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Persistence of Swidden Cultivation in the Face of Globalization: A Case Study from Communities in Calakmul, Mexico

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Abstract Over the last decades, political, economic and environmental pressures have encouraged changes from swidden to more intensive agricultural practices, resulting in the hypothesis that swidden cultivation systems are disappearing. In Calakmul, southeastern Mexico, communities decreased the area under *milpa,* the traditional maize swidden system, but a collapse did not occur. To document and explain the persistence of swidden we employ a variety of data: (1) 59 standardized household surveys from 2003 and 2010 in five villages, (2) in-depth interviews in one village, and (3) coupled human–environmental timelines in this same village. Droughts, hurricanes, and remittances were important drivers of decreases in *milpa* cultivation. Market crop profitability and conservation programs were also reported to affect the area under *milpa.* Off-farm employment and governmental transfers have tended to stabilize household economies and decrease dependency on agricultural production, but have also allowed households to maintain their *milpas* for subsistence and cultural reproduction. Findings in Calakmul point to the need to consider swidden as an evolving and active response to changing policy, economic, and environmental conditions.

Keywords Shifting cultivation · Swidden · International migration · Globalization · Southern Mexico

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Introduction

Over the last three decades, large areas of the forest-agriculture frontiers worldwide have been substantially transformed from swidden cultivation to more intensive and permanent cultivation systems, or abandoned in favor of forest regrowth (Rudel *et al.* 2005; Van-Vliet *et al.* 2012). These changes in swidden cultivation are more pronounced in Southeast Asia (Padoch *et al.* 2007) than in other regions, most likely due to government policies that have curbed swidden via strict prohibition or incentives for its conversion to permanent agriculture (Padoch *et al.* 2007; Fox and Fujita 2009; Ziegler *et al.* 2009). Even in Southeast Asia, changes in swidden are spatially uneven. A meta-analysis of swidden change shows, for example, that all studies of Cambodia and Thailand indicate a decrease in swidden cultivation, whereas in Lao PDR in half of the cases swidden decreased and in the other half it increased or remained stable (Van-Vliet *et al.* 2012).

Swiddening is often cited as a biodiversity-friendly land use system (Padoch and Pinedo-Vásquez 2010), where short cultivation periods, long fallows, and the mosaic character of traditional systems maintain sufficient seed pools to allow the regeneration of diverse secondary forests (Rerkasem *et al.* 2009). Recent research now questions long-standing assumptions about soil and water degradation tied to swidden cultivation on tropical hillslopes (Hecht *et al.* 1998; Schmidt-Vogt *et al.* 2009; Ziegler *et al.* 2009). Swidden is also often cited as a rational choice for forest farmers under prevailing

demographic, environmental, economic and cultural conditions, such as low population densities, poor soil quality, and unequal access to markets (Fox *et al.* 2000; Ickowitz 2006; Mertz 2002; Nielsen *et al.* 2006).

Many farmers in the Global South rely on traditional farming practices, including swidden cultivation, as these traditional techniques have co-evolved over time as adaptations to particular environmental, social, economic, and political circumstances and pressures (Chambers 1988; Denevan 1995). While yields in traditional agricultural systems may be lower than those of more intensive production systems, they offer the advantages of a low level of monetary investment, including minimal agrochemical inputs. They also generate a relatively reliable harvest, and therefore facilitate household food security in unpredictable agro-environments with highly variable soils and rainfall (Tuxill *et al.* 2010). The high crop diversity in some traditional systems constitutes an adaptive mechanism in these difficult agro-ecological environments (Altieri 1999). Farmers' strategy of minimizing risk by planting several species and varieties of crops stabilizes yields over the long term, promotes dietary diversity, and maximizes returns under low levels of technology and limited resources (Chang 1977; Clawson 1985; Harwood 1996; Thrupp 1998). Livestock are kept, either as a primary agricultural enterprise or linked to crop production. The roles of livestock are manifold: the production of milk, meat, hides, manure, draft power, among others, as well as the accumulation of wealth, security against contingencies, and display of status (Moll 2005). Access to forest resources is often key in traditional systems as it provides farmers with building materials, firewood, bush meat and edible plants, and buffers farm families against market fluctuations and failed crop harvests (Alcorn 1984; Chambers and Leach 1989; Barham *et al.* 1999).

In Central America and particularly in Mexico, the *milpa*, a traditional Maya swidden system, exemplifies these diverse subsistence and livelihood security benefits. Ancient in origin, the Mexican *milpa* system refers to a complex combination of agronomic practices, crop associations, and rotation sequences that vary with cultural context and agro-environment. Traditional *milpa* cultivation involves cutting an area of forest, burning, and planting maize mixed with squash (*Cucurbita* spp.) and beans, such as *'ib'* (lima bean; *Phaseolus lunatus (L.)*) and *'xpelo´n'* (cowpea; *Vigna unguiculata (L.)*). While the traditional Maya *milpa* includes annual, bi-annual and perennial cultivars with up to 87 different crops and tree crops within a single village (Terán and Rasmussen 1994), recently many farmers have turned their *milpas* into maize monocrops, as they increasingly use herbicides (Prebisch *et al.* 2002) that are incompatible with, for example, beans.

Slashing and burning clears the soil for planting, releases nutrients from slashed vegetation for crop growth, and reduces the population of weed seeds. Steggerda (1941) hypothesized that without the availability of draft animals, swidden cultivation was the only method available to people farming in such a densely forested landscape. Extremely rocky soils and distinct wet and dry seasons are additional factors that contribute to the prevalence of the *milpa* systems. Each year, approximately two million farming households across Mexico continue to cultivate *milpas* on around six million hectares of land; and most of these households depend on *milpa* production for food security (Bellon and Berthaud 2004).

Milpa, according to Alcorn and Toledo (2000) is both an institution and a process. It is a "cultural script" – an internalized plan consisting of a series of routine steps with alternative subroutines, decision nodes, and room for experimentation, rather than simply a patch in space (Berkes *et al.* 2000). Culture plays a significant role in *milpa* management. Researchers have often commented on the integral role *milpa* plays in Mesoamerican life. For example Nigh (1976), in a study of Maya agriculture in highland Chiapas, states that "the making of *milpa* is the central, most sacred act, one which binds together the family, the community, the universe." Hostettler (1998) notes that above all, identity is rooted in *milpa*, and that "maize is both the most important element of Maya diet and the "stuff of life" in the wider sense of religious practice and identity." According to Mayan mythology, the *milpa* is the sacred place in which the raw material of humans was created, and maize is the holy substance from which the Maya emerged, and as such is considered to be sacred and life-giving (De Frece and Poole 2008).

There is evidence suggesting that, while the basic structure of the swidden system has persevered since pre-Columbian days (Terán and Rasmussen 1995), *milpas* in Mexico's Yucatan Peninsula have been largely transformed or replaced by more intensive or commercial production systems, such as pasture or chili cultivation (Klepeis *et al.* 2004; Keys 2005). Global processes such as market integration, liberalization of national policies, international labor migration, climate change, and conservation measures have largely contributed to the reduction or modification of swidden in the Yucatan Peninsula (Toulmin and Guèye 2005).

