

Chapter 2

LAND-COVER AND LAND-USE CHANGE (LCLUC) IN THE SOUTHERN YUCATÁN PENINSULAR REGION (SYPR)

An Integrated Approach

Billie L. Turner II

Graduate School of Geography and George Perkins Marsh Institute, Clark University
bturner@clarku.edu

Jacqueline Geoghegan

Department of Economics and George Perkins Marsh Institute, Clark University

Abstract

The southern Yucatán peninsular region (SYPR) project seeks to demonstrate the value of “integrated land-change science” approaches to understanding tropical deforestation and land-use and land-cover change in the region in question. Ecological, social, and remote sensing–GIS sciences are joined in an examination of political economic forces driving land change in this “hot spot” of tropical deforestation, the impacts and feedbacks of these changes on forest and household dynamics, and the ability to advance spatially explicit land-change models of these dynamics linked to TM Landsat imagery. Emphasis here is placed on the methods used to collect and analyze household data in regard to a regional model that addresses both the magnitude and location of deforestation in the region. While exploratory in kind, the effort illustrates the potential to improve land-change models in ways that resonate with the interests of the three research communities involved in the project. The project indicates that integrated land-change science is possible, holds promise to improve understanding across a wide range of research questions, but invariably involves large start-up costs and entertains other requirements that make its practice a long-term research investment.

Keywords:

Yucatán, tropical deforestation, land change, household survey, models

1. INTRODUCTION: THE SYPR PROJECT

The SYPR project began in 1997 as part of a three-year grant from NASA's LCLUC program, with sustained support from the NSF's Center for Integrated Studies of the Human Dimensions of Global Environmental Change (CIS-HDGEC, Carnegie Mellon University). Its theme during that phase of work was "spatially explicit probability approaches for modeling and projecting deforestation and land conversion linked to remotely sensed imagery." Subsequently, a second phase of the project began in 2001 (three years) under the auspices of LCLUC and CIS-HDGEC, focusing on "refining models and projections of deforestation with application to the carbon cycle, biotic diversity and regeneration capacity, sustainability and vulnerability."¹ Four overarching goals combine the two phases of the project: (1) to advance *integrated land science*, coupling ecological, remote sensing and GIS, and social science as a robust means of addressing land-use/cover change, (2) by developing a sound understanding of deforestation and agricultural change in the southern Yucatán peninsular region, and (3) placing this understanding into a suite of spatially explicit models that can explain and project land change, (4) with special references to forest carbon flux, loss in biotic diversity, and the vulnerability of the coupled human environment system to perturbations and stresses of various kinds. In addition, SYPR has joined a comparative LCLUC study on land-change effects on biodiversity near parks and reserves. Given the complexity of this large interdisciplