

En Buck, Louise E., Geisler, Charles C., Schelhas, John y Wollenberg, Eva, *Biological Diversity. Balancing Interests Through Adaptive Collaborative Management*. New York (Estados Unidos): CRC Press.

Population dynamics, migration, and the future of the Calakmul Biosphere Reserve.

Ericsson, Jenny A., Freudenberger, Mark S. y Boege, Eckart.

Cita:

Ericsson, Jenny A., Freudenberger, Mark S. y Boege, Eckart (2001). *Population dynamics, migration, and the future of the Calakmul Biosphere Reserve*. En Buck, Louise E., Geisler, Charles C., Schelhas, John y Wollenberg, Eva *Biological Diversity. Balancing Interests Through Adaptive Collaborative Management*. New York (Estados Unidos): CRC Press.

Dirección estable: <https://www.aacademica.org/eckart.boege/28>

ARK: <https://n2t.net/ark:/13683/pGRt/WM5>



Esta obra está bajo una licencia de Creative Commons.
Para ver una copia de esta licencia, visite
<https://creativecommons.org/licenses/by-nc-nd/4.0/deed.es>.

Acta Académica es un proyecto académico sin fines de lucro enmarcado en la iniciativa de acceso abierto. *Acta Académica* fue creado para facilitar a investigadores de todo el mundo el compartir su producción académica. Para crear un perfil gratuitamente o acceder a otros trabajos visite: <https://www.aacademica.org>.

Population Dynamics, Migration, and the Future of the Calakmul Biosphere Reserve

Jenny Ericson
Mark S. Freudenberger
Eckart Boege

Summer 1999

**Occasional Paper No. 1
Program on Population and Sustainable Development
(PSD)
American Association for the Advancement of Science
(AAAS)**

Acknowledgments

The authors would like to express their appreciation to the following institutions for their generous financial support: The Summit Foundation; the American Association for the Advancement of Science (AAAS) Program on Population and Sustainable Development (PSD); Los Trigos Fund; the Ministries of the Environment (INE-SEMARNAP) of the Mexican Federal Government; the Population-Environment Fellows Program of the University of Michigan, and; the Department of Population, Health and Nutrition of USAID.

They would also like to acknowledge the administrative and technical assistance of Pronatura Peninsula de Yucatán, A.C.; World Wildlife Fund, Mexico Program, and; the Department of Social Science and Economics in the Washington, DC offices of the World Wildlife Fund. For instruction in the use of participatory rural appraisal techniques they would like to recognize the members of the Grupo DIP of the Autonomous University of Yucatán. For editing and compilation of this document they are grateful to Lars Bromley, Project Coordinator of the AAAS-PSD, and to Victoria Dompka, Director of the AAAS-PSD, for its publication.

Above all they wish to express appreciation to the members of the communities Conhuas, 11 de Mayo and Nueva Vida for their patience, time and energy, and to the members of the land use planning team, for all their hard work in realizing this project. The team members are: Armando Montejo Alvarez, ejidatario of ejido 11 de Mayo; Diego Hernandez López, ejidatario of ejido Nuevo Campanario; Jenny Ericson, MS (Environmental Systems); Manuel Santis Hernandez, ejidatario of Ejido Conhuas; Reyna S. Maas Rodríguez, BA. (Social Anthropologist); Rosa Arcos Díaz (rural health assistant), and; Mauro Perez Rodríguez, poblador of ejido Xpujil and ejidatario of ejido 11 de Mayo. They would also like to mention the members of Pronatura's reproductive health team who participated with them in the early stages of the project: Mauricio Ortiz, BA. (Biologist) and Oscar Prieto, BA. (Social Anthropologist).

About AAAS

This publication was published as part of an ongoing series of Occasional Papers by the American Association for the Advancement of Science - Program on Population and Sustainable Development (AAAS-PSD). The opinions in this paper are those of the authors and do not necessarily reflect the opinions of AAAS. AAAS is the world's largest federation of scientists and engineers, with nearly 300 affiliate organizations and more than 140,000 scientists, engineers, science educators, policy makers, journalists and interested citizens worldwide. AAAS publishes *Science*, one of the most prestigious and frequently cited scientific journals. The Association also undertakes program activities to expand international scientific cooperation on global issues, advance science education, and shape policy issues grounded in science and technology. Through the Program on Population and Sustainable Development, AAAS applies scientifically-based, multi-disciplinary, policy and field-driven analysis to the relationships between population, the environment and consumption, and the vital, interrelated roles they play in building and strengthening sustainable societies worldwide.

Additional copies of this paper are available from:

© 1999 American Association for the Advancement of Science (AAAS)

International Directorate

Program on Population and Sustainable Development (PSD)

1200 New York Avenue, NW

Washington, DC, 20005, USA

Telephone: USA + 202-326-6495

Fax: USA + 202-289-4958

Email: lbromley@aaas.org

Internet: <http://www.aaas.org/international/psd/psd.htm>

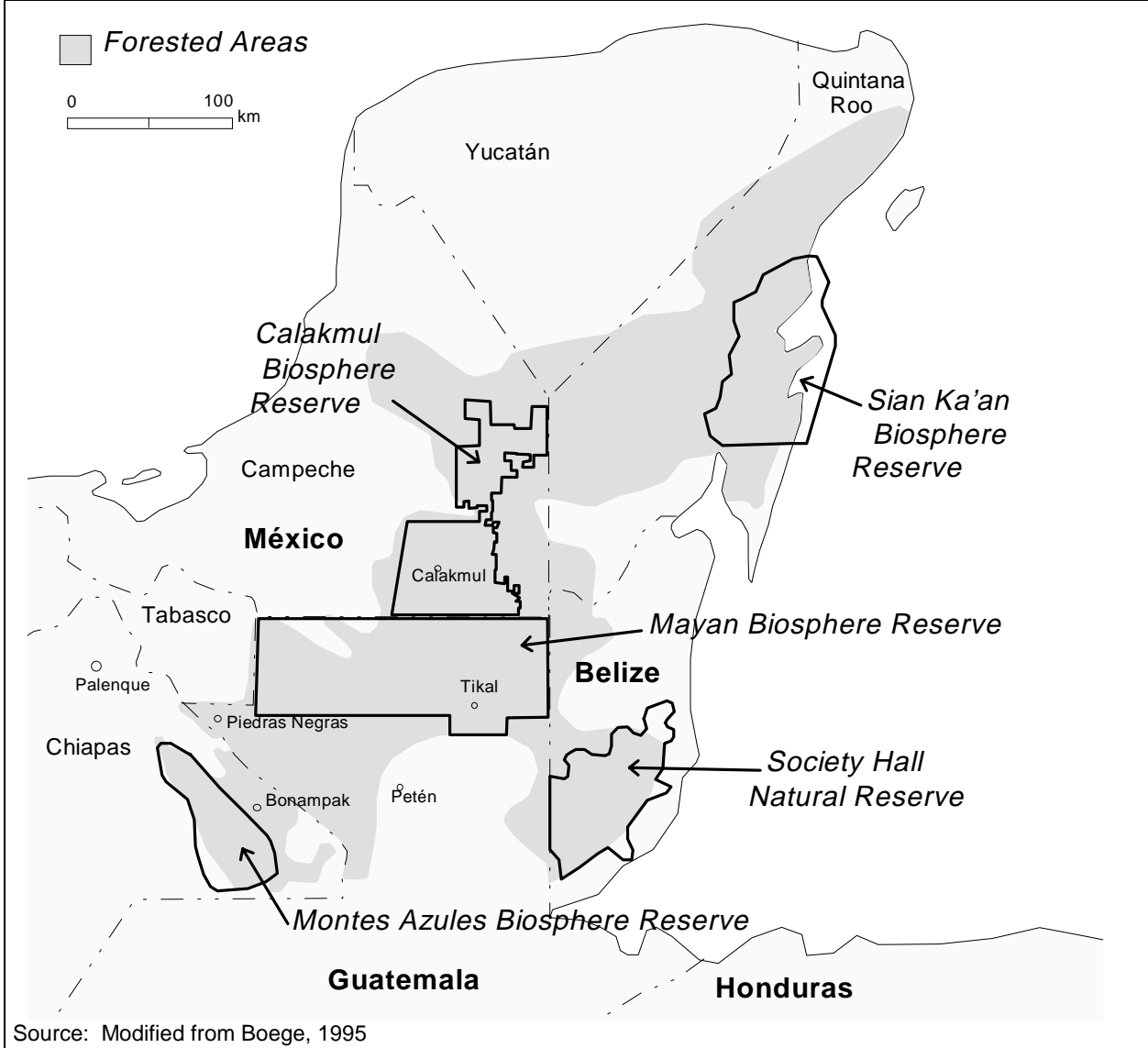
TABLE OF CONTENTS

| | |
|--|-----------|
| Introduction | 7 |
| The Calakmul Biosphere Reserve and Conservation Initiatives | 8 |
| <i>Research Program on Population</i> | <i>10</i> |
| <i>Research Methodology: PRA and Land Use Planning Team.....</i> | <i>10</i> |
| Population Dynamics in the Calakmul Biosphere Reserve | 11 |
| The Mosaic of Human Patterns of Land Occupation | 18 |
| <i>Colonization Adjacent to the Calakmul Biosphere Reserve</i> | <i>18</i> |
| <i>Natural Population Growth.....</i> | <i>19</i> |
| <i>Inappropriate Agricultural Technologies</i> | <i>21</i> |
| <i>Resource Conflicts and the Calakmul Biosphere Reserve</i> | <i>23</i> |
| <i>Land Markets and Land Sales</i> | <i>24</i> |
| <i>Infrastructural Development</i> | <i>24</i> |
| Challenges and Opportunities for Mitigating Migration Impacts | 25 |
| <i>Federal Government Land Use Policies</i> | <i>25</i> |
| <i>State of Campeche Land Use Policies</i> | <i>25</i> |
| <i>Community Land Use Planning Practices</i> | <i>26</i> |
| <i>Household Livelihood Strategies</i> | <i>28</i> |
| Implications for Community-Based Resource Conservation Programs | 28 |
| Conclusions | 32 |
| References | 33 |

TABLE OF FIGURES

| | |
|---|----|
| Figure 1: Protected Forest Areas in the Yucatan Peninsula | 6 |
| Figure 2: Map of Calakmul Biosphere Reserve and Land Ownership Patterns | 9 |
| Figure 3: Demographic Characteristics of Diagnostic Case Study Ejidos | 12 |
| Figure 4: Themes and Objectives of Diagnostic Case Studies | 12 |
| Figure 5: Population Change in Selected Ejidos in the Calakmul Region | 14 |
| Figure 6: Demographic Statistics of Communities around Calakmul Biosphere Reserve | 15 |
| Figure 7: Evolution in Numbers of Families in Ejido 11 de Mayo | 19 |
| Figure 8: Oral History of the Community of 11 de Mayo | 20 |
| Figure 9: One Family's Present Land Use and Future Land Use Plan: Ejido Conhuas | 22 |
| Figure 10: Planning Priorities of Tzeltal Women in the Ejido 11 de Mayo | 29 |

Figure 1: Protected Forest Areas in the Yucatan Peninsula



INTRODUCTION

The international conservation community continues to direct its focus on the environmental consequences of human settlements in and around protected areas. Particularly in less developed regions of the world, protected areas are often little more than polygons on a map; and administrative capacity is insufficient to control both the impact of colonists seeking land and the traditional use of resources by local populations (McNeely and Ness 1995). Conservationists are beginning to confront the reality that hard-earned conservation gains are threatened by an influx of people into national parks, biosphere reserves, extractive reserves and other types of protected areas (Barton, Borrini-Feyerabend, de Sherbinin, Warren 1997; Caudill 1997; Cruz 1995; Dompka and Allcott 1998; Engelman 1998). For example, in the rain forests of the Central African Republic, miners extract diamonds from the rivers and streams of the Dzanga-Sanga Special Dense Forest Reserve located in the buffer zones (Freudenberger, Mogba, Misso et al 1997). In the Annapurna Conservation Zone of Nepal, employment generated by ecotourism draws in migrant workers whose dependency on the extraction of firewood and other forest products increases pressure on surrounding resources (Bajracharya, Gurung, and Manandhar 1997). The rich literature on settlement along roads constructed into Amazonian forests paints a grim picture of the difficulties encountered in mitigating the impacts of in-migration (Hecht 1989; Rudel 1993; Pichon 1993). And, as in southeastern Mexico, landless rural populations in Central American countries are encouraged to settle around national parks which constitute some of the last remaining agricultural frontiers (Bilsborrow and DeLargy 1991; Pasos, et al. 1995).

The history of the human species is certainly one of migration. Demographers warn the conservation community that “of all population problems, those of migration appear the most intractable... migration streams are very difficult to start when people are not willing to move, and very difficult to stop when they do wish to move” (Ness with Golay 1997:119). With increasing frequency, conservationists are recognizing that landscapes harboring rich pockets of biodiversity will soon be radically transformed due to unprecedented levels of in-migration and that actions must be taken now to mitigate the ecological impacts of this phenomenon.

This paper is a description of population dynamics and in-migration around the Calakmul Biosphere Reserve located in the southern Yucatán Peninsula of Mexico. It presents results from the initial phases of an applied research program developed with the following objectives: 1) Generate dialogue between stakeholders (e.g. community members, regional authorities, and national and international governmental and non-governmental institutions) about the impact of population growth or distribution on biodiversity conservation around the reserve; 2) develop an effective, low-cost population monitoring system; and 3) establish a culturally and politically appropriate participatory land-use planning process that takes account of complex local and regional human population dynamics. The program is a collaborative effort between Pronatura Península de Yucatán, A.C. (PPY), World Wildlife Fund (WWF), and the University of Michigan Population-Environment Fellows Program.

Information gathered primarily through the use of participatory and other qualitative research methods illustrates the complex mosaic of causes and environmental consequences of in-migration around the reserve. The applied research shows that the future of the reserve is

compromised by both a steady influx of migrants and rapid natural population growth rates in the *ejido*¹ communities. Moderating the environmental consequences of in-migration involves the creation of effective community land-use planning practices coupled with supportive national and regional economic and social policies. However, numerous deep structural challenges confront institutions committed to the promotion of conservation and just economic and social development.

THE CALAKMUL BIOSPHERE RESERVE AND CONSERVATION INITIATIVES

Covering 723,185 hectares, the Calakmul Biosphere Reserve (CBR) is the largest tract of protected tropical forest in Mexico and an important site for biodiversity conservation. Established in 1989 by presidential decree, the reserve is located in the state of Campeche on the Yucatán Peninsula. It is an important element in a larger system of protected areas which form an ecological corridor of over two million hectares stretching between central Yucatán and the Belizian forests (see Figure 1). The main objective of the Calakmul Biosphere Reserve is the long-term maintenance of biodiversity. Accepted into the UNESCO network of biosphere reserves in 1993, the Calakmul Biosphere Reserve is divided into *core* and *buffer* zones. Although to date no management plan has been approved, the general understanding is that ecologically-sustainable production activities are allowed within the buffer zone while no human activity is permitted within the core zone (Galindo-Leal 1996). Conflict arises from the fact that the borders of the core zone cut across the territory of

pre-existing *ejido* communities and privately held properties (see Figure 2). Agriculture, forestry, cattle-ranching and subsistence-level hunting are practiced on *ejido* and privately held lands that overlap with the reserve. The buffer zone of the southern division of the reserve is composed of forest extension lands belonging to *ejido* communities north of the reserve.

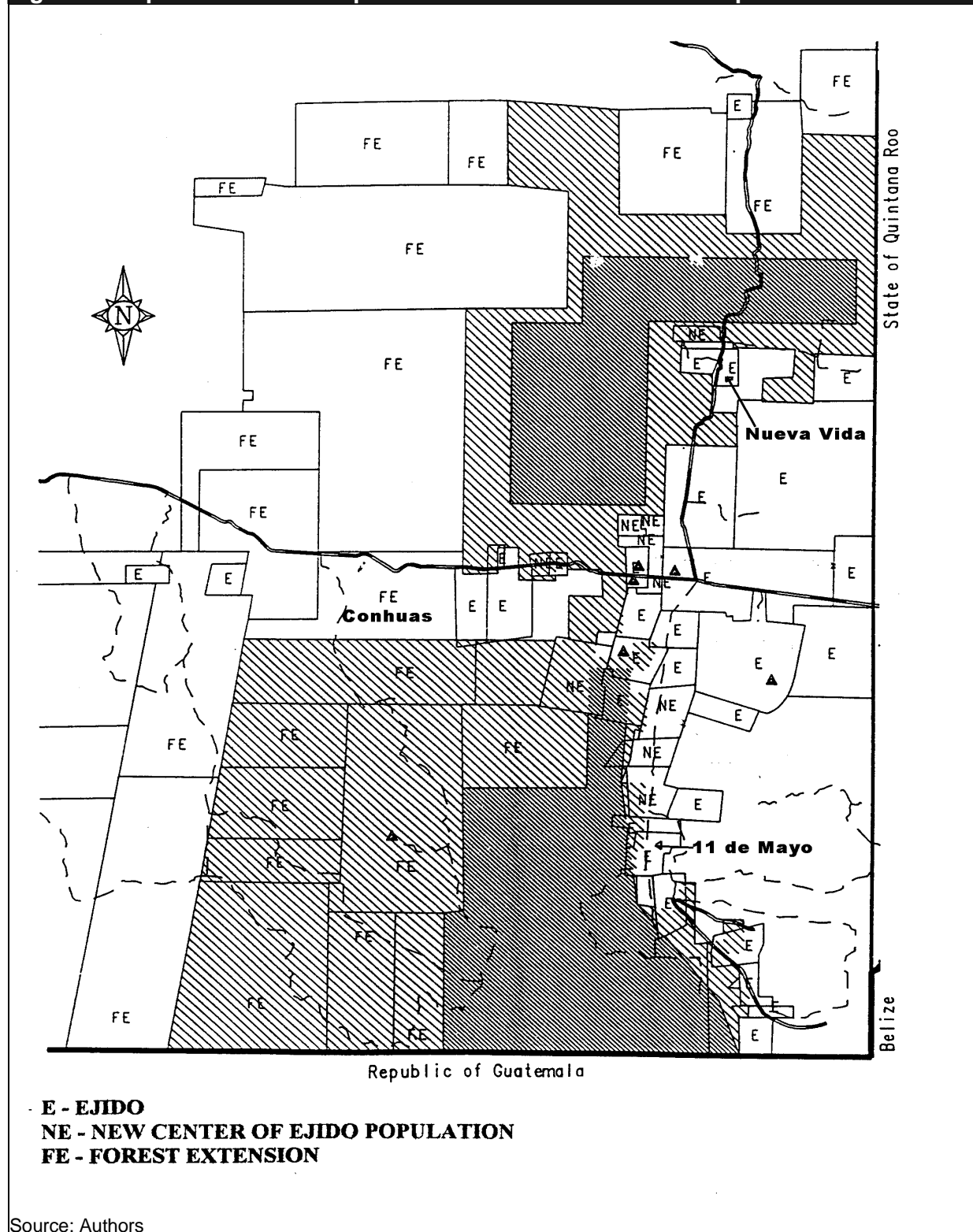
The Calakmul Biosphere Reserve is a patchwork of mature disturbed forest, secondary growth vegetation of less than 25 years and savanna-type flood plains. The present state of the forest both within the reserve and in the *ejido* communities that surround it is a result of timber extraction, forest clearing for agriculture and cattle ranching. The most abundant tall trees include chicozapote (*Manilkara zapota*) and ramón (*Brosimum alicastrum*) (Miranda and Hernandez-Xolocotzi 1985; Rzedowski 1989). Prominent commercial species are mahogany (*Swietenia macrophylla*) and Spanish cedar (*Cedrela odorata*). Biological inventories indicate that 18 endemic plant species are found in the larger Peten ecosystem.

Despite transformations in the landscape, the Calakmul Biosphere Reserve is home to charismatic, threatened and endangered mammals such as jaguars (*Panthera onca goldmani*), howler monkeys (*Alouatta pigra*), spider monkeys (*Ateles geoffroyi*) and tapir (*Tapirus bairdii*). Thirty percent of the bird species sighted in the reserve breed in the United States and Canada and use these forests as their wintering grounds (Berlanga and Wood 1997). Some of these neotropical migrants such as the hooded warbler (*Wilsonia citrina*) and the swainson's warbler (*Limnothlypis swainsonii*), are threatened or endangered species (NOM 1994).

Inconsistency and variability characterize the climatic conditions of the region. Historically, variation in pre-

¹ An *ejido* is a land grant administered by a group of individuals called *ejidatarios* who hold the usufruct rights to their *ejido* accorded to them by the Mexican federal government.

Figure 2: Map of Calakmul Biosphere Reserve and Land Ownership Patterns



cipitation levels on the Yucatán Peninsula has affected agricultural production and caused famine particularly when dry years succeed one another (Farriss 1984; Murphy 1990). Powerful hurricanes can cause severe flooding and crop devastation.

Shallow lowland basins called *bajos* are scattered throughout the reserve. Lined with heavy clay soils, *bajos* retain water during the wet season and quickly dry up when precipitation levels decrease during the dry season.

Following the establishment of the Calakmul Biosphere Reserve in the late 1980s, the government of Mexico encouraged non-governmental organizations to participate in the design and implementation of management strategies for the reserve (Boege 1995). PPY, a Mexican non-governmental organization founded in 1988, has promoted an integrated conservation and development approach in the region during the past five years. WWF, The Nature Conservancy, and other international donors contribute to PPY's work by providing project assistance funds, training, and technical assistance. PPY's strategy is to involve the people who live in the communities surrounding the reserve in environmental education and sustainable development activities. This strategy is based on the theory that if people living in and around natural areas receive economic and social benefits from these areas their convictions about preserving these areas will be strengthened.

Research Program on Population

The administration of the Calakmul Biosphere Reserve has long noted the importance of understanding and monitoring the population dynamics of the rural communities located in and around the reserve. Concern exists about the probable impact of migrant populations settling in this frontier agricultural zone and the need to

formulate appropriate policy responses. The applied research program and its aforementioned objectives were developed through discussions between the reserve management and collaborating parties. They are being carried out in four phases: 1) Assessment of the forces that affect population growth at the regional level and identification of the critical areas around the reserve where population increases appear to place pressure on the reserve; 2) literature review of available census data and secondary sources; 3) diagnostic case studies carried out in selected *ejido* communities using the Participatory Rural Appraisal (PRA) methodology; 4) use of research results to launch a region-wide debate through various public fora on the threats posed by migration to the long-term economic, social, and ecological viability of the reserve. Stakeholder debate will generate the foundation for the formulation of appropriate policy responses to migration and shape the form of culturally and politically appropriate land-use planning in the communities around the reserve.

Research Methodology: PRA and Land Use Planning Team

In order to assess the complex interrelationships between population growth and migration, tenure regimes and land-use practices, the use of PRA techniques are employed as the primary tool in performing the diagnostic case studies. A non-governmental organization associated with the University of Yucatán, Grupo DIP, trained the principal researchers and a team of *ejido* members in use of the methodology. PRA facilitates local people's participation in the collection, sharing and analysis of a broad spectrum of data with a reduced amount of researcher-imposed bias (Bruce 1989; Chambers 1983; Freudenberg, K.S. 1994). It strives to deepen already existing knowledge and generate specific hy-

potheses, perhaps with recommendations for intervention (Freudenberger, K.S. 1994). The concept of *triangulation* is used to minimize bias and dependency on any one tool, information source, or perception based on the gender, ethnic group or intellectual background of the researcher (Anderson and Rietbergen-McCracken 1994).

Of the one hundred and fourteen communities located in and around the Calakmul Biosphere Reserve three were selected for participation in the case studies: Conhuas, 11 de Mayo, and Nueva Vida. The selection of these *ejidos* was based on a matrix of criteria, including population growth rates, ethnic composition, and geographic relation to the reserve. All experienced rapid population growth rates from 1990 to 1995; and, as is typical of the region, population densities in these *ejidos* are low (see Figure 3). Four main themes were selected for these case study *ejidos* (see Figure 4). Each community has a unique mix of indigenous² and non-indigenous groups from southeastern, northern and central Mexico. Conhuas is located along an interstate road and extends into the buffer zone, 11 de Mayo borders the core zone in the remote southeast near the border of Guatemala, and Nueva Vida is just north of the region's most urbanized area and does not border the reserve (see Figure 2). Conhuas has had minimal exposure to conservation and development projects while the other two are actively involved with Pronatura Peninsula de Yucatán.

Field work carried out by a six-member team trained in PRA averaged fourteen to twenty-one days of residency in each community. Team composition is diverse in terms

of gender, age, ethnic origin, and educational background. Four members of the team live in the region and arrived there fifteen to twenty years ago as migrants. Three of them are *ejidatarios* who play active roles in the social, economic and political development of their communities. A woman social anthropologist of Mayan origins and an American woman with a graduate degree in resource management complemented the team.