Our aim is to understand the reasons for the persistence of maize swidden systems despite the large increase in intensive or commercial production. These reasons might include changing climate conditions and the incorporation of new economic activities like off-farm work and national and international migration by family members. In this article, we review existing literature on factors that have influenced agricultural land use in Mexico, and specifically in the municipality of Calakmul, since the 1980s. Based on one in-depth community case study, we then present an analysis of the historical timeline describing changes in local livelihoods and land use in order to highlight the main

drivers of change in *milpa* cultivation in this community. Finally, based on our household surveys from five communities, we report findings on the most recent changes in land use and household livelihoods over the last 10 years to assess the status of *milpas* in Calakmul. Our discussion explores some possible explanations of the context in which *milpas* have been able to persist.

Factors Shaping Land Use in Calakmul: Prior Research

In this section we review factors influencing agricultural land use in Mexico, and specifically in the municipality of Calakmul, by identifying six explanatory categories from existing research: (1) climate change; (2) liberalization of the agricultural sector and market integration; (3) changes in subsistence crop subsidies; (4) expansion of social governmental subsidies, as well as conditional cash transfer programs; (5) growth of labor migration; and (6) implementation of conservation measures.

Climate Change

One factor influencing swidden agriculture cultivation is climate change. Farmers respond to droughts by adjusting the agricultural calendar, engaging in strategies for income diversification, water and maize storage, and by slightly diminishing the overall area cultivated with crops (Perea-Blazquez 2011). Droughts are common in Calakmul (Oglesby *et al.* 2010), where they are defined as "meteorological droughts" and understood as a marked reduction in precipitation from the average over a given time period (Hernández-Cerda *et al.* 2007). An important factor that influences the occurrence of droughts in the study area is the el Niño Southern Oscillation (ENSO) (Márdero *et al.* 2012). Rainfall records for the period 1953 to 2010, from the meteorological station of Zoh Laguna, located close to our study area, show a decreasing trend in precipitation, high rainfall fluctuations and increasingly frequent occurrence of meteorological droughts. Precipitation patterns have become more spatially and temporally inconsistent during the last decades, mainly after the mid-1980s. From that time, average annual precipitation decreased from 1,100 mm (1953 – 1986) to 938 mm (1987 – 2010) (Márdero *et al.* 2012).

In addition to droughts, hurricanes also play an active role in the climate of the Yucatan Peninsula, causing great losses in agriculture (Huicochea and Gurri 2005). Campeche State, which contains Calakmul, belongs to a group of states categorized as the second most affected by hurricanes in Mexico (CENAPRED 2012). From 1886 to 2000, Campeche has been hit by 61 tropical storms and 28 hurricanes. The municipality of Calakmul was struck by 47 of those tropical storms, and 25 hurricanes (CENECAM 2010).

Liberalization of the Agricultural Sector and Market Integration

Beginning in the mid-1980s, Mexico initiated a radical revision of economic policies toward greater liberalization, bolstered by legal reforms enacted in the subsequent decade. In 1986, Mexico entered into the General Agreement on Tariffs and Trade (GATT). GATT's impact reached the agricultural sector by 1990, when tariffs on most imported products were dropped or drastically lowered, subsidies on agricultural inputs were withdrawn or sharply reduced, and the guaranteed minimum price was eliminated for all crops but maize and beans (Foley 1995). The continuation of these reforms was secured under the terms of the North American Free Trade Agreement (NAFTA), effective in 1994. NAFTA obligated Mexico to completely open its agricultural markets and eliminate the remaining guaranteed prices for staple crops, including maize and beans, over a 15-year period. The reforms impacted land access as well. The Mexican Constitution was amended in 1992 to terminate the distribution of federal lands to farming communities, and to permit lands held in usufruct under the *ejido* system to be bought and sold (Goldring 1995).

As state support for small-scale agriculture has diminished in Mexico (Appendini 2003; Echánove and Steffen 2003; Gravel 2007), swidden cultivation, and smallholder agriculture in general, has become less "profitable" and more economically risky. Inputs are more expensive, and maize earnings are subject to a market price more tightly connected to world markets. As a result, rural livelihood strategies in Calakmul have diversified. Household economies increasingly include more and more non-agricultural activities (Radel *et al.* 2010).

In addition, market integration, in association with reduced transportation costs, acts as a driver of intensification and more market-oriented production (Schmook and Vance 2009). In Calakmul the improvement of road access since the mid-1970s has encouraged swidden cultivators in the region to increasingly engage in jalapeño chili cultivation (Keys 2005). Also, since the 1980s, small-scale cattle ranching and beekeeping have become increasingly popular in communities around the Calakmul Biosphere Reserve (Vance *et al.* 2004). Instead of allowing for natural regeneration, old fields are now frequently converted into pasture as an investment to prepare for cattle ranching in the future (Klepeis *et al.* 2004).

Subsistence Crops Subsidies

Starting in the mid-1990s, several programs were implemented to preempt the anticipated adverse welfare effects of agricultural liberalization, the two largest of which are the Programa de Apoyos Directos al Campo (PROCAMPO;

Direct Payments to the Countryside), and Alianza para el Campo (Alliance for the Countryside). The overarching aim of both programs is to increase investment and productivity in the agricultural sector without distorting production incentives, thereby facilitating the integration of agricultural producers into the market economy.

In the case of PROCAMPO, farmers received an annual lump-sum payment of roughly 1,000 pesos (USD 76) per hectare as of 2010. As one of the central goals of PROCAMPO is to promote land use intensification (SARH 1993), the payments are conditional on the farmer maintaining the same plot of land under the same crop. In practice, this rule is rarely enforced in the study region, as program staff is aware that farmers' agricultural practices entail crop rotation. Farmers report that it is rare for inspectors to make field visits. Nonetheless, we can hypothesize some impact on traditional swidden practices. Schmook and Vance (2009) found that farmers in the Southern Yucatan responded to the cash transfers from PROCAMPO by increasing the area under *milpa*, jalapeños and pasture, while decreasing the area under forest.

Unlike PROCAMPO, support by Alianza para el Campo is provided on a demand-driven basis. Farmers petition for financial or technical assistance to undertake particular productive investments. In 1996, the first year of the program in Calakmul, this subsidy was generally directed toward agricultural and livestock improvement. Payments from Alianza para el Campo, like PROCAMPO, increased the area under *milpa* and pasture, but had no negative effect on forest cover (Schmook and Vance 2009).

Social Governmental Subsidies and Conditional Cash Transfer Programs

A government subsidy associated principally with women is Oportunidades, a poverty alleviation program that supports some 75 % of Calakmul households (Haenn 2011). Women receive Oportunidades payments conditional on regular medical check-ups and attendance at healthcare presentations. Children qualify for the program through school attendance as well as regular check-ups. Payments in support of children are made to the mother. Household monthly payments in the municipality can reach up to 2,440 pesos (USD 185) with several children attending high school (MS Antonio Ek, Unit of Access to Public Information, Xpujil, Personal communication August 2010). According to Haenn (2011), average bi-monthly payments per household in Calakmul are roughly equal to 15 days of labor wages, thus representing a significant input into a household's economy. Governmental subsidies for education, like Oportunidades, have encouraged younger generations to abandon farming and migrate to urban areas.

Labor Migration

One response to the changing opportunities for semi-subsistence agriculture production in the region has been the emergence of circular or temporary migration patterns over the last decade, similar to those found elsewhere in Mexico (Massey *et al.* 2002; Cohen 2004). Labor migration from Calakmul to the United States (U.S.) only started seriously around 2000. In 1997 in Calakmul, only 3.1 % of household heads surveyed had migrated nationally and no head of household worked in the U.S., but by 2003 eight percent of surveyed household heads had migrated to the U.S. (Schmook and Radel 2008). Most migrants go to Alabama, California and Texas, but a few go to other destinations, including Georgia, Virginia, Oklahoma, and Massachusetts. Repeated crop failures from droughts and hurricanes, unpredictable prices for the jalapeño chili cash crop, an end to state-guaranteed prices for maize, and limited local labor markets are the main drivers of international labor migration (Schmook and Radel 2008). An in-depth case study in one *ejido* (Radel and Schmook 2008) demonstrates the intricate relationship between chili cultivation as both migration enabler (with successful cultivation) and motivator (unsuccessful cultivation): the earliest migrants were chili "winners," but increasingly, migrants are chili "losers." By 2007, in one Calakmul *ejido* (see Schmook *et al.* forthcoming), over half of the male heads-of-household had migrated, at least for some period of time, to the U.S. By 2010 and 2011, however, fewer were migrating to the U.S., but instead headed to nearby Mexican destinations, especially to the tourist corridor along the coast of the neighboring state of Quintana Roo.

We might expect that labor migration would not only reflect the difficult conditions for agricultural production discussed earlier (climatic and economic), but in turn that labor migration might also impact swidden cultivation through labor and remittance effects (see Gray 2009 for research in Ecuador). In an earlier study in southern Campeche state, migrant households, especially those with migrating heads of households, were found less likely to plant the traditional *milpa* (intercropping maize, beans, and squash), but instead tended to cultivate maize in monoculture or invest in pasture for cattle production (Schmook and Radel 2008). When semi-subsistence maize cultivation continues in the absence of male household heads, some families use remittances to hire local male day laborers to carry out various production tasks (Radel *et al.* 2012).

Conservation Measures

The Calakmul Biosphere Reserve (CBR) was established in 1989 and joined the United Nations' Man and Biosphere Reserve Program in 1992 (Roy-Chowdhury 2006). The

reserve, which resides fully within the municipality of Calakmul, is composed of a core and a buffer zone of 2,479 and 4,746 km^2, respectively (Rueda 2010). The World Bank-funded Mesoamerican Biological Corridor links the CBR to existing protected areas in southern Mexico and Central America through conservation corridors (Miller *et al.* 2001), creating an even larger conservation extent. Forest cutting and wildlife extraction are prohibited in the core of the reserve, while cultivation and some "sustainable" activities focused on forest products extraction are permitted in the buffer zone (Primack *et al.* 1998; Klepeis and Chowdhury 2004; Haenn 2005; Roy Chowdhury and Turner 2006). Some conservation policies in Mexico continue to discriminate against traditional *milpa* cultivation, through programs such as *milpa sin quema* (swidden without burning), which pays farmers not to burn their plots, and seed programs providing high-yielding varieties that do not respond well in swidden systems (De Frece and Poole 2008).

On the other hand, the Calakmul reserve is Mexico's largest protected area for tropical forest ecosystems and has received the support of the United Nations Global Environment Facility (GEF) and the World Wildlife Fund. Money flowing into the region, from these and other sources, finances projects with local farmers and, in effect, subsidizes local livelihoods. This may permit the persistence of swidden as these funds satisfy farmers' need for cash and farmers consequently do not need to engage in or expand commercial agriculture, thereby freeing time for subsistence swidden cultivation. Other project money has also been important to the region over the last three decades. Since the 1980s, conservation and tourist groups have promoted the Ruta Maya program (the Maya Route), the largest proposed archaeo-eco-tourist zone in the world (see Garrett 1989; Primack *et al.* 1998). Finally, one of the best-known sustainable development programs within the region, Bosque Modelo de Calakmul (Model Forest of Calakmul), began in 1993 and has operated in an area of 380,000 ha immediately east of the Calakmul Biosphere Reserve (Turner *et al.* 2001).

In addition to potentially facilitating the persistence of local farming systems, project money may also have been important in establishing a resource-use-based philosophy, which has indirectly encouraged swidden persistence. The notion of a philosophy of resource use or "diversity in use" was advanced in Calakmul by the first director of the reserve, as he believed that if farmers received financial gain from exploiting an array of forest resources, then they would be motivated to protect them (Haenn 1999). Such positive correlation between local access to conserved forest and support for the conservation regime has been demonstrated elsewhere (Li 2007). During the early to mid-1990s, residents in Calakmul supported resource-use conservation through their participation in a farmer organization, the Xpujil Regional Council, as well as through their work with the Biosphere Reserve, two institutions that were closely aligned (Haenn 1999). With the aid of the first Reserve Director, the Council received funds from federal and non-governmental agencies for conservation-development projects in the buffer zone (Boege 1995). Consequently, the Council became a site where local people connected resource use to conservation.

Methods

Study Region

The five study communities are located along the southeastern boundaries of the Calakmul Biosphere in the municipality of Calakmul, Campeche. The study area is primarily a flat, karstic landscape, but can reach up to 300 m near to the town of Zoh Laguna (see Fig. 1). Soils are thin and often stony, and few surface water bodies exist in the region (García *et al.* 2002). Rainfall is seasonal, with a wet season from May to October and a dry season from November to April (Magaña *et al.* 1999; Márdero *et al.* 2012; Neeti *et al.* 2012).

This area, now the municipality of Calakmul, was once part of the heartland of the lowland Maya civilization. Centuries ago, it devolved into a frontier region, which it remains today (Primack *et al.* 1998; Turner *et al.* 2003). Calakmul has gone through different waves of resource extraction (Klepeis *et al.* 2004). *Chicle* and timber extraction in the early twentieth century was first accompanied, and then followed, by *milpa* cultivation. During the mid-twentieth century, the central government started to grant federal lands to smallholders as *ejido* communal lands (Primack *et al.* 1998; Turner *et al.* 2004). In the 1970s, the Escarcega-Chetumal highway was completed, connecting this part of the Yucatán Peninsula to the rest of the country. Also in the 1970s, the federal government promoted the formation of new *ejidos*, which attracted farmers from 23 states, especially from Michoacán, Guanajuato, Durango, Coahuila, Veracruz, Tabasco and Chiapas (Farfán 1996). Today, there are more than 80 communities in the municipality of Calakmul (Haenn 2011), and the population has grown from a little over 4,000 in 1970 (Turner *et al.* 2004) to 26,882 in 2010 (INEGI 2011). Despite this rapid growth, population density remains at only 1.5 persons per km^2 (Alayón-Gamboa and Ku-Vera 2011).

By Mexican standards, the region is not prosperous. Mexico's National Population Council maintains an 'Index of Marginalization' that compares municipalities on aspects such as urbanization, literacy, and household income. Each municipality is assigned to one of five categories ranging from 'very high' to 'very low' marginalization. In 2000, the Council

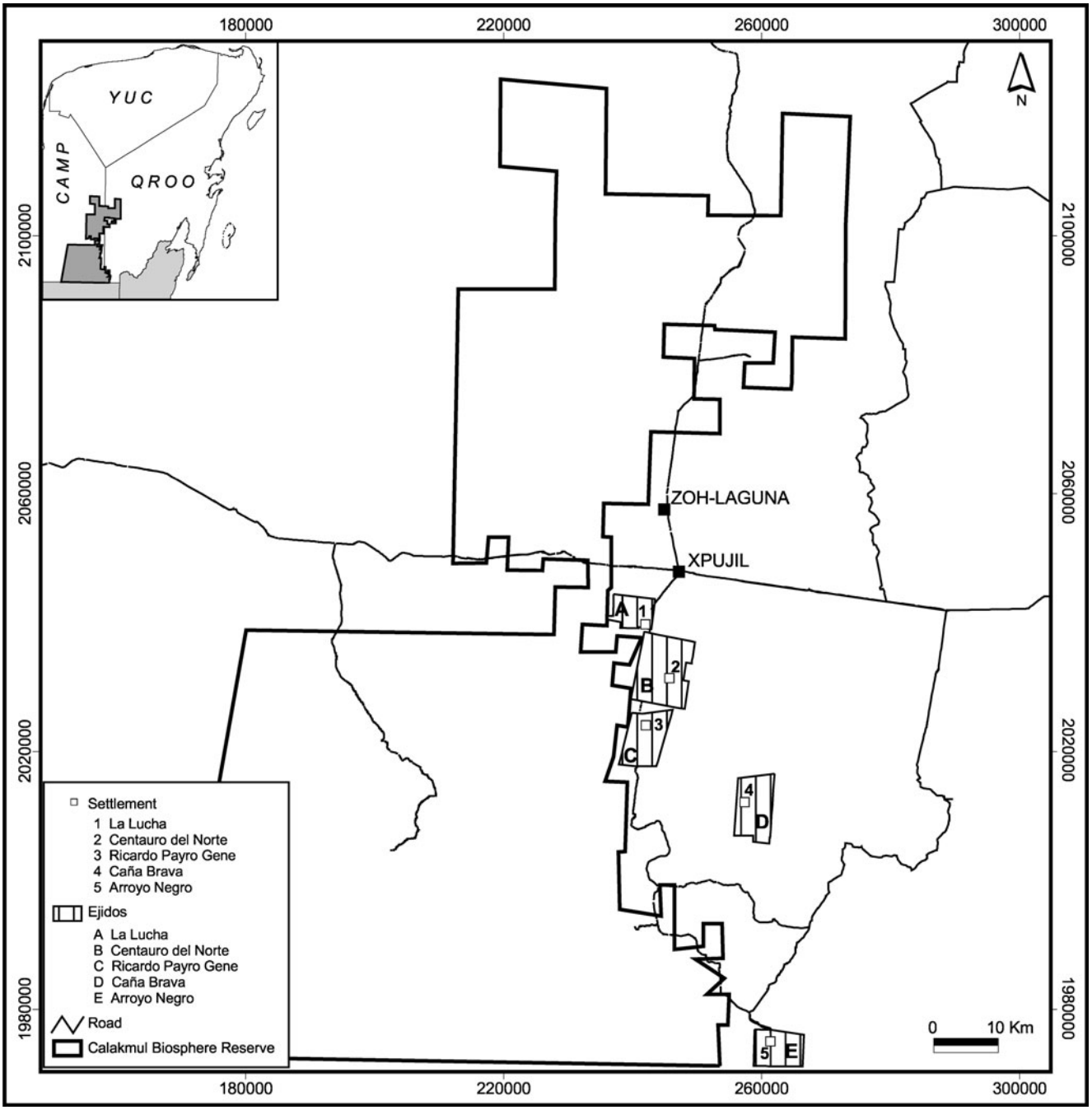

Fig. 1 Study region including the 5 villages

ranked Calakmul a zone of 'very high' marginalization, but by 2005, the municipality had advanced to merely 'high' marginalization (Anzaldo and Prado 2006; Haenn 2011).

Data Collection and Analysis

We gained in-depth understanding of the historical and contemporary factors driving land use changes and influencing livelihoods during several visits in 2010 and 2011 to one *ejido*, Ricardo Payro. Data collection methods in this *ejido* included ethnographic participant observation, the participatory creation of a coupled human–environmental timeline, and in-depth interviews with key informants. The participant observation and in-depth interviewing were used to gain insight into the diversity of livelihood activities in the community. These insights were then explored further in a focus group discussion. The aim of the focus group discussion was to create a framework for identifying and discussing the most significant changes in local land use and their effects on local livelihoods. A human-environmental

timeline, based on the methodology proposed by Nielsen and Reenberg (2010), was created with participants to list the most significant changes in the broader (natural, social, political and economic) context. Participants were asked to describe the major changes in their community going back to its 1975 establishment. In particular, they were asked to identify (a) general events in the village; (b) social and political changes; (c) infrastructure development; (d) changes in health and education; (e) agro-technological changes; (f) climate events; (g) land use/land cover changes; and (h) when certain livelihood strategies were initiated. To broaden and deepen the human-environmental timeline, we later added information gathered through the in-depth interviews conducted throughout the field period and from the existing literature on the region (as reviewed above).

Detailed transcripts from participant observation and in-depth interviewing were developed, along with field notes, and were read through several times to uncover themes and patterns, thereby allowing the creation of a coding scheme for further systematization and analysis. As is common in qualitative research (Creswell 1994), findings were triangulated. Themes gained from the multiple sources of data were cross-checked with each other to: (1) improve the reliability of the findings by confirming and validating points raised in multiple data sources; and (2) ensure consistency of dominant themes regarding changes in *milpa* cultivation and local land use, and their effects on local livelihoods.

In addition to the above qualitative data collection, we collected follow-up quantitative data with a sample of households in five *ejidos* to analyze recent changes in land use with emphasis on *milpa* cultivation and changes in livelihood strategies. We used information from 59 household surveys in 2003,[1] returning to these families in 2010. These households were asked in 2003, and again in 2010, to describe household composition, household assets, principal income and expenditure sources, main livelihood activities, and use of land (area under pasture, area under different crops, area under *milpa,* etc.). In 2010, the household heads were also asked, through open-ended interview questions, to describe the most important changes (if any) in land use over the past 10 years and the main causes of these changes (if any). The 2003 and 2010 interviews were used to provide quantitative evidence of changes,[2] if any, in land use and main livelihood activities, supplemented by respondents' own qualitative insights. To test for significant differences in continuous variables (e.g., hectares of maize) between the two survey years, we used a two-way analysis of variance (ANOVA). A Pearson's chi-square test was used to investigate whether distributions of categorical variables (cultivates maize or not, e.g.) differ from one another between the two survey years.

[1] For the sampling methods of the original 2003 survey, see Schmook and Radel (2008).

[2] As wealth differences are minimal among the sampled households, we did not include an analysis on how variations in household wealth relate to use of swidden or other strategies.

Results and Discussion

Historical Human-Environmental Timeline for Ricardo Payro

We first analyze the settlement and land use history of one *ejido* drawing on the ethnographic participant observation, coupled human–environmental timeline, and the in-depth key informant interviews.

Life Before the 1980s: Establishing the Ejido

Before Ricardo Payro was an established settlement and recognized as an *ejido* it was no more than a small camp providing shelter for men engaged in the extraction of *chicle*, a resin of the zapote tree (*Manilkara zapota* L.) used to produce chewing gum. Although timber extraction was also important in these early days, *chicle* captured interviewees' memories. People vividly remembered the little airplane (*avioneta*) from the cooperative "Los Chenes" flying in daily during the rainy season, when *chicle* is tapped, and taking the *chicle* out in dried blocks of about 10 kg. After more than 30 years, "Los Chenes" ceased operations in the early 1980s, because of the low price of the raw material; it was now cheaper to manufacture chewing gum from synthetic rubber. Some residents believed the region's *chicle* economy ended due to the establishment of the *ejido* and the internal division of plots for agricultural use. *Ejidatarios* began to oppose non-*ejido* members' harvesting of *chicle*, timber, and game from their lands.

The *ejido* was officially recognized by the Registro Agrario Nacional (National Agrarian Registry) on the first of July 1980, but it had existed informally since 1975. The informal establishment of the *ejido* was a long process that included not only negotiations with local strongmen (*caciques*), local governmental authorities, and other migrant families, but also tensions between groups of families in the *ejido*. Then, in 1975, when the first 23 founding families could finally settle, knowing that the lands would be theirs, they instituted the same agricultural livelihood activities practiced in their places of origin. They continued cultivating *milpas* and jalapeño peppers, and producing broiler chickens and other small animal products in their home gardens. Initially, these practices accompanied *chicle* extraction. But after the end of the *chicle* economy, farmers in Ricardo Payro based their livelihoods on their *milpas,* cultivating maize, beans, and squash in a swidden system. Households also managed poultry in their home gardens and a few had pigs.

Throughout Calakmul, once *chicle* and timber extraction[3] was no longer economically feasible, *chicle* and timber camps in the forest were abandoned and the next wave of migrants started to settle in *ejidos* for farming. They came in search of agricultural land, mostly from the states of Veracruz and Tabasco. Most of the *ejidos* founded in the late 1970s and early 1980s, like Ricardo Payro, were designed for agricultural development and not for *chicle* extraction and forestry, and therefore received smaller land allocations. As a result, Ricardo Payro comprises 5,020 ha and is considered relatively small by Calakmul standards.

With respect to livelihoods, this period is characterized by dependence on non-timber forest products (NTFPs) and the full use of the forest in the *milpa* cycle. People remember that in 1975 there was still plenty of old growth forest, which they partially slashed and burned for their *milpas.* Felling old growth forest was not banned at that time, but rather it was encouraged by state-sponsored projects for colonization, modernization, and mechanization of agriculture (Turner *et al.* 2001). Deforestation rates in the region between 1975 and 1985 were as high as 2 % annually (Cortina-Villar *et al.* 1999). Most households also hunted, and game such as *venado* (White-tailed deer; *Odocoileus virginianus*), *tepezcuintle* (Paca; *Cuniculus paca*), *armadillo* (Nine-banded armadillo; *Dasypus novemcinctus*), and *pavos* (Ocellated turkey; *Meleagris ocellata*) was abundant, given the large forest areas adjacent to the *ejido*, which now form part of the Calakmul Biosphere. Households also used other NTFPs, such as palms for roofing, and *ramón* tree (*Brosimum alicastrum*) leaves for feeding farm animals, and its seeds for human consumption.

For residents, water access issues were important during this period and infrastructure was almost non-existent. Access to clean water was extremely difficult, as water sources were located far away. In the first years after their arrival, family members had to walk to one of two water bodies (*aguadas*), each about 4 km away, or construct artificial ponds (*jagueyes*) for water collection. Residents also collected rainwater from their roofs. Our interviewees reported that during this period people relied only on traditional medicine for their health care. Finally, in 1980, electricity reached the community and a primary school was built.

Overall, this period was a difficult one for residents. Given harsh environmental conditions, especially the lack of water, many early colonizers went back to Tabasco and Veracruz. One interviewee explained how the livelihood challenges of the period, including a drought, led to an initial failure to establish the community:

> "When we arrived here there was only vegetation. Yes, there were a few houses that belonged to three people who had arrived earlier and tried to establish an *ejido*. Back then they called the *ejido* Melchor Ocampo, but the people lived here for a little time only and left because there was a drought lasting several years back then."

Life from 1980 to 2000: Consolidating the Ejido

In 1980, the land rights for the *ejido* were officially recognized. Ricardo Payro quickly completed the transition from an extractive, *chicle* and timber-based local economy to a consolidated farming economy based on *milpa* cultivation, jalapeño pepper production, small-scale animal husbandry, and home garden production. At the same time, the government initiated the construction and implementation of infrastructure to develop the community. In 1989, the Calakmul Biosphere Reserve was founded, initiating many changes in the subsequent years for the *ejido*.

At the start of the 1980s, INEGI reported a population of 285 in the *ejido* (Arreola *et al.* 2004). The population continued to grow from in-migration, mainly from Tabasco. By the early 1990s, the population reached 428 (INEGI 1990). The next wave of migrants came from Chiapas, mainly after 1994, the year of the Zapatista uprising. Until the early 1990s, new migrants could still get an *ejidal* right in Ricardo Payro, but following the changes to Article 27 of Mexico's constitution in 1992, no new *ejidatarios* have been accepted. *Ejidatarios* argue that now a person can become an *ejidatario* only if he or she purchases someone's *ejido* rights or if an existing *ejidatario* dies and leaves an opening in the *ejido* assembly.

At the start of the 1980s, the *ejido* only had access to electricity and a primary school, but the infrastructure of the village improved dramatically throughout this period with the construction of the first water retention structures (*piletas*) by 1986, the construction of a health center in 1991, and the pavement of the road to Xpujil into the early 1990s. Finally, in 1995 the *ejido* received a secondary school.

Farming strategies changed dramatically over this period as well. In the early 1980s, all farming activities were undertaken using the traditional swidden system. Between 1985 and 1995, mechanized plots introduced via government programs became increasingly popular among farmers. Forest cover decreased with increased population density and the conversion of forest to agricultural fields. Between 1990 and 2000, deforestation rates in Ricardo Payro amounted to 1.1 % annually (Ramírez-Delgado 2012). Farmers perceive mechanized plots as advantageous,

[3] Although the interviewees did not mention timber extraction, we know from the literature and local experts that intensive logging for mahogany and Spanish cedar was carried out in the 1950s in southeastern Campeche by the parastatal company, Caobas Mexicanas/Impulsora Forestal Peninsular. By 1983, the last of the parastatal forest concessions ended without being renewed because of depleted mahogany and cedar reserves, and rising pressure for land and logging rights by *ejidatarios* in the region (Bray and Klepeis 2005).

as there is no need to fell (slash) old growth forest or secondary vegetation every year. Mechanized plots can be worked continuously, and according to many farmers, they have better rainfall retention capacities, important in years with less or irregular rainfall. In addition to their *milpas,* more farmers were gaining interest in jalapeño pepper cultivation, following the success of migrant *chileros* moving to the community from Veracruz. In a few years, jalapeño pepper production became very popular, and the region around the *ejido* became known as a *zona chilera*. Almost all families had chickens in their home gardens, and some had pigs, but cattle-raising had not yet started in earnest. Some households started to plant pasture, but they commented that pasture and cattle, given a continued lack of water, is not as easy to establish and maintain as it was in their states of origin (e.g., Tabasco).

Despite the changes in infrastructure and agricultural practices perceived by farmers as beneficial, farming remained difficult and livelihoods precarious. Residents report increasingly unreliable rainfall and periods of drought beginning around the end of the 1980s. Hurricane Gilberto hit in 1988, and residents remember the following years as extremely dry, destroying all the maize crops. In 1995, Hurricane Roxana hit the region, destroying most of the crops. Once again, the years after the hurricane were characterized by heavy droughts and increasingly variable rainfall.

With the creation of the Calakmul Biosphere in 1989, Ricardo Payro found its lands directly abutting the new reserve. Hunting and gathering were restricted in the area, and law enforcement encouraged people to reduce their reliance on forest products. The state-imposed conservation policies also attempted to change traditional *milpa* cultivation by banning the cutting of old growth forest. Reforestation was a priority on every institutional agenda, and programs like PRONARE (National Program for Reforestation) were initiated in 1989, intensified from the early 1990s onwards, and channeled via the Consejo Regional de Xpujil (Xpujil Regional Council) (PMRBC 1999). Many farmers in Ricardo Payro reported that the forest-cutting ban interfered with their livelihood strategies.

From the early 1990s onward, conservation was a priority of the Mexican government, and therefore traditional *milpa* cultivation was seen as a threat to these government initiatives. The government started implementing "modern" and innovative agricultural techniques, including a "big wave" of mechanization programs between 1985 and 1995, to prevent farmers from slashing and burning forest for agriculture. Nonetheless, many farmers kept on practicing traditional *milpa* cultivation, as they were not comfortable with or did not have access to mechanization. During this period, *milpa* cultivation persisted as a cultural practice that has been passed on from generation to generation, despite the many changes in the agricultural and conservation sectors.

Life from 2000 to 2010: Leaving the Farm to Keep the Farm

By 2000, INEGI (2000) counted 585 people in the *ejido,* and by 2010 the population had reached 648 (INEGI 2010). At the beginning of this period, *ejido* members started to migrate to the United States, inducing social change and affecting local agricultural practices. Several heads of household initially migrated to the U.S., given diminishing returns from selling their crops and the lack of local labor markets. Farmers did not perceive governmental subsidies as sufficient to prevent them from migrating. By the middle of the first decade of the 21st century, however, when the economic recession in the United States and increased border control made migration more difficult, people, especially young women, started instead to migrate to the tourist corridor of Cancún and Playa del Carmen in the neighboring state of Quintana Roo.

Infrastructure in the community has continued to expand. In 2005, the Secretary of Social Development started a program that focused on integrated development of marginalized areas and established a community internet center. Most of the roads are now paved and most households have access to municipal water.

Concomitantly, as jalapeño pepper production became more and more popular, pests became more frequent. Despite government support to purchase fertilizers, jalapeño pepper cultivation became less attractive to farmers because it implied high input costs, high risks from pests and variable rainfall, and prices fluctuated widely. After the height of mechanization, which lasted through 1995, by 2010 many farmers did not plough but only harrowed their plots before planting.

Two other livelihood activities started to (re)gain farmers' interest during this time: pasture establishment and honey production. Pasture establishment normally follows a pattern of cultivating *milpa* or jalapeño peppers for 1 or 2 years and then, instead of allowing the natural regeneration of vegetation, pasture grasses are planted. Pasture and cattle ranching have been an important item on the municipal agenda, and Allianza para el Campo and other programs targeted at increasing and improving local herds, have channeled subsidies into an effort to expand this activity. PROCAMPO, initially meant to support basic grain production, can now also be used for pasture establishment. Farmers initially perceived cattle as an excellent economic option. As one interviewee stated, *"porque ganado es ganar, son animales que dejan ganancia"* (because cattle [a word that also means earned] is to earn, they are animals that leave earnings). In addition, a few people in the village have always managed beehives, but only in the last several years has the activity become popular and economically attractive. Just like cattle ranching, honey production has been encouraged at the level of the municipality. It has also received capacity-building support, especially among

women's groups. In the last 5 years, farmers have also diversified into reforestation and tomato and lime production. Lime tree planting started in 2007, with economic support from the CBR.

In 2002, Hurricane Isidoro affected the region, and in 2007 Hurricane Dean destroyed most of the crops, which had been affected by a drought that same year. Residents remember hurricanes because of their destructive impact on houses and other personal belongings and potential threat to human life, and of course because they can destroy the harvest of a whole year in a matter of hours. Despite their less dramatic impacts, droughts and increasingly unpredictable rainfall patterns, are of great concern to local farmers. Older farmers, especially, told us that there was much more rain when they first arrived in the region, and that their *milpas* grew much better then.

In addition to the negative impacts of a variable and changing climate, farmers also now report more and more conservation-related government restrictions on their traditional livelihood activities. For example, in one neighboring *ejido,* farmers set aside 2,000 ha for conservation and installed motion-triggered cameras in order to identify people who were hunting. But this *ejido* informed neighboring *ejidos* including Ricardo Payro, so that their inhabitants were aware of this new measure and would not be caught by surprise. Continued restrictions on burning are perceived by *milpa* farmers as an additional hardship. On the other hand, conservation projects are popular in the *ejido*, and people try to be proactive in order to be ready for new conservation project opportunities. Some farmers stated that with ongoing reforestation programs and a land title in their name, they have been more willing to engage in reforestation, which they can creatively combine with *milpa* cultivation. Other important subsidies mentioned by interviewees were PET (Programa de Empleo Temporal, Program for Seasonal Employment) payments to households (mostly to establish firebreaks), PROGAN payments (for cattle and infrastructure, like fences), and Allianza para el Campo subsidies.

