jaumave</td>
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<td>2. Miquihuana</td>
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<td>Zacatecas</td>
<td>1. Concepción del Oro</td>
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<tr>
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</tbody>
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# APPENDIX IV

## INDEX OF PLANTS CITED IN DISSERTATION

<table>
<thead>
<tr>
<th>Common Name</th>
<th>Botanical Name</th>
<th>Family</th>
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<tbody>
<tr>
<td>azafrancillo</td>
<td>Buddleia marrubiifolia Benth.</td>
<td>Loganiaceae</td>
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<tr>
<td>babassú palm</td>
<td>Orbignya martiana Barb.-Rodr.</td>
<td>Palmaceae</td>
</tr>
<tr>
<td></td>
<td>Orbignya oleifera Burret</td>
<td>Palmaceae</td>
</tr>
<tr>
<td>biznaga</td>
<td>Echinocactus visnaga Hooker</td>
<td>Cactaceae</td>
</tr>
<tr>
<td>Brazil nut</td>
<td>Bertholletia excelsa Humb. &amp; Bonpl.</td>
<td>Lecythidaceae</td>
</tr>
<tr>
<td>candelilla</td>
<td>Euphorbia antisiphilitica Zucc.</td>
<td>Euphorbiaceae</td>
</tr>
<tr>
<td>carnauba palm</td>
<td>Copernicia cerifera (Mill.) H.E. Moore</td>
<td>Palmaceae</td>
</tr>
<tr>
<td>chicosapote</td>
<td>Achras sapote L.</td>
<td>Sapotaceae</td>
</tr>
<tr>
<td>cortadillo</td>
<td>Nolina microcarpa S. Watson</td>
<td>Liliaceae</td>
</tr>
<tr>
<td>coyonostle</td>
<td>Opuntia imbricata (Haworth) DC.</td>
<td>Cactaceae</td>
</tr>
<tr>
<td>espadín</td>
<td>Agave striata Zucc.</td>
<td>Amaryllidaceae</td>
</tr>
<tr>
<td>garambullo</td>
<td>Myrtillocactus geometrizans</td>
<td>Cactaceae</td>
</tr>
<tr>
<td>gobernadora (creosote bush)</td>
<td>Larrea divaricata Cav.</td>
<td>Zygophyllaceae</td>
</tr>
<tr>
<td>granjeno</td>
<td>Celtis spinosa</td>
<td>Ulmaceae</td>
</tr>
<tr>
<td>guapilla</td>
<td>Hechtia glomerata Zucc.</td>
<td>Bromeliaceae</td>
</tr>
<tr>
<td>guayule</td>
<td>Parthenium argentatum Gray</td>
<td>Compositae</td>
</tr>
<tr>
<td>hojasén</td>
<td>Flourensia cernua DC.</td>
<td>Compositae</td>
</tr>
<tr>
<td>lechuguilla</td>
<td>Agave lecheguilla Torrey</td>
<td>Amaryllidaceae</td>
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<td>mesquite</td>
<td>Prosopis juliflora Torrey</td>
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<td>nopal cardón</td>
<td>Opuntia streptacantha Lemaire</td>
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<tr>
<td>ocotillo</td>
<td>Fouquieria splendens Engelm</td>
<td>Fouquieriaceae</td>
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<td>palma china</td>
<td>Yucca filifera Chabaud</td>
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<td>palma pita</td>
<td>Yucca treculeana Carriere</td>
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<td>palma samandoca</td>
<td>Yucca carnerosana (Trelease)</td>
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<td>sotol</td>
<td>Dasylirion cedrosanum Trelease</td>
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<td>Zizania aquatica L.</td>
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<td>wild rubber</td>
<td>Hevea brasiliensis (H.B.K.) Muell. Arg.</td>
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</tr>
<tr>
<td></td>
<td>Acacia crassifolia Gray</td>
<td>Leguminosae</td>
</tr>
</tbody>
</table>
VITAE

Samuel Richard Sheldon was born December 10, 1941 in North Tonawanda, New York and graduated from St. Mary's High School in June 1959. He entered the State University College at Buffalo, earning a Bachelor of Science degree in Elementary Education in 1964. After teaching fourth grade for one year in the Cheektowaga Public School System Mr. Sheldon entered Graduate School in Geography in September 1965. A Master of Arts degree from Eastern Michigan University was conferred on him in 1968. From January 1968 to August 1969 he was an Instructor in the Department of Geography at the State University College at Buffalo. Graduate work towards the doctorate commenced in September 1971 in the Department of Geography at Southern Illinois University at Carbondale. Mr. Sheldon transferred to the Department of Geography and Anthropology at Louisiana State University in Baton Rouge, and continued to work toward the doctorate from 1971 to 1973. Between 1973 and 1975 he was an Instructor in the Department of Geography at Salem State College in Salem, Massachusetts. During the summers of 1973 and 1974 he served as an Instructor of Geography in the cruise program of the Texas A & M Moody College of Marine Sciences and Maritime Resources, located at Galveston, Texas. In May 1975 Mr. Sheldon returned to Louisiana State University to resume doctorate work. The topic for his dissertation on the ixtleros was determined during the summer of 1975. Field research for the doctorate was carried out from January to July 1976, and during August 1977, in north-central Mexico. Mr. Sheldon is currently Assistant Professor of Geography at the University of Arkansas at Pine Bluff. He has been married to the former Ellen Payne O'Callaghan since May 20, 1978.
Candidate: Samuel Richard Sheldon

Major Field: Geography

Title of Thesis: THE IXTLEROS OF NORTH-CENTRAL MEXICO: A GEOGRAPHICAL STUDY OF MAN-PLANT RELATIONSHIPS

Approved:

[Signature]
Major Professor and Chairman

[Signature]
Dean of the Graduate School

EXAMINING COMMITTEE:

[Signature]
[Signature]
[Signature]

Date of Examination:

May 11, 1978