Research results were presented to the *ejido* assembly, the community's governing body, at the completion of each case study for its approval prior to distribution to outside groups. The document containing the results was presented as an educational tool for use by the community to share and discuss their own history and future plans amongst themselves, with other communities, and interested non-governmental and governmental organizations. It is illustrated with photos of the community, maps, diagrams, calendars and matrices produced by community and team members during the field work. The text was carefully written and discussed by the team to ensure that the document can be easily understood by local audiences.³ The final document is intended to represent the voice of the community and reflect the complexity of rural reality.

POPULATION DYNAMICS IN THE CALAKMUL BIOSPHERE RESERVE

The forests of the Calakmul Biosphere Reserve shelter numerous ruins of the Preclassic and Classic Mayan civilization which gives them cultural as well as ecological value. Archeologists suggest that this area was once one of the largest and most powerful urban centers in

² In this context indigenous refers to ethnicity. It is not meant to imply that these people are native to the Calakmul region. Very little is known about the region's inhabitants prior to the arrival of chicle and timber concessionaires in the early 1900's.

³ This has been one of the most challenging parts of the work due to the difference in educational levels and cultural perspectives amongst team members. Local resident team members become the mentors of the non-local team members because their perception of rural realities is closer to that of community members.

Figure 3: Demographic Characteristics of Diagnostic Case Study Ejidos

| Ejido Name | Inhabitants | | C.G.R.* | Tdouble** | Land Area | Pop. Density | | Ethnic | Legal Date |
|------------|-------------|------|------------|-----------|------------|--------------|------|--------|------------|
| | 1990 | 1995 | (per year) | (years) | (hectares) | 1990 | 1995 | | |
| Conhuas | 250 | 398 | 9% | 7.45 | 59,840 | 0.42 | 0.67 | mixed | 1931 |
| 11 de Mayo | 80 | 253 | 23% | 3.01 | 4,116 | 1.94 | 6.15 | mixed | 1995 |
| Nueva Vida | 72 | 163 | 16% | 4.24 | 2,500 | 2.88 | 6.52 | mixed | 1984 |

* Crude Growth Rate
 ** Doubling Time in Years at *Current* Rate
 Notes: All calculations based on census information acquired from the Mexican Instituto Nacional de Estadística Geografía e Informática (INEGI), 1990 & 1995. Legal date refers to the date the ejido was officially recognized by the Mexican government although the settlement may be older.

Figure 4: Themes and Objectives of Diagnostic Case Studies

| Theme | Objectives |
|---|---|
| 1 Migration and changes in population over time. | History of the community and how it was founded; how migrants learned about the location of the community; migrant's reasons for arriving; where they came from; how long they tend to stay; why those that choose to leave the community do so. |
| 2 General and reproductive health among community members. | Type of health services available in the community; health conditions and illnesses commonly occurring among community members; how illnesses and health problems are treated; problems encountered among pregnant women; the level and understanding regarding reproductive health; the woman's role in the community. |
| 3 Land use and exploitation of natural resources. | Use and type of forest on community land; animal and soil resources; methods of natural resource exploitation; economic importance of production activities; resource relations between <i>ejido</i> communities; causal factors leading to changing land use patterns. |
| 4 Planning mechanisms and discussions about the future at both family and community levels. | How community members intend to manage land distribution once their sons are grown and in need of land for crop cultivation; current internal community laws with respect to new migrants and land distribution; how recent migrants are treated; the decision-making process regarding location and amount of land available to recent migrants. |

the region, possibly the principal rival of neighboring Tikal in Guatemala (Folan, cited in Garrett 1989). Archaeological discoveries indicate that the Classic Mayans used intensive agricultural practices and elaborate hydrological works to support substantial population densities (Thomas 1981; Turner 1978; Adams 1977). Relic terraces, drainage systems and related stone works indicating raised fields and field demarcation have been detected over an area of approximately 10,000 square kilometers in the Rio Bec zone. Drought and the disappearance of natural water sources in the region may have contributed to the drop in population levels of the Classic Maya and led to the shift of the ancient power center towards the northern Yucatán Peninsula (Dominguez and Folan 1995).

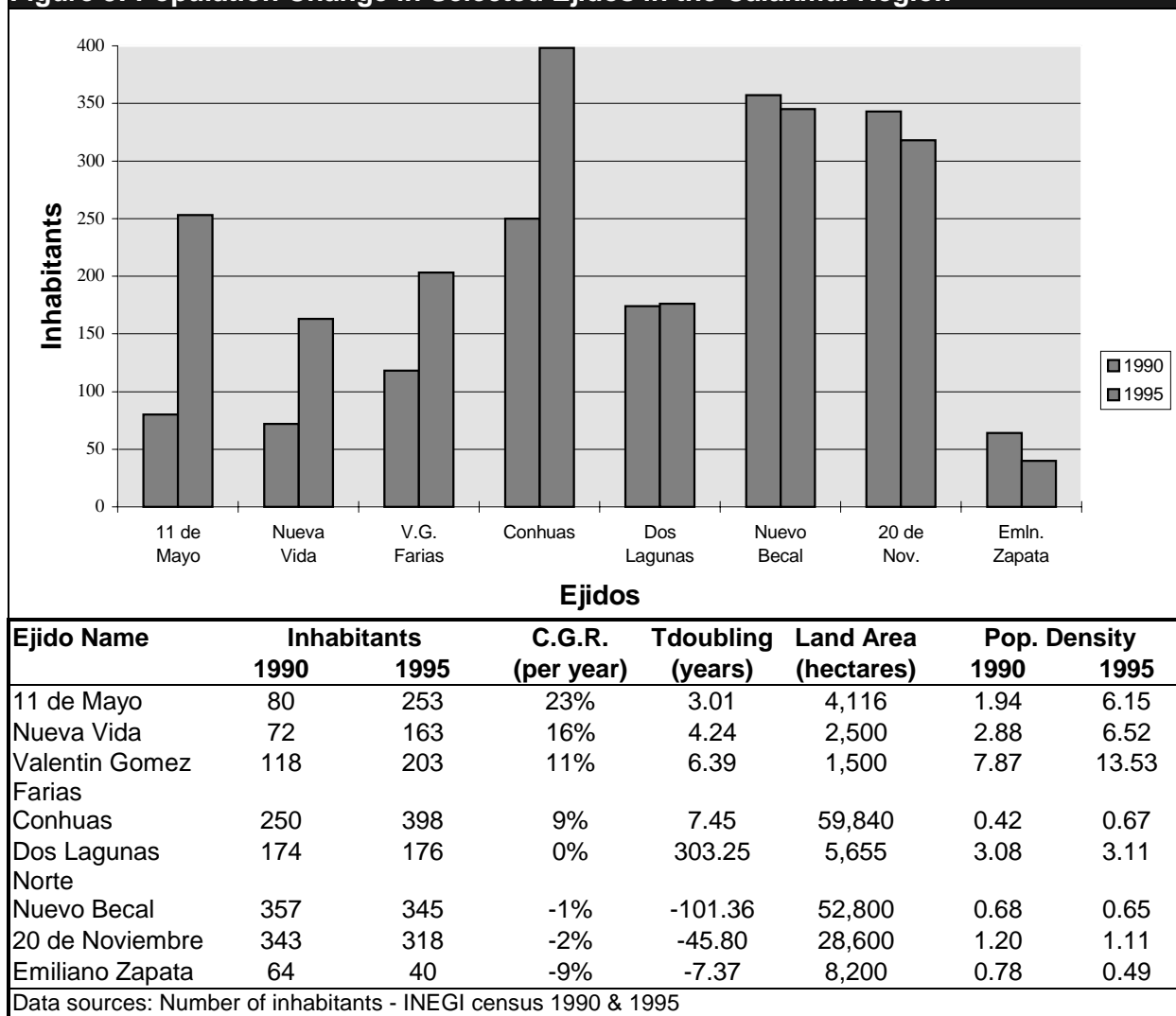
Since the decline of the Classic Maya civilization (circa AD 950), the southern lowland region is thought to have been sparsely populated. Evidence exists that scattered communities of the Chontal Maya existed in the area during the Terminal and Post Classic periods (Sharer 1994); but it is believed that the Cehache, originally associated with Rio Bec, constituted the majority of the population (Antochiw 1997).

For centuries during and after the conquest, the region's forests, considered uninhabitable by the Spanish, provided a safe place of refuge for Mayan resistance (Jones 1989). In the 1800's logwood trees (*Haematoxylon campechianum*) found in swampy parts of the forest were felled and exported to Britain for their dye. At the turn of the century, rapidly rising international demand for chewing gum brought chicle tappers to the region to extract resin from the chicozapote trees (*Manilkara zapota*). The chicle industry encouraged conservation of standing chicozapote trees and, in so doing, sought to protect mature forest areas containing these trees. In the late 1940's petroleum-based chicle

substitutes were developed and global demand for the natural variety declined causing a depression in the extractive tree crop economy. Also in the 1940's lumber camps, like the town of Zoh Laguna, were built to support the extraction of precious hardwoods such as mahogany (*Swietenia macrophylla*) and Spanish cedar (*Cedrela odorata*). Until the 1970's, the interior was largely the domain of lumber companies holding private concessions. Population levels were low and government investment in public infrastructure was minimal.

To the north of the reserve evidence found in Maya communities seems to indicate that they may have been continuously populated since ancient times. Based on the size of Franciscan friaries and churches built in the early 1600's, it appears that there was a fairly large population in the area at the time of first contact by missionaries. A recent surface survey conducted in the *ejido* Pich revealed ceramic shards and the remains of buildings stylistically dated to the Late or Terminal Classic (AD 850-1000) (Faust 1998). Other communities to the north were established in the late 1800's by Mayans fleeing the War of the Castes in the state of Yucatán. During the 1940's some of these northern communities were granted extensions to their lands for increased access to forest products such as chicle and precious hardwoods. Nine such extensions comprise the buffer zone of the southern division of the reserve (see Figure 2).

Much of this region was colonized prior to the formation of the reserve, due to government policy encouraging the settlement of areas considered to be underutilized. The lands on the eastern side of the Calakmul Biosphere Reserve and the strip stretching between the northern and southern divisions of the reserve have become rapidly changing frontier zones during the last twenty years, most of them inhabited primarily by pio-

Figure 5: Population Change in Selected Ejidos in the Calakmul Region

neer settlements dependent on a largely subsistence-level economy (Ericson 1996, Boege 1995). As is typical of frontier zones, a great deal of fluctuation and instability characterizes population dynamics in the communities. Figure 5 shows trends of both positive and negative growth in six *ejidos* between 1990 and 1995. Reduced out-migration seems to be the result of the arrival of government-relief programs, especially during times of drought and flooding, and the improvement of infrastructure, such as road construction and water catchment structures.

Ejido status was acquired by most of these communities during the 1980's, although many were settled as much as a decade earlier. Figure 6 shows that in 1995 *ejido* population averaged around 215 inhabitants with a regional population of 24,295 inhabitants in the 114 *ejido* communities of the Calakmul municipality. Numbers of *ejidatarios* vary from 25 to 200 per *ejido*. Population density for the municipality, which includes the biosphere reserve itself, is approximately 2.5 persons per square kilometer. While land distribution within the *ejidos* is determined by internal regulations, parcel al-

| Figure 6: Demographic Statistics of Communities Around Calakmul Biosphere Reserve | | | | | |
|--|--------------------|-------------|-------------|-------------------|--------------------|
| Community Name | Inhabitants | | | C.G.R.* | Tdoubling** |
| | 1980 | 1990 | 1995 | (per year) | (years) |
| <i>State of Campeche</i> | 420,553 | 535,185 | 642,516 | 4% | 18.96 |
| 11 de Mayo | n.d. | 80 | 253 | 23% | 3.01 |
| 16 de Septiembre (L. Alvarado) | 57 | 125 | 71 | -11% | -6.13 |
| 20 de Noviembre | 211 | 343 | 318 | -2% | -45.80 |
| A. Obregon, Gen. (Zoh Laguna) | 791 | 1,098 | 985 | -2% | -31.91 |
| Aguas Amargas (San Isidro) | n.d. | 48 | 68 | 7% | 9.95 |
| Aguas Turbias | n.d. | n.d. | 15 | n.d. | n.d. |
| Alacranes, Los | 77 | 156 | 158 | 0% | 272.06 |
| Alianza Productora | n.d. | 91 | 102 | 2% | 30.37 |
| Altamira de Zinaparo | 175 | 1,016 | 1,139 | 2% | 30.33 |
| Amapola, La | n.d. | n.d. | 24 | n.d. | n.d. |
| Angeles, Los | n.d. | 311 | 390 | 5% | 15.31 |
| Arroyo de Cuba | n.d. | n.d. | 128 | n.d. | n.d. |
| Arroyo Negro | 44 | 131 | 182 | 7% | 10.54 |
| Becan | n.d. | 100 | 164 | 10% | 7.01 |
| Bel Ha | n.d. | 71 | 95 | 6% | 11.90 |
| Bella Union de Veracruz (Los Chinos) | n.d. | 68 | 72 | 1% | 60.63 |
| Benito Juarez Garcia No. 3 (Lic.) | n.d. | 177 | 240 | 6% | 11.38 |
| Blaisillo | n.d. | 124 | 98 | -5% | -14.73 |
| Bonanza | n.d. | 17 | 20 | 3% | 21.33 |
| Cana Brava | n.d. | 81 | 102 | 5% | 15.03 |
| Carlos A. Madrazo | 22 | 26 | 36 | 7% | 10.65 |
| Carlos Sansores Perez (La Paz) | n.d. | 37 | 123 | 24% | 2.89 |
| Carmen II | n.d. | 229 | 290 | 5% | 14.68 |
| Centauro del Norte | n.d. | 56 | 179 | 23% | 2.98 |
| Centenario | 481 | 792 | 760 | -1% | -84.03 |
| Central Chiclera Villahermosa | n.d. | 7 | 12 | 11% | 6.43 |
| Cerro de las Flores | n.d. | n.d. | 74 | n.d. | n.d. |
| Chan Laguna | 210 | 503 | 539 | 1% | 50.14 |
| Chichonal | n.d. | 56 | 79 | 7% | 10.07 |
| Concepcion | 65 | 180 | 189 | 1% | 71.03 |
| Constitucion | 500 | 726 | 898 | 4% | 16.30 |
| Cristobal Colon | 111 | 278 | 337 | 4% | 18.01 |
| Dos Lagunas | n.d. | n.d. | 176 | n.d. | n.d. |
| Dos Lagunas | n.d. | 174 | 228 | 5% | 12.82 |
| Dos Naciones | n.d. | 106 | 190 | 12% | 5.94 |
| E.Eugenio Castellot I | 35 | 44 | 66 | 8% | 8.55 |
| E.Eugenio Castellot II (El Carrizal) | n.d. | 120 | 210 | 11% | 6.19 |
| Emiliano Zapata | 158 | 64 | 40 | -9% | -7.37 |
| Felipe Angeles | n.d. | 220 | 192 | -3% | -25.46 |
| Felipe Angeles II | n.d. | 51 | 63 | 4% | 16.40 |

Figure 6: Demographic Statistics of Communities Around Calakmul Biosphere Reserve

| Community Name | Inhabitants | | | C.G.R.* | Tdoubling** |
|---------------------------------------|-------------|------|------|------------|-------------|
| | 1980 | 1990 | 1995 | (per year) | (years) |
| Flor de Chiapas | n.d. | 72 | 218 | 22% | 3.13 |
| Guadalupe, La | n.d. | 217 | 298 | 6% | 10.93 |
| Guillermo Prieto | n.d. | 102 | 94 | -2% | -42.43 |
| Gustavo Diaz Ordaz (San. Antn. Soda) | 259 | 362 | 435 | 4% | 18.87 |
| Heriberto Jara | n.d. | 131 | 195 | 8% | 8.71 |
| Hermenegildo Galeana | n.d. | 137 | 98 | -7% | -10.35 |
| Innominado | n.d. | n.d. | 8 | n.d. | n.d. |
| Jobal, El | n.d. | 99 | 100 | 0% | 344.84 |
| Jose Lopez Portillo No. 1 (Lic.) | n.d. | 127 | 289 | 16% | 4.21 |
| Jose Morelos YP. (Civalito) | 102 | 162 | 253 | 9% | 7.77 |
| Josefa O. de Dominguez (Icaiche) | n.d. | 107 | 156 | 8% | 9.19 |
| Justo Sierra Mendez | 109 | 94 | 104 | 2% | 34.28 |
| Kiche Las Pailas | n.d. | 185 | 284 | 9% | 8.09 |
| Km 120 (San Jose) | 5 | 75 | 140 | 12% | 5.55 |
| Laguna Grande | n.d. | 556 | 550 | 0% | -319.42 |
| Lazaro Cardenas II (Ojo de Agua) | n.d. | 239 | 328 | 6% | 10.95 |
| Ley de Fomento Agrop. (La Misteriosa) | n.d. | 78 | 123 | 9% | 7.61 |
| Lopez Mateos (Lic. Adolfo) | 340 | 583 | 454 | -5% | -13.86 |
| Lucha, La | n.d. | 180 | 232 | 5% | 13.66 |
| Lucha, La | n.d. | 28 | 105 | 26% | 2.62 |
| Manantial | n.d. | 271 | 319 | 3% | 21.25 |
| Mancolona. La (Union 20 de Junio) | n.d. | 191 | 270 | n.d. | n.d. |
| Manual Castillo Brito | 226 | 255 | 380 | 8% | 8.69 |
| Manuel Crecencio R. | 68 | 189 | 271 | 7% | 9.62 |
| Maravillas, Las | 171 | 123 | 97 | -5% | -14.59 |
| Mirador, El | n.d. | n.d. | 21 | n.d. | n.d. |
| Narciso Mendoza | n.d. | 301 | 273 | -2% | -35.50 |
| Ninos Heroes | n.d. | 184 | 209 | 3% | 27.20 |
| Nueva Vida | n.d. | 72 | 163 | 16% | 4.24 |
| Nuevo Becal (El 19) | 262 | 357 | 345 | -1% | -101.36 |
| Nuevo Campanario | n.d. | 189 | 254 | 6% | 11.72 |
| Nuevo Conhuas | 250 | 250 | 398 | 9% | 7.45 |
| Nuevo Paraiso | 9 | 126 | 115 | -2% | -37.94 |
| Nuevo Progreso | n.d. | 46 | 35 | -5% | -12.68 |
| Nuevo San Jose | n.d. | 22 | 208 | 45% | 1.54 |
| Nuevo Veracruz | n.d. | 97 | 184 | 13% | 5.41 |
| Pablo Garcia | 166 | 545 | 611 | 2% | 30.32 |
| Paraguas | n.d. | n.d. | 26 | n.d. | n.d. |
| Pioneros del Rio Xnoha | n.d. | n.d. | 234 | n.d. | n.d. |
| Placeres | n.d. | 17 | 10 | -11% | -6.53 |
| Placeres | n.d. | 17 | 10 | -11% | -6.53 |
| Plan de Ayala (5 de Mayo) | n.d. | 163 | 250 | 9% | 8.10 |

Figure 6: Demographic Statistics of Communities Around Calakmul Biosphere Reserve

| Community Name | Inhabitants | | | C.G.R.* | Tdoubling** |
|---------------------------------------|--------------|---------------|---------------|------------|--------------|
| | 1980 | 1990 | 1995 | (per year) | (years) |
| Plan de San Luis | n.d. | 50 | 50 | 0% | no growth |
| Pollos, Los | n.d. | n.d. | 15 | n.d. | n.d. |
| Porvenir, El | n.d. | 20 | 32 | 9% | 7.37 |
| Porvenir, El | n.d. | 362 | 34 | -47% | -1.47 |
| Puebla de Morelia | 77 | 67 | 104 | 9% | 7.88 |
| Refugio. El | n.d. | 71 | 107 | 8% | 8.45 |
| Ricardo Flores Magon (Lag. Cooxli) | n.d. | 151 | 175 | 3% | 23.50 |
| Ricardo Payro Jene, Ing. (Polo Norte) | 285 | 428 | 594 | 7% | 10.57 |
| San Antonio | 3 | 20 | 18 | -2% | -32.89 |
| San Dimas (Alianza II) | n.d. | n.d. | 18 | n.d. | n.d. |
| San Miguel | n.d. | 82 | 78 | -1% | -69.30 |
| Santa Lucia | 298 | 240 | 245 | 0% | 168.08 |
| Santo Domingo | n.d. | n.d. | 14 | n.d. | n.d. |
| Silencio, El | n.d. | n.d. | 6 | n.d. | n.d. |
| Silvituc | 386 | 639 | 739 | 3% | 23.84 |
| Solidaridad | n.d. | n.d. | 137 | n.d. | n.d. |
| Tambores de Emiliano Zapata, Los | n.d. | 134 | 159 | 3% | 20.26 |
| Tepeyac | n.d. | 17 | 12 | -7% | -9.95 |
| Tesoro, El | n.d. | 191 | 288 | 8% | 8.44 |
| Tomas Aznar (La Moza) | 151 | 167 | 176 | 1% | 66.03 |
| Tombola, La | n.d. | n.d. | 25 | n.d. | n.d. |
| Tres Reyes | n.d. | n.d. | 68 | n.d. | n.d. |
| Unidad y Trabajo | 86 | 61 | 83 | 6% | 11.25 |
| Union, La (Dos Arroyos) | n.d. | n.d. | 108 | n.d. | n.d. |
| Valentin Gomez Farias | 10 | 118 | 203 | 11% | 6.39 |
| Veintidos de Abril | n.d. | 12 | 40 | 24% | 2.88 |
| Veintiuno de Mayo (Lechugal) | n.d. | 130 | 163 | 5% | 15.32 |
| Victoria, La | n.d. | 136 | 120 | -3% | -27.69 |
| Virgencita de la Candelaria, La | n.d. | 272 | 325 | 4% | 19.47 |
| Xbonil | 319 | 443 | 490 | 2% | 34.37 |
| Xpuhil | 339 | 865 | 1,213 | 7% | 10.25 |
| Yazuchil | n.d. | n.d. | 4 | n.d. | n.d. |
| TOTAL: | 6,858 | 19,331 | 24,295 | 4% | 19.42 |

* Crude Growth Rate

** Doubling Time in Years at *Current* Rate

NOTES: Crude Growth Rate and doubling time based on 5-year period (1990-1995). Total CGR adjusted for comparison ie. excluding communities for which there is no data in 1990. Between 1980 and 1990 there were **60** new communities founded. Between 1990 and 1995 **18** new communities were founded. In 1997 there were approximately **57 ranchos** in Calakmul. Negative doubling times indicate the number of years necessary for the population to decrease to half its present size. Most of the communities listed are *ejidos*.

Data source: Instituto Nacional de Estadística Geografía e Informática (INEGI) 1980, 1990 and 1995.

lotment to individual *ejidatarios* generally varies from 20 hectares to 100 hectares.

THE MOSAIC OF HUMAN PATTERNS OF LAND OCCUPATION

Anthropological studies identify the laborers in the chicle and timber industries as the first two of three distinct waves of migrants to enter the region in the 1900's (Boege and Murguía 1990). Due to the seasonal nature of the work, these migrants were largely transient and dependent on fluctuating employment opportunities tied to variable international market conditions. The third wave of migrants are *ejidal* colonists who began arriving in the region in the 1970's and continue to arrive today. These colonists have been *pushed* from their places of origin by lack of land, lack of employment, displacement by commercial agriculture, ecological catastrophe, and social unrest occurring in other parts of Mexico, including the state of Chiapas in recent years. They are subject to the *pull* of available land and the opportunity to establish new lives in a relatively unpopulated and still peaceful area. A fourth wave of in-migration, mostly government and service-industry workers, can be anticipated with the recent creation of the municipality of Calakmul, the strengthening of rural infrastructures, and the development of tourism in the region.

Colonization Adjacent to the Calakmul Biosphere Reserve

*Ejid*os in the frontier zone contain an important percentage of mature primary and young secondary forests with some possessing as much as 50,000 hectares of forested land. Rapid population growth rates in these *ejidos* indicate critical areas where land use may be subject to greater change. Of primary concern is the continuing in-migration to *ejidos* contiguous with the reserve. The *ejido* 11 de Mayo is located along the southeastern border of the reserve not far

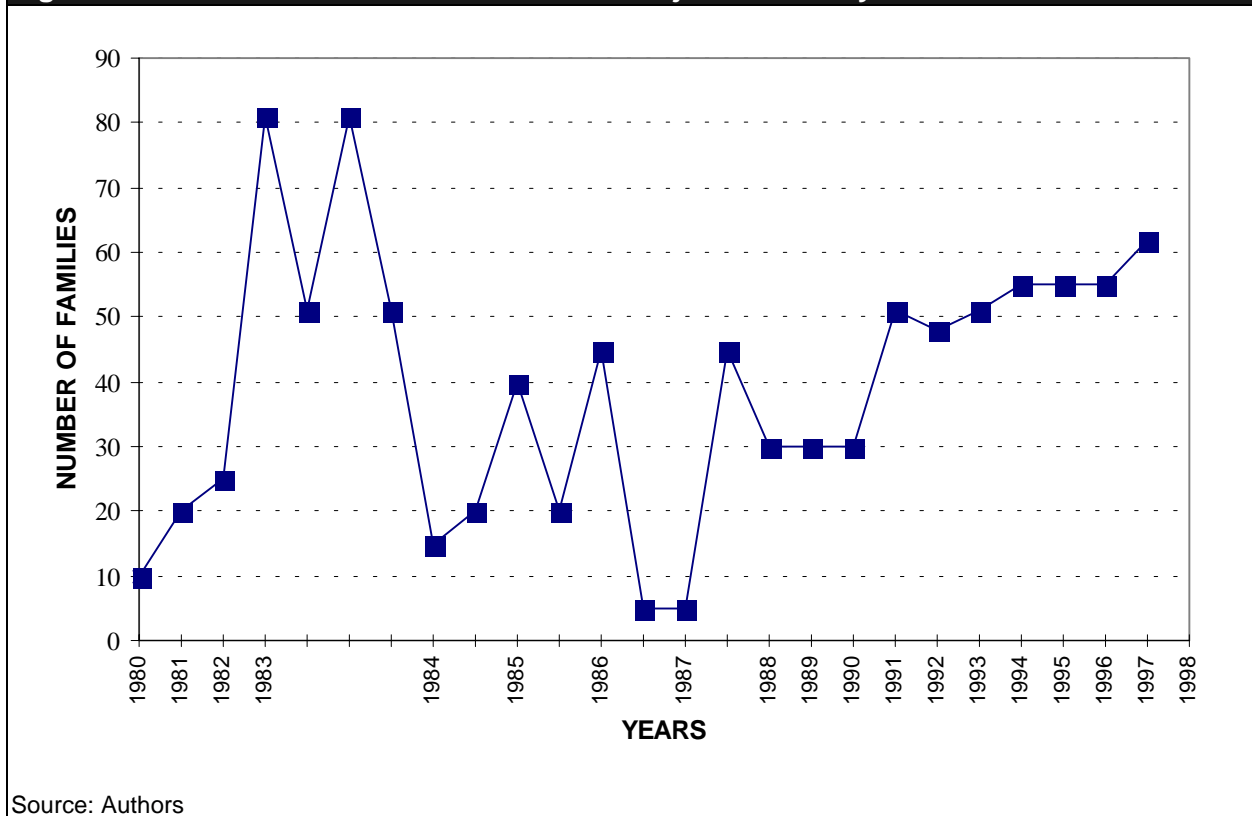
from the border with Guatemala. The first eleven years of the history of the community, shown in Figure 7, are characterized by a series of extreme changes in population level. Establishment of the *ejido* was prompted by agrarian reform policies in the early 1980's. Subsequent migrants are friends and family of original settlers.⁴ In recent years, the number of Chol and Tzeltal families has increased due to the social and political unrest in the neighboring state of Chiapas. Most members of these families speak Spanish, some are bilingual and others, mainly adult women, speak only the language of their ethnic group.

During the five-year period between 1990 and 1995, the population of 11 de Mayo grew at a rate of twenty-three percent according to government census data. Case study research shows that most of the growth in this period took place during 1990, just after road access was improved, and that population growth slowed significantly after 1991. The *ejido's* limit of fifty-five *ejidatarios*, established by internal law and registered in the agrarian reform offices, was reached in 1991 and there was no more available land for distribution to newcomers. Each *ejidatario* has been allotted 60 hectares plus a half hectare plot in the *ejido's* "urban" zone. Population growth slowed but did not diminish during this period in part due to improved infrastructure provided by the government, including solar powered electricity, a primary school, and a water catchment system. Population density was calculated at 6.15 people per hectare in 1995.

As illustrated in Figure 8, an oral history of 11 de Mayo according to one of its founding members, the mid-eighties brought fear and internal conflict. Division within the community over whether to apply for *ejido* status or small

⁴ In the *ejido* Conhuas we found that many new families arrived during the past few years due to availability of work in government sponsored archeological site excavations. This type of migration tends to be less permanent and lasts the duration of the job which may be anywhere from one to five years.

Figure 7: Evolution in Numbers of Families in Ejido 11 de Mayo



property-owner status resulted in violence, and population levels fell to their lowest at this time. The *ejido* was not legally recognized by the agrarian reform offices until 1994. For the first fourteen years of its existence, the community operated with an informal governing body which allocated parcels of land to older residents and withheld it from newcomers. Declines in the number of people living in the *ejido* during the early years also resulted from climatic conditions. The site is located on the border of the reserve in a lowland *bajo* which often floods during the rainy season and where water is retained in pools during much of the dry season. Severe flooding has on more than one occasion caused families to leave the community.







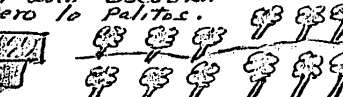



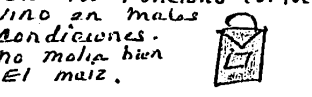

A particularly important *ejido* in the frontier zone is Xpujil. This community is quickly becoming urbanized as it has become the seat of the new municipality of Calakmul and is a major transport hub located at the

crossroads of two main roads running through and alongside the reserve. In Xpujil it is evident that the number of individuals with *ejidal* rights to the land, *ejidatarios*, has stabilized while the number of *pobladores*, individuals without *ejidal* rights to the land, continues to increase. *Pobladores* are opening shops, providing services and looking for work in the administration of the new municipality, the biosphere reserve and the tourism sector.

Natural Population Growth

Although migration is the primary force behind the rapid rate of increase in population region-wide, high rates of natural increase are beginning to show their effects. A recent study based on samples from four communities shows 5.8 children per family (Ericson 1996). Global fertility rates based on government census data range between 3.9 and 5.2 live births per woman (CONAPO

Figure 8: Oral History of the Community of 11 de Mayo

| | | |
|--|---|---|
| <p>HISTORIA DEL ETIDO II A LO DE 1997.</p> | <p>PUEBLO DE MAYO ABRIL DE</p> | |
| <p>TIENE 17 años llegaron EN 11 DE mayo de 1980 AVIA TRES Familias Y UN SEÑOR VIVIA Solo</p>  | <p>EL año 1987 SE FUERON gente por miedo por ASUNTOS DE Problemas.</p>  | <p>EN ESTE mismo año LES DIERON un credito de Pronasol a todas Las integrantes de la UAIM. 1993</p> |
| <p>AVIA MUCHO MONTAÑA</p>  | <p>Poblado 11 de mayo ESTA llegando los campesinos. Veracruzano HACE 9 años.</p>  | <p>PROCAMPO a Poyo al campo <1994> Solo para los Hombres.</p> |
| <p>durante hace 3 años llovian muy fuerte se perdian mucho cosecha de maiz Fisoles.</p>  | <p>EL Poblado 11 de mayo AVIA Pobladores. ESIDATARIO poblador</p>  | <p>HACE 3 años NO HABIA CARRETERA ni AVIA ESCUELA Pero lo Palitos.</p>  |
| <p>EL AÑO DE 1982 SE FUE SU PAPA La Señora NUEVO MICHOACAN Por Boncil Campeche 2 años.</p>  | <p>HACE 7 años que PUEDEN Vender y Comprar las Parcelas.</p>  | <p>INFORMANTE: DOÑA SILVIA SANDOVAL AVILA.</p> |
| <p>1983 SE FUE OTRAS Familias 2 Por el Problema de Las FUERTES llovias.</p>  | <p>HACE 5 años SE organizo LA UAIM (1992) \$ 1,500.00 LES DIERON EL molino PERO no Funciona porque vino en malas condiciones. no molia bien El maiz.</p>  | |
| <p>LA MILPA Lo Siembra YA SE VAN A ESPIGAR</p>  | <p>Pronasol <1993> Credito PARA Los Campesinos. ES PARA Los Hombres y mujeres.</p> | |

Source: Authors

1996).⁵ Twenty-one percent of the population is comprised of women in their childbearing years, between 15 and 49 years (Loudiyi 1994). As in many rural areas of developing countries, fifty-one percent of the population is under the age of fifteen years with only 2 percent of the population 65 years or older (WWF 1994). Confronted by a situation of high fertility and rapid rates of natural growth, PPY is incorporating an educational reproductive health program into the population component of its work around the Calakmul Biosphere Reserve. The program is designed to increase family access to existing reproductive health services offered by government health services.

A sample of seventeen women from the *ejido* 11 de Mayo shows that the average number of pregnancies among Chol, Tzeltal, and Spanish-speaking women is calculated at 5.2. When this same group of women was asked how many children they had desired at the time of marriage, many said they had never thought about it while others reported a desire for an average of 2.8 children. This large discrepancy between children desired at the time of marriage, and number of pregnancies may reflect male rather than female preferences in use or non-use of family planning methods.⁶

Inappropriate Agricultural Technologies

Along with aspirations for a better future, colonists often bring with them land-use practices which may be unsuitable to the ecological conditions of their new home. Although most of the farmers in the region's eco-

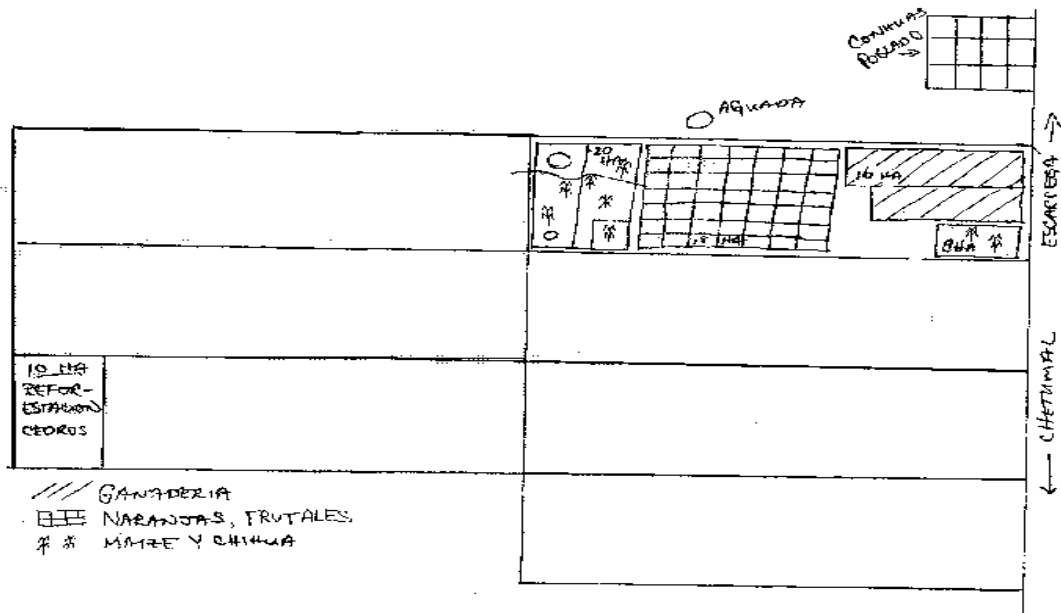
nomically marginalized communities practice subsistence and small-scale agriculture, migrants from central and northern Mexico have a propensity to employ mechanized agriculture and agrochemicals for cash crop cultivation. These farming technologies contribute to reduction in the forest cover as well as declines in soil fertility and structure of this tropical ecosystem. In contrast, colonists already familiar with the tropical forest of the Yucatán Peninsula, such as the indigenous Maya, use the swidden system of agriculture that allows the forest to regenerate. Regeneration of secondary growth during the fallow period is encouraged by the Mayan populations because various forest products have use and exchange values (Murphy 1990). In both systems, the use of fire to clear brush and crop residue before the onset of the rainy season can be sorely destructive. Unless watched with an experienced eye of farmers familiar with the ecosystem, fires burn quickly out of control.

Cattle-ranching is another land-use practice that can be destructive. The cattle hoofs tend to compact the fragile limestone soils while the tight webs formed by the roots of forage grasses prohibit the regrowth of forest vegetation. In the communities participating in this study, informants spoke of plans to convert agricultural lands to pasture (Figure 9). From a conservationist viewpoint, the aspiration of colonialists to raise livestock such as goats and cattle is viewed with considerable alarm. Yet, local communities view cattle as a symbol of wealth. Wealth-ranking exercises performed with informants in these communities put cattle owners among those with the fewest financial difficulties. The conversion of forest to pasture lands may result in a profound and perhaps irreversible land use transformations within the *ejido* communities. The future of the Calakmul Biosphere Reserve is at stake if this forest

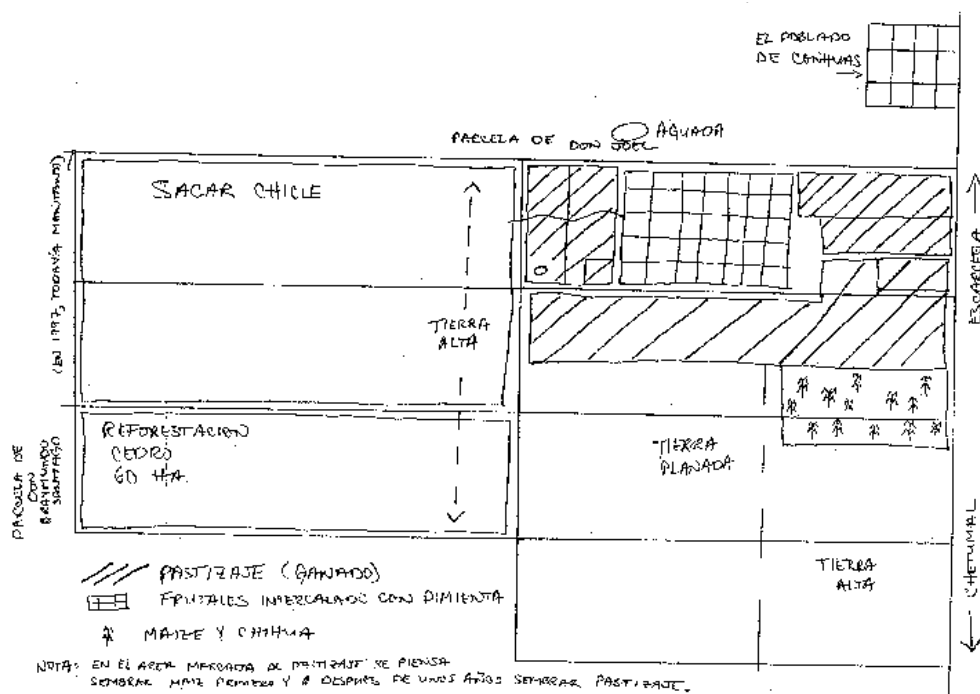
⁵ These figures represent fertility rates calculated for the municipalities of Hopelchen and Champoton which, prior to the establishment of the Calakmul municipality in 1997, included the communities around the biosphere reserve. At this time fertility rates based on government data for the Calakmul area are not available.

⁶ Measuring pregnancy intentions has been shown to be problematic, but some studies indicate that fertility intentions are closely related to whether or not a woman has another child (Tan and Tey 1995).

Figure 9: One Family's Present Land Use and Future Land Use Plan: Ejido Conhuas
Current Parcelas Land Use Plan, Ejido Conhuas



Future Parcelas Land Use Plan, Ejido Conhuas (year 2005)



Source: Authors

conversion in surrounding *ejidos* becomes more extensive. With rapidly growing rural populations occurring around the reserve, it is likely that political pressure will increase to convert the forest resources of the reserve into pastures and farmed lands.

The trends toward mechanized agriculture and cattle ranching are currently kept in check by financial and ecological constraints. Both activities require a financial investment greater than that available to the majority of the region's colonists. Although very few farmers can afford to purchase a tractor, many of them pay to have one or two hectares plowed each year by a regional *campesino* organization. In some communities, poor soil conditions and a shortage of permanent water sources prohibit both these activities. Conservation programs in the communities focus on stabilizing land-use and curbing the expansion of agricultural and pasture lands by improving incomes from forestry-based enterprises such as sustained-yield timber harvesting, chicle extraction, apiculture, and agroforestry. However, it is uncertain that increased income generation from forest product extraction will reduce the amount of land in agriculture without effective land-use planning. Anecdotal experience in the region suggests farmers are investing incomes from commercial forest product extraction into land clearing of prime forest lands and agricultural inputs detrimental to the environment (Stedman-Edwards 1997).

Resource Conflicts and the Calakmul Biosphere Reserve

The establishment of the Calakmul Biosphere Reserve has caused conflicts between local communities and the reserve management. Although various studies were carried out in the region during the 1980's when the creation of an archeoecological park was under

consideration,⁷ the reserve boundaries were drawn with insufficient consideration for the existence of *ejido* and private lands. The boundaries of the reserve as currently delineated are problematic due to previously existing land tenure arrangements and current resource use patterns. As a result, a number of *ejido* communities and small landholdings are either within or straddle the border of the core area in both northern and southern divisions of the reserve.⁸ Considerable unease exists within the communities regarding their tenuous tenurial position.

According to national forestry law, forestry studies and a management plan are required to receive permission from the federal government for felling authorized volumes of specified forest tree species in designated locations. Enforcement of this law has been inconsistent which causes some residents to express frustration and anger at the prohibition of unauthorized timber exploitation on *ejido* lands and the complete prohibition within the core zone of the reserve. Many ignore the restrictions and continue cutting timber. This attitude is more evident in communities in which alternative income generating projects have not yet been introduced. Many local residents believe that conservation of stand-

⁷ Ecological, archeological, legal and political studies were carried out in the early to mid-1980's by the Centro de Investigaciones Históricas y Sociales of the Universidad Autónoma de Campeche under the direction of Dr. William Folan in collaboration with the Secretaría de Desarrollo Urbano y Ecología and the Instituto Nacional de Antropología e Historia. World Wildlife Fund in collaboration with Pronatura Península de Yucatán, A.C. and the Centro de Estudios para la Conservación de los Recursos Naturales, A.C. also performed studies during the latter part of the 1980's (see Vasquez Sánchez 1991).

⁸ In 1993 the state government succeeded in relocating one of the communities located within the core zone of the reserve. The community was persuaded to move because they were offered another site with improved access to communication and services. In addition, the government constructed housing for each family in the new site and provided solar power for each house.

ing forest limits livelihood strategies necessary for survival.

No formal mechanism yet exists by which surrounding communities can share in the funds collected from tourists entering the CBR to view wildlife and archeological sites. However, a tourist guide service run by a handful of local residents trained through a collaborative effort between NGO and governmental institutions exists in Xpujil. And, with help from a regional campesino organization two *ejidos* with excavated archeological sites in their locality have organized tourist services.

Land Markets and Land Sales

Land markets are emerging due to changes in the federal constitution and major land tenure reforms in the early 1990's. Land can now be bought and sold within *ejidos*. During the past couple of years more than 100 hectares of land in Xpujil have been sold. Buyers are generally investors from outside of the region. Much of this land has been purchased for construction of shops and hotels in anticipation of a growing demand for tourist facilities. Land has also been purchased for construction of an airstrip in Xpujil.

Concern exists about the market sales of forest extension lands located within the reserve's buffer zone and along the western border of the reserve. These extension lands belong to *ejido* communities located to the north of the reserve. Large distances exist between the extension lands and the communities to which they belong indicating that these lands are probably not in use and *ejidatarios* may choose to sell them. In 1996 the forest extension lands of the *ejido* Dzibalchen which border the northern division of the CBR were expropriated by the federal government for the relocation of indigenous people from Chiapas. After Chiapas decided not to relocate its people to Campeche, the land was

received by the Campeche state government. The future use of this land is now uncertain. In the case of Dzibalchen, a damage payment significantly lower than the commercial value of the land was paid to *ejidatarios*.

Infrastructural Development

Recent infrastructural developments may stimulate increased in-migration in the coming years. Scarcity of water resources in the region has in the past often encouraged the out-migration of large numbers of people. A large-scale water project currently underway will carry water eighty-five kilometers from a shallow lagoon, Laguna de Alvarado, near the border with Guatemala to service twenty-two communities in the frontier zone. The aqueduct is intended for use during the dry season as a complement to already existing water catchment systems in the *ejidos*. Increased water security will decrease out-migration and may attract more migrants. However, based on population projections calculated on current growth rates it is estimated that this new system will only be able to service the needs of these communities until the year 2005 (CNA 1996).

The Calakmul Biosphere Reserve is crossed by two major roads. An east-west inter-state highway runs through the narrow mid-section separating the northern and southern core areas. And, there is a paved road running north-south along the eastern side of the reserve through the upper core area and down to the *ejidos* located near the with Guatemala border. The road will facilitate market and services access to the *ejidos* located along it and inevitably affect population growth rates in these communities. This road, as well as an airstrip under construction in Xpujil, will also encourage greater tourist access to the natural and archeological sites within and around the reserve. The Mexican

government has proposed that this road be extended to Tikal, Guatemala.

CHALLENGES AND OPPORTUNITIES FOR MITIGATING MIGRATION IMPACTS

Federal Government Land Use Policies

The Calakmul Biosphere Reserve was created by the Mexican federal government for the protection of the biological and cultural wealth of southeastern Campeche state. While some ministries and departments of the government support the policy to establish and protect the reserve, others promote policies that may undermine conservation goals. Federal governmental bodies may not yet recognize the ecological and social consequences of contradictory policies because the region is remote and relatively understudied. The contradictions are clearly present regarding policies to expand roads into the Calakmul region and to subsidize agricultural production.

As noted above, road construction through core areas of the reserve opens up the region for agricultural and social development. In-migration and its associated environmental consequences are stimulated by the growth of a rapidly improving road infrastructure. Federal government policy explicitly encourages the social and economic development of this frontier area. The Mexican press reports that officials in the federal offices of the ministry of social development (SEDESOL) consider this region to be among the ninety-one priority regions of the country due to its development potential (*Diario de Yucatan*, November 7 1996). Unless effective land use planning occurs, it is difficult to envisage how the municipality of Calakmul can be transformed into a development zone without undermining

the rich natural resources found within and around the biosphere reserve.

During the presidential administration of Salinas de Gortari, a country-wide agricultural program called PROCAMPO was initiated to cushion the impact of the removal of trade barriers and price subsidies by improving incentives for basic food crop cultivation.⁹ Scheduled to continue for a period of fifteen years, the program provides cash subsidies directly to farmers on a per hectare basis for planting crops such as corn, beans, and rice regardless of yields produced. These politically popular subsidies provide much needed economic assistance in the region. However, not only does this program encourage the reduction of forest cover by supporting agriculture, but research in other parts of Mexico has shown that PROCAMPO financially benefits livestock producers and the commercial sector more than it benefits the agricultural sector (Yúñez-Naude, et al. 1995). Officially, only areas that had been planted for three years (1989-1992) prior to the initiation of the program are eligible for the subsidy; but it is likely that farmers have also claimed the subsidy for newly cleared lands, especially in tropical areas like the Calakmul area where soil conditions for agriculture rapidly deteriorate.

State of Campeche Land Use Policies

In January 1997, the region around the Calakmul Biosphere Reserve was given municipal status to facilitate a greater governmental presence in the region.¹⁰ According to state government officials, the creation of the Calakmul municipality is designed to

⁹ National Farm Modernization Program (Programa Nacional de Modernización del Campo).

¹⁰ The eastern border of the Calakmul municipality is being disputed by the neighboring state of Quintana Roo due to a historical conflict over the exact location of the border marker, the punto Put, lost to the jungle many years ago.

facilitate the economic development of the region around the administrative capital of Xpujil. The fledgling municipality of Calakmul is being promoted as an *ecological* municipality due to the presence of the biosphere reserve within its borders. Thus, the concept of an ecological municipality exists as somehow distinct from the typical municipality. However, there is still no clarity about what distinguishes an *ecological* municipality from a standard municipality. While the state of Campeche plans to designate a protected area within each of the state's municipalities, some observers suggest that this is simply an administrative mechanism for attracting additional international donor funding to the state for environmental programs.

Contradictions exist between the reserve, destined for the protection of the environment, and the newly established municipality designated as a priority area for development. Because the objectives of conservation and development are often incompatible, land-use planning and the creation of strategies for sustainable development in the region will be a topic of continual tension in the struggle to balance interests among stakeholders. Unfortunately, local-level institutional structures most likely to be involved in planning initiatives at this time (i.e. the administration of the new municipality, the administration of the CBR, and the various *campesino* councils, such as the Consejo Regional Agrosilvopecuario de Xpujil) lack experience in this field.

Although implications are not yet clear, the creation of the ecological municipality will probably stimulate another wave of migration into the region. Government and service oriented workers are erecting homes and offices in Xpujil, the seat of the new municipality. Greater development in the region's infrastructure is inevitable with meeting the needs of the region's water requirements as no doubt the largest hurdle to be overcome.

Community Land Use Planning Practices

The applied research conducted for this study in selected *ejidos* around the Calakmul Biosphere Reserve suggests that effective land use planning is intimately linked to a sense by residents that their rights to land and other natural resources are secure. According to Mexican agrarian reform law, residents are divided into *ejidatarios*, those with rights to the land and most often the *ejido's* founders, and *pobladores*, those without rights to the land most often the recent immigrants.¹¹ In some communities, a considerable gulf exists between *ejidatarios* and *pobladores* because of differences that exist between the two groups in terms of access to social services from government agencies, decision-making power, and natural resources. *Pobladores* may not invest labor and financial resources in sustainable agricultural technologies if they do not have secure access to land. In contrast, *ejidatarios* have much greater authority and institutional incentives to manage resource. Registered with the agrarian reform offices, *ejidatarios* are responsible for formulation and enforcement of internal *ejido* laws and they must participate in *ejido* management through an assembly. *Ejidatarios* are usually men, but women can also be *ejidatarias* under special circumstances specified in agrarian reform law.

In *ejidos* such as 11 de Mayo and Nueva Vida, *pobladores* still constitute a minority of the population. They are newcomers hoping to acquire *ejidatario* status after a stated period of time, or sons of *ejidatarios* expecting to become *ejidatarios* themselves. To be admitted to the *ejido* an applicant must present a letter of recommendation from the authorities of his/her previ-

¹¹ The term *poblador* is commonly used in southeastern Campeche to refer to those without rights to the land. The term *avecindados* is used in agrarian law to signify the same.

ous *ejido* or village and pay the required fee. Although they often have to share in communal work, contribute to *ejido* funds and participate in assemblies, *pobladores* have neither a voice nor a vote in the *ejido*. Depending on the size of the *ejido*, *pobladores* are sometimes provided with the same amount of land allotted to *ejidatarios*, albeit located in a less desirable part of the *ejido* farther from the settlement area and covered with tall trees of the primary forest - an undesirable situation because considerable investments of labor must be allocated for forest clearing.¹² This land can be taken away at any time if one's behavior fails to satisfy the assembly of *ejidatarios*. When not provided with a *parcela*,¹³ *pobladores* may be lent land on an informal basis by an *ejidatario*. Without land of their own, *pobladores* are an important labor pool for clearing fields and harvesting the crops of *ejidatarios*. However, the supply of wage labor is scarce in most of the region's communities. *Pobladores* often prefer to leave their family to travel to other communities, cities or, in the case of some young people, to the United States in search of employment.

Conflict, corruption and violence are recognized problems in *ejido* life (Ronfeldt 1973; Haenn 1997). Mischievous acts are sometimes used to discourage *pobladores* from becoming too comfortable within an *ejido*. This is due to the fear that *pobladores* will gain excessive authority within the community. In Conhuas, for example, the footpath to the borrowed land of a particularly outspoken *poblador* was blocked repeatedly with fallen logs. He had been promised *ejidatario* status within one year after his arrival in the *ejido*, but almost two

years passed before he received recognition by the assembly. Tensions are growing in the Conhuas community because the number of *pobladores* in almost equals the number of *ejidatarios*. Although the *ejido* assembly plans to recognize all current *pobladores* as *ejidatarios* before closing the door to new arrivals, the *pobladores* endure a constant stream of criminal acts performed by a clandestine group of young people from some of the *ejido*'s founding families. While the community intends to close the door to newcomers, this is easier said than done because it is very difficult to refuse settlement of newly arrived family members.

Informal, and to some extent formal, land-use planning already occurs in the *ejidos*. Land allocation decisions are made by the *ejido* assembly. Within the *parcelas*, households determine land uses largely based on the evaluation of environmental parameters such as soil type. But, land use planning at the community and household level is sharply constrained by the legitimate tendency of individuals to seek out short term economic benefits for the household. In poverty-stricken communities, this short-term calculation is certainly understandable. Yet, planning for conservation of biodiversity at the *ejido* level requires a much longer term vision about how land use arrangements should be shaped in order to guarantee the maintenance of habitats and ecological processes. To the economically and politically marginalized peoples living in and around protected areas such as the Calakmul Biosphere Reserve, it is difficult to derive a long-term vision of how to conserve resources in perpetuity when a family is confronted by immediate pressures to produce sufficient food and monetary benefits for household survival.

The pressures between short-term survival strategies and long-term conservation objectives play themselves

¹² More labor is required to convert a hectare of primary growth forest to agricultural land or pasture than is required to convert a hectare covered with secondary growth vegetation. Primary forest of tall trees is thus less desirable for the cultivation of basic crops such as maize.

¹³ A *parcela* is the worksite assigned to an *ejidatario* or *poblador* by the *ejido* assembly.

out in the illegal trade for tropical hardwoods. Illegal extraction of precious and other marketable hardwoods occurs from individual *parcelas* and communally managed forest areas on *ejido* lands. Illegal timber cutting also occurs within the core area of the reserve and along both sides of the border shared with Guatemala. Both the *ejidos* and the reserve management staff lack an effective enforcement system to control this extraction. Enforcement structures are difficult to build when demand for precious hardwoods is high. Some of the timber is sold to carpentry workshops in the communities north of the reserve, (Faust, pers. comm. September 1997) but most of it is purchased by distributors from states as far away as Veracruz and Jalisco.

Household Livelihood Strategies

Throughout the case study research conducted in the three *ejidos*, the rural peoples interviewed stressed the importance of improving the conditions of life for community members. Women seek to meet immediate household needs such as firewood, clothing for the children, roofing materials, and wire fencing for protecting domestic livestock, as shown in Figure 10. Men voice the need to improve crop yields primarily through mechanized agriculture. They seek to obtain credits from the government, and take advantage of services afforded by NGO's working in the area. Both men and women agree that water, electricity, schools, health services, and roads are priorities.

The three *ejido* communities participating in this study declare a strong preference and expectation of government assistance. This expectation is fueled by the history of job creation programs introduced just after the creation of the biosphere reserve in the early 1990's with the support of the government program Solidaridad and the national program for reforestation (PRONARE).

Farmers largely depend on government subsidies from programs like PROCAMPO and on food aid provided by the federal agency for family development (DIF). Solidaridad also provides financial assistance to families with small children to encourage primary school attendance. This dependency on state subsidies tends to undermine community self-determination.

Interviews with women in these communities indicate that family reproductive decisions are most often made by men. Successful families are often those with many children who become *ejidatarios* in their own right and combine forces with other family members in productive activities, or become professional people such as teachers, or migrate to the United States and send remittances back home. Thus the life projects of many rural women revolve around or are constrained by reproductive decisions made by their husbands and are based on hopes of increasing the family living standard once the children are old enough to join the labor force.

IMPLICATIONS FOR COMMUNITY-BASED RESOURCE CONSERVATION PROGRAMS

Consideration 1: Opportunities and Dangers of Participatory Research

PRA is a *participatory* research method, designed to empower informants as well as collect data. Working in a participatory manner with *campesinos* creates an opportunity for them to tell their own story by giving them tools to communicate their concerns to outside groups. It has great potential for use in multi-level community and regional planning as it creates opportunities to build mutual understanding among different parties.

However, the effectiveness of a participatory methodology must be considered within the context of power

| Figure 10: Planning Priorities of Tzeltal-Speaking Women in the Ejido 11 de Mayo | | | |
|---|---|--|--|
| PLANNING FOR THE FUTURE OF THE EJIDO 11 DE MAYO BY TZELTAL-SPEAKING WOMEN | | | |
| | HOW IS THE EJIDO PRESENTLY? (What do they have and what is missing?) | HOW TO RESOLVE OR ATTAIN WHAT THEY WANT IN THE FUTURE | HOW WOULD THEY LIKE THEIR EJIDO IN THE FUTURE, YEAR 2005 (What would they like to have?) |
| | They think the ejido has 4,116 ha. They think there are 500 inhabitants | | They think it will have 4,115 ha. They think it will have 1,000 inhabitants. |
| SERVICES Problems / Solutions | <ul style="list-style-type: none"> Not enough water They have to go far to look for water and fuelwood School teachers do not always come to class every day of the week | <ul style="list-style-type: none"> They will ask the authorities for everything they want | <ul style="list-style-type: none"> Each house has a water tank Piping / drinking water / another fenced water catchment basin so that people can drink the water Cars to go to the water hole to wash clothes and carry fuelwood Conasupo (government-owned store run by the community that provides basic necessities) Electricity |
| COMMUNICATIONS Problems / Solutions | <ul style="list-style-type: none"> The road is bad; no cars can pass through when it rains | <ul style="list-style-type: none"> They will ask the authorities for everything they want | |
| POPULATION Problems/ Solutions | <ul style="list-style-type: none"> Sheep and other animals trespass into their back yards | <ul style="list-style-type: none"> Work with Pronatura. Ask them for animals Get an operation to have less children | <ul style="list-style-type: none"> Wire fencing for the back yards of houses Sewing machines for the women Clothes for the children Stuffed animals Tin roofs for the houses |
| FORESTS Problems/ Solutions | <ul style="list-style-type: none"> Not everyone has a plot of land Small harvests because of lack of rain Sheep and other animals trespass into their plots | <ul style="list-style-type: none"> Mechanize the land so that their children can have a place to work/mechanize the land to save the forests Buy gas stoves to save fuelwood | <ul style="list-style-type: none"> Not everyone has a plot of land There will be less forests and fuelwood |

Note: Participatory exercise carried out with a group of Tzeltal-speaking women in the ejido 11 de Mayo.

structures that characterize the society-at-large (Boesveld 1991). Because *campesinos* are a relatively non-empowered group within Mexican society, the risk exists that data collected may be used to the detriment of informants in the design of top-down management plans. This risk is related to the fact that unempowered groups are generally unfamiliar with information management and unaware of how it can be manipulated by decision makers. Organizations basing their work on participatory field research methodologies must always ask themselves at what point does divulged information damage the interests of informants. Free and open exchange of all information can break the bonds of trust so carefully constructed during the research process.

Consideration 2: Diverging Perspectives between Conservation Objectives and “Life Projects” of Local Communities

Participatory research may not always provide results expected by the conservation organization. Conservation organizations must be willing to accept and work with the perspectives of rural peoples that may indeed differ from those of the conservationists. This study shows that around the CBR considerable efforts must be undertaken to narrow the gap that currently exists between local community concerns and the objectives of conservation organizations. Our study suggests that community members become interested in ecologically sustainable activities, such as beekeeping or intensified agriculture, if these activities are economically viable. The marginalized people of this region seek financial advancement, and the package of inputs so far presented by conservation organizations may not be generating economic benefits that are sufficient to meet their expectations. In the harsh physical and social en-

vironment of the Calakmul area, communities around the reserve tend to see conservation agendas as a force that undermines survival strategies. This seems to indicate that environment and development programs may need to lobby for policy changes that increase the cost effectiveness of sustainable agricultural technologies.

Consideration 3: Challenges for Building Population Monitoring Systems

As population dynamics are bound to continue to change rapidly over the coming years in the communities around the CBR, decision-makers have requested the development of a multi-level population monitoring system that includes the participation of local residents. Conservationists seek a system that accurately measures trends at both the micro level of the *ejido* and the macro level of the region. Decision-makers are interested to know where and why people settle the way they do and to better understand the determinants of fertility. This request harkens back to the ethical problems accompanying participatory research stated earlier. People divulging information about where they live may result in government restrictions and even forced removal from their lands. Alternatively, local people may surmise that such information might bring benefits and so distort the information accordingly. Local people need to be involved in this monitoring but, unless they can trust that the information will not undermine survival strategies, they may not be truthful.

Consideration 4: Community Land Use Planning and Conservation Planning

Little cultural homogeneity exists in the *ejidos* surrounding the Calakmul Biosphere Reserve. Within each community divisions can be uncovered along ethnic, kin-

ship or religious lines and conflicts are an ever-present reality. Inheritance customs with respect to the land vary between ethnic groups. In addition, because these communities were only recently established, they have limited experience undertaking collective action. Few rural institutions are present in the communities, and political parties seem to encourage internal divisions in the communities through few seem to receive benefits from political participation. Working with the rural communities around the Calakmul Biosphere Reserve is thus a major challenge for conservation and development organizations.

Land-use planning at the local level entails the formulation and enforcement of rules on how land is to be used in the present and future. Certainly, within the current *ejido* system of governance, local communities have the freedom and legal protection to enforce internal rule-making. When it is in their interest to do so, *ejidos* can be effective units for land use planning.