Changes in Land Use in Five Calakmul Communities

The data from the 59 re-surveyed households show that in 2010 the most common agricultural activities in Calakmul were *milpa* cultivation (either as a maize monocrop or intercropped with beans and squash), jalapeño pepper cultivation, and the establishment or maintenance of pasture for cattle ranching. This has been consistent over the last decade, with the same activities dominant in 2003. A few households practice beekeeping, while some keep sheep and almost all have chickens. A very few households in Calakmul have diversified further with other crops, including lime, green tomatoes or habanero peppers. The proportion of households with no agricultural activities did not change between the 2 years; in both years it was 6.8 % of the interviewed households.

In both 2003 and 2010, 91.5 % (n=54) of all surveyed households cultivated *milpa*, either as their sole crop or in combination with jalapeño pepper plots or pasture plots (see Table 1). The average area of *milpa* appeared to decrease for our sampled households, from 3.3 ha in 2003 to 2.8 ha in 2010, but this decrease is not statistically significant (p=0.14). In 2010, only 3.4 % (n=2) of the households focused their activities solely on *milpa* (with no jalapeños, pasture, or cattle), as compared to 11.9 % (n=7) of the households in 2003 (but this decrease was not statistically significant either).

The number of surveyed households cultivating jalapeño peppers increased from 64.4 % (n=38) in 2003 to 72.9 % (n=43) in 2010. The average area cultivated with jalapeño pepper also increased, from 1.3 ha in 2003 to 1.6 ha in 2010, but this increase is not statistically significant (p=0.160). The cultivation of *milpa* and jalapeño pepper (without pasture or cattle) was practiced by 28.8 % of households (n= 17) in 2010, which is only 2 households less than in 2003 (32.2 %, n=19).

Households planting pasture increased from 49.2 % (n= 29) in 2003 to 61 % (n=36) in 2010. Although this increase observed in our sample was not statistically significant, an observed increase in the average amount of pasture was. Average household land in pasture increased from 8.1 ha in 2003 to 21.3 ha in 2010 (p=0.001). Households cultivating pasture with *milpa* remained almost unchanged between the 2 years, with 13.6 % (n=8) in 2003 and 11.9 % (n=7) in 2010. There was a non-statistically-significant increase in the number of households with pasture combined with both *milpa* and jalapeño pepper, from 2003 (25.4 %, n=15) to 2010 (37.3 %, n=22).

Compared to the number of households with pasture, the number of households actually owning cattle remains low, and the percentage of households with cattle only increased slightly from 10 % (n=6) in 2003 to 12 % (n=7) in 2010. The average number of cattle owned by these households, however, did increase significantly (p=0.034) (from 11 heads in 2003 to 43 heads in 2010). In 2003, only one household owned cattle and also cultivated *milpa* and pasture, and in 2010 only two households did so. The number of households engaged in all four main agricultural activities (*milpa*, jalapeños, pasture and cattle) remained unchanged with 6.8 % (n=4) in both years. And in both years, only one household specialized in only cattle (with pasture).

Additionally, in 2010 three households reported that they practiced beekeeping, three were raising sheep, two started to plant lime trees, one was cultivating and selling vegetables, and one household cultivated habanero pepper.

During the 2010 survey, we asked interviewees to assess changes in the households' overall crop area over the last

Table 1 Percentage and number of households with *milpa,* jalapeño pepper, pasture, cattle, and activity combinations. Average hectares of each crop and average heads of cattle

	2003	2010
Households cultivating *milpa*[a]	91.5 % (n=54)	91.5 % (n=54)
Average ha of *milpa*[b]	3.3 ha	2.8 ha
Households cultivating *milpa* only	11.9 % (n=7)	3.4 % (n=2)
Households cultivating jalapeño pepper	64.4 % (n=38)	72.9 % (n=43)
Average ha of jalapeño pepper	1.3 ha	1.6 ha
Households cultivating *milpa* and jalapeño pepper only	32.2 % (n=19)	28.8 % (n=17)
Households with pasture	49.2 % (n=29)	61 % (n=36)
Average ha of pasture	8.1 ha	21.3 ha**
Households with *milpa* and pasture only	13.6 % (n=8)	11.9 % (n=7)
Households with *milpa,* jalapeño pepper and pasture only	25.4 % (n=15)	37.3 % (n=22)
Households with cattle	10.2 % (n=6)	11.9 % (n=7)
Average heads of cattle	11	43*
Households with *milpa,* pasture, and cattle only	1.7 % (n=1)	3.4 % (n=2)
Households with *milpa,* jalapeño pepper, pasture and cattle	6.8 % (n=4)	6.8 % (n=4)
Households with only pasture and cattle	1.7 % (n=1)	1.7 % (n=1)
Households not engaging in agricultural activities	6.8 % (n=4)	6.8 % (n=4)

[a]Unless specified, categories refer to cultivation, etc. as either a sole crop or in combination with other crops.

[b]Averages are not taken over the entire sample and only apply to those households cultivating *milpa*, jalapeño, etc.

*Difference from 2003 to 2010 is statistically significant at p=0.034

**Difference from 2003 to 2010 is statistically significant at p=0.001

10 years and the reasons for change, or lack thereof. Of the 47 households that responded, only 14.9 % (n=7) responded that they had increased the amount of land under cultivation, 21.3 % (n=10) stated they were cultivating a smaller area now, and 25.5 % (n=12) reported that they have cultivated more or less the same amount of land year after year. The most frequent response (36.2 %, n=17), in fact, was that the area cropped varies from year to year.

The most frequently reported reason for households reducing the area of cultivated land was the changing and unpredictable climate, especially the increase in droughts. Other common reasons were the fluctuating price of jalapeño peppers or difficult access to markets. Many middlemen no longer pick up the jalapeño peppers at the field and instead ask farmers to transport their product to a central location in the village, or a location close to the nearest paved road. The consistently reported reason for maintaining or even increasing the area under crops, despite difficult farming conditions, was the lack of other income-generating activities in the region and therefore the need to cultivate in order to satisfy household food requirements and produce some surplus for sale.

Off-Farm Employment and the Diversification of Calakmul Livelihoods

In addition to agricultural activities, 44.1 % (n=26) of the 59 households surveyed in 2010 reported having at least one member engaged in off-farm work. In 18.6 % (n=11) of households, members worked as seasonal agricultural laborers (*jornaleros*) in plot preparation, weed control, or jalapeño pepper harvesting, in the same or in a neighboring *ejido*. Usually only a single household member worked as a seasonal agricultural laborer, but in one household, two members did. In 28.8 % (n=17) of households, members were participating in other off-farm activities, with three households having two members engaged in non-agricultural, off-farm employment. The most common off-farm employment (6 households) was working in a local store (self-owned or owned by another), followed by being an employee at the CBR or the municipality; working as a watchman, waiter, van driver, or schoolteacher; and working other, mostly low-paid, jobs.