However, community level planning alone in the region's *ejidos* may not be strong enough to withstand the pressures exerted from paternalistic political and administrative structures, land tenure insecurity, the limited internal skills for community level resource planning, and major development and conservation programs. Community-based planning alone can not stem biodiversity loss linked to the growth of population densities that in themselves are associated with external factors such as the construction of new roads and water systems in the region. These pervasive forces overwhelm the ability of local communities to control the settlement of in-migrants and land uses within the *ejido*. While conservationists tend to treat increasing growing populations as a threat to the ecological viability of the reserve, many local residents see this in quite

a different light. From their perspective, population growth contributes to the taming of the hostile and difficult physical environment.

Conservation NGO's such as WWF and PPY should begin to take a larger role in promoting environmental education program that build upon the concerns of communities to assure household survival. Programs should continue that propose economically sound sustainable agricultural practices linked to effective community level land-use planning. Rural communities request access to family planning, but often for cultural and economic reasons lack access to reproductive health services. Although it is somewhat easier to focus on providing technical extension services to rural communities, conservation and development organizations should begin to look at more complex institutional and policy questions.

Consideration 5: Building Conditions for Dialogue on Population Dynamics and Conservation

The applied research program launched as part of Pronatura Peninsula de Yucatán's population initiative indicates that fostering public debate and dialogue on population dynamics is a critically important tool for building consensus on future courses of action. But first, conservation organizations need to listen carefully to local residents, enter into discourse with them, and attempt to view conservation and development challenges from their perspective. Evidence provided by the diagnostic case studies is sobering in that it indicates the extent of work that must be done to assure that the environmental agenda is included in community level planning activities. Following these case studies, an opportunity now exists for organizations like PPY to begin to launch dialogue and discussion on

these issues and to learn to struggle together with local residents to come up with new solutions to old problems. This is the essence of environmental education. The PRA research process of this study experimented tools to generate dialogue in order to see what type of responses are recommended by rural communities. Numerous insights have been generated, though it takes considerable foresight to link the current lack of community level environmental awareness with conservation objectives. For instance, conservation of wildlife is viewed only as a peripheral part of the world view of *campesinos*, but it might become more important to them if direct benefits can be derived from a tourism industry interested in conserving both forests and wildlife.

Consideration 6: Meeting Unmet Needs for Public Health and Reproductive Health Care

A concerted effort was made throughout the diagnostic case studies to link our study with one carried out by PPY's reproductive health team. This later study sought to increase understanding of factors that contribute to natural population growth rates in the *ejidos* and to integrate reproductive health issues into community-level discussions. From our research, it seems clear that the provision of reproductive and family health care assistance can help build trust and confidence with community members because improvements in health tend to offer rapid returns to the household. This approach is based on the hypothesis that local people will be more open to initiatives that offer long-term gains, such as conservation, once immediate community concerns have been addressed. In addition, resolving conflicts over health care provision may be a step toward resolving a wide array of impediments to planning for economic development and sustainable uses of natural re-

sources. PPY's reproductive health project attempts to respond to an expressed need for reproductive health services through an educational process based within the communities. As government sponsored reproductive health services already exist in the communities but are generally not promoted, the project also reinforces local capacity to take advantage of these services.

CONCLUSIONS

The future of the Calakmul Biosphere Reserve is at stake. Rapid population growth, primarily attributed to a dramatic rate of in-migration, threatens the long-term viability of the reserve unless effective land use planning approaches and practices are put in place. At this time in the Calakmul region, there are few structures for empowering local communities to determine their future destinies. Caught in a web of dependency, local communities have neither the incentives nor the institutional support to plan for a just and sustainable future. Government at the federal and state level play vital roles in building options and incentives for economic development and sustainable land uses. At the same time, non-governmental organizations face great challenges to encourage the creation of institutional structures that increase community participation in decision-making and land-use planning, and ultimately lead to sustainable use of natural resources.

REFERENCES

- Adams, R.E.W. 1977. Rio Bec archeology. In: Adams, R.E.W., ed. *The origins of Maya civilization*, pp. 85-99. University of New Mexico Press: Albuquerque, New Mexico.
- Anderson, Simon and Jennifer Rietbergen-McCracken. 1994. *El diagnostico participativo: un manual aplicado de tecnicas*. El Grupo DIP; Merida, Yucatan.
- Antochiw, Michel. 1997. La cartografia y los Cehaches. In: *Gobierno del Estado de Campeche. Calakmul: volver al sur*, pp. 23-32. Campeche, Mexico.
- Bajracharya, Sidhartha B.; Gurung, Lal Prasad; Manandhar, Anil. *Population dynamics and resource conservation initiative in Annapurna Conservation Area Project, Nepal*. WWF Nepal. March, 1997.
- Barton, T., Borrini-Feyerabend, G., de Sherbinin, A. and Warren, P. 1997. *Our people, our resources*. The World Conservation Union (IUCN).
- Berlanga, Mauro; Wood, P. 1997. *Las aves de la Reserva de la Biosfera de Calakmul, Campeche, Mexico*. Internal report: Pronatura, Península de Yucatán, A.C.: Mérida, Yucatán.
- Bilsborrow, Richard D. and DeLargy, Pamela. 1991. Land use, migration, and natural resource deterioration: the experience of Guatemala and the Sudan. *Population and development review*. Supplement to volume 16.
- Boege, Eckart and Raul Murguia. 1990. Diagnostico de las actividades humanas que se realizan en la reserva de la biosfera de Calakmul, estado de Campeche. Internal report: Pronatura, Peninsula de Yucatan, A.C.; Merida, Yucatan.
- Boege, Eckart. 1995. *The Calakmul biosphere reserve, Mexico*. Working paper No. 13. Paper presented at international conference; UNESCO South-South Cooperation Programme, Paris.
- Boesveld, M. and E. Postel-Coster. 1991. Planning with women for wise use of the environment. Research and practical issues. In: *Landscape and urban planning*, 20:141-150. Elsevier Science Publishers B.V., Amsterdam.
- Bruce, John. 1989. Rapid appraisal of tree and land tenure. Food and Agriculture Organization. *Community Forestry Note no. 5*.
- Caudill, Denise. 1997. *Lessons from the field: Integration of population and environment*. World Neighbors.
- Chambers, Robert. 1983. *Rural development: Putting the last first*. New York: John Wiley and Sons.
- Comision Nacional del Agua (CNA). 1996. Internal report: Abastecimiento de agua potable en la region de Xpujil, municipios de Hopelchen y Champoton, Campeche. Gerencia estatal de Campeche. Campeche, Campeche.
- Cruz, Maria C.J. 1996. Management options for biodiversity protection and population. In: Dompka, Victoria, ed. *Human population, biodiversity and protected areas: science and policy issues*. American Association for the Advancement of Science; Washington, DC. pp. 71-89.

Diario de Yucatan, November 7, 1996. Xpujil, region prioritaria para el Gobierno Federal, dice el titular de Desarrollo Social. Merida, Yucatan.

Dompka, Victoria and Allcott, Peggy. 1998. Do numbers matter: population impacts on environmental projects. American Association for the Advancement of Science and World Wildlife Fund, UK.

Dominguez, Maria del Rosario and William J. Folan. 1995. Calakmul, Mexico: aguadas, bajos, precipitacion y asentamiento en el Peten Campechano. Paper presented at: IX simposio de investigaciones arqueologicas en Guatemala. Museo Nacional de Arqueologia y Etnologia. July, 1995; Guatemala.

Engelman, Robert. 1998. Plan and conserve: A source book on linking population and environmental services in communities. Population Action International.

Ericson, Jenny. 1996. Conservation and development on the border of the Calakmul Biosphere Reserve. Masters thesis: Humboldt State University. Arcata, California.

Ericson, Jenny. 1997. Regional assessment: Calakmul population-environment initiative. Internal report. World Wildlife Fund Mexico program. Mexico City.

Farriss, Nancy. 1984. Maya society under colonial rule: the collective enterprise of survival. Princeton University Press: Princeton, New Jersey.

Faust, Betty. 1998. Mexican rural development and the plumed serpent. Bergin and Garvey: Westport, Connecticut.

Freudenberger, Mark, Mogba, Zéphirin; Zana, Henri; and Missosso, Monique. 1996. Migrations humaines et leurs impacts sur la conservation des ressources naturelles dans la Réserve de Dzanga-Sangha: Etude de cas de l'économie de diamant à Ndélengué, République Centrafricaine." WWF. Social Science and Economics Program.

Freudenberger, K.S. 1994. Tree and land tenure: rapid appraisal tools. Food and Agriculture Organization. Community Forestry Manual no. 4.

Galindo-Leal, Carlos. 1996. La biosfera de Calakmul y el desarrollo sustentable. In: Voz Comun: un espacio de integracion social en Campeche, 30:20-21.

Garrett, W.E. 1989. La ruta Maya. In: National Geographic Magazine, 176(4):424-479.

Haenn, Nora. 1997. Creating communities through acceptance/rejection of migrants in frontier Campeche. Paper presented at meeting of Latin American Studies Association; April 17-19: Guadalajara, Mexico.

Hecht, S. and A. Cockburn. 1989. The fate of the forest: Developers, destroyers and defenders of the Amazon. New York: Verso.

Jones, Grant. 1989. Maya resistance to Spanish rule: time and history on a colonial frontier. University of New Mexico Press: Albuquerque, New Mexico.

Miranda, F.; Hernández Xolocotzi, E. 1985. Los tipos de vegetación de México y su clasificación. In: Xolocotzia, tomo I. Universidad Autonoma Chapingo: México, D.F.

- Ness, Gayl with Meghan V. Golay. Population strategies for national sustainable development: a guide to assist national policy makers in linking population and environment in strategies for sustainable development. 1997. London: Earthscan Publications.
- McNeely, Jeffrey A. and Gayl Ness. 1996. People, parks, and biodiversity: issues in population-environment dynamics. In: Dompka, Victoria, ed. Human population, biodiversity and protected areas: science and policy issues. American Association for the Advancement of Science; Washington, DC. pp. 19-70.
- Murphy, Julia. 1990. Indigenous forest use and development in the "Maya zone" of Quintana Roo, Mexico. York University: Ontario, Canada. Major paper.
- Norma Oficial Mexicana; NOM-059-ECOL-1994.
- Pasos, Ruben; Pascal Giro; Michel Laforge; Pablo Torrealba; David Kaimowitz. 1995. El ultimo despale, la frontera agricola centroamericana. Fundacion para el Desarrollo Economico y Social de Centroamerica (FUNDESCA); Panama.
- Pichon, Francisco. 1993. Agricultural settlement, land use and deforestation in the Ecuadorian Amazon frontier: a micro-level analysis of colonist land-allocation behavior. Ph.D. dissertation, Department of City and Regional Planning, University of North Carolina at Chapel Hill.
- Ronfeldt, David. 1973. Atencingo: the politics of agrarian struggle in a Mexican ejido. Stanford University Press; Stanford, California.
- Rudel, T and B. Horowitz. 1993. Tropical deforestation: Small farmers and land clearing in the Ecuadorian Amazon. New York: Columbia University Press.
- Rzedowski, Jerzy; Calderón de Rzedowski, G. 1989. Transisthmic Mexico: Campeche, Chiapas, Quintana Roo, Tabasco and Yucatán. In: Campbell, David G.; Hammond, H.D., eds. Floristic inventory of tropical countries: the status of plant systematics, collections, and vegetation, plus recommendations for the future. The New York Botanical Garden: New York.
- Sharer, Robert J. 1994. The ancient Maya. Stanford University Press: Stanford, California.
- Thomas, Prentice M. Jr. 1981. Prehistoric Maya settlement patterns at Becan, Campeche, Mexico. Middle American Research Institute. Tulane University: New Orleans. Publication 45.
- Turner, B.L. II. 1978. Ancient agricultural land use in the central Maya lowlands. In: Harrison, P.D.; Turner II, B.L., eds. Pre-Hispanic Maya agriculture. University of New Mexico Press: Albuquerque, New Mexico.
- Yúñez-Naude, Antonio; J. Edward Taylor and Maria del Refugio Rodriguez-Gonzalez. 1995. Impactos de las reformas economicas en una poblacion ejidal: una propuesta de analisis cuantitativo. Presentation given at El Taller del Proyecto de Investigacion sobre la Reforma Ejidal. Centro de Estudios Mexico-Estados Unidos, University of California San Diego; August 25-26 1995.

NOTES

NOTES

NOTES

NOTES