In addition to generating income from local off-farm work, 23.8 % (n=14) of the surveyed households reported members engaged in work in more distant locations. The sampled households had a total of 18 members working in either the U.S., the tourist corridor of the neighboring state of Quintana Roo (in the cities Cancun and Playa del Carmen), or in the nearby city of Chetumal. Of these 14 households with labor migrants, 18.6 % (n=11) of them had members in the U.S. (a total of 12 individuals, four of whom were heads of household). Most of these migrants left the *ejidos* between 2005 and 2008. By 2009, labor migration to the U.S. was decreasing and only one migrant left after 2008. Meanwhile, in 2009, migration to the Quintana Roo tourist corridor started.

Asked to describe changes in their household's engagement in off-farm activities, 10.2 % of interviewees (n=6) reported that their household increased its participation in off-farm activities over the last 10 years, 5.1 % (n=3) reported decreased participation, and 11.0 % (n=7) reported unchanged participation. Just 2 households said that their household's engagement in off-farm labor varied from year to year over the last decade.

Reported reasons for greater engagement in off-farm employment were the ever-growing need for cash and the

increasing risks inherent in crop cultivation and cattle ranching given declining and unpredictable rainfall and the increasingly frequent droughts. Interviewees occasionally reported working as agricultural laborers simply as a result of having been asked to do so or in response to the opportunity arising. Relatively secure off-farm employment, like working for the CBR, was regarded as desirable and interviewees reported trying to secure and keep these jobs. Village store employment is one of the most appreciated and preferred off-farm jobs, but interviewees reported that in recent years store sales have gone down and income decreased.

Conclusions

A decrease in *milpa* cultivation in the study area in Calakmul was associated with climatic factors such as droughts and hurricanes, U.S. labor migration, and conservation programs. However, the profitability of market crops increased the area cultivated with *milpa,* making it more attractive when prices for jalapeño peppers decreased. In addition, increased income from remittances, off-farm employment and governmental cash transfer programs have tended to stabilize household economies and decrease households' dependency on agricultural production allowing households to maintain their *milpas* for subsistence production and cultural reproduction.

Milpas were increasingly combined with other land uses, including the popular combination of *milpa*, jalapeño pepper, and pasture. Farmers often converted their non-mechanized *milpas* into pasture after 2 years of cultivation. Pasture holds the promise that at some point there will be cash, from labor migration, off-farm jobs, and government subsidies, to purchase cattle. Households desire to incorporate cattle as a long-term source of income, but also as a relatively liquid asset in case of an emergency.

Rural households in Calakmul's *ejidal* sector are increasingly dependent on off-farm economic activities, including labor migration (Schmook and Radel 2008; Radel *et al.* 2010) and salaried employment, for example, work for the municipality. Even as men's labor migration to the U.S., which was very common from the late 1990s to the mid-2000s, began to decline, labor migration remained a significant aspect of household livelihood strategies in many Calakmul villages. As male heads of household have increasingly returned from working in the U.S., the remittances of migrant sons and daughters have become the key source of migration earnings in local household economies (see Schmook *et al.* forthcoming). Labor migration to the U.S. is associated with smaller *milpa* plots (as well as with less jalapeño hectarage and more pasture) (see Schmook and Radel 2008). More recently, in research in another Calakmul *ejido*, we have found that household accumulation of cattle and land is often financed with daughters' remittances. Agricultural strategies are changing in Calakmul, but often it is remittances which make household persistence, and even increased investment, in agriculture possible (Schmook *et al.* forthcoming).

Furthermore, many households rely on local and federal subsidies. Consequently, a growing proportion of rural families are connected to the cash economy via salaried labor, state welfare, subsidies, and remittances. These substantial changes, from a livelihood based on agricultural activities to a diversified household portfolio that links rural households to local, regional, and global political economies in a myriad of different ways, are part of larger changes in Latin American rural areas that researchers characterize as the new rurality (Kay 2008). Yet households are able to maintain *milpa* cultivation within a larger set of activities, which likely allows households to limit their various risk exposures. Being a "*milpero*" is also a cultural identity for local farmers linked to their sense of what it means to be a *campesino* and connecting individuals and families to their Maya ancestors. A *milpero* fulfills the role he has been given as a Maya (De Frece and Poole 2008).

Thus, although livelihoods in Calakmul have diversified and commercially oriented agricultural activities have continued to grow (especially cattle production), subsistence *milpa* production has persisted alongside these activities. There is some indication from the survey results that farmers are decreasing the size of their *milpas,* and other research from the region confirms a tendency towards decreased *milpa* areas has occurred since at least the late 1990s (see Schmook 2010). The *milpa* as practiced in Calakmul has evolved over the last decades, with maize often now planted as a low-input monocrop or in the traditional combination with beans and squash (see Schmook 2010 for more details). For the most part, however, *milpa* has retained its swidden characteristics. Farmers in Calakmul still practice *milpa* cultivation despite adaptations to external forces. In fact, it might be more accurate to state that farmers practice *milpa* cultivation as *part of their adaptations to external forces*. *Milpa* cultivation remains the main agricultural activity and is practiced by 92 % of all households.

We argue here that the general external forces that have driven intensification and livelihood diversification in Calakmul have in fact contributed to this persistence of *milpa* cultivation. Off-farm work by other household members provides necessary cash income, which allows farmers to spend time on *milpa*. The "double exposure" of households to climate changes and neoliberal policies (O'Brien and Leichenko 2000) has made farming more difficult. This situation also means that farmers are in a more economically marginal position, which, ironically, suggests that subsistence food production is all the more important to households. Maize in Calakmul, as in the rest of Mexico, is the

main staple and its cultivation allows, at least in part, for the household to secure basic food security. Almost all maize cultivation in Calakmul is subsistence production, as maize production for the market is currently not perceived as a feasible economic option.

Farmers have adapted their *milpas* over the last three decades responding to socioeconomic and legal circumstances. They have changed the area of their *milpas,* the degree of mechanization, and the variety and area of crops other than maize (with corresponding impacts on *milpa* production through labor availability). As a result, it is almost impossible to disentangle cause and effect. Associated factors can be external to household decisions, like climate, availability of agricultural subsidies, market prices, and conservation laws and enforcement; or they can be related to other household decisions, particularly those centered around labor, like participation in off-farm activities and labor migration. Household *milpa* cultivation decisions thus reflect the combination of both external factors and other linked household decisions. Fundamentally, the persistence of *milpa* in Calakmul represents a complex intertwining of the past and the present; of cultural identity and material necessity; and of a suite of household responses to extra-household forces. Thus, swidden also can be seen as an active response on the part of farmers in the Global South to processes of economic marginalization within and through globalization. This perspective can help us understand that swidden today is not always the same as swidden decades ago. Swidden as both cultural practice and livelihood strategy evolves in response to changing coupled human-environment systems and the position of the farm household in these systems.

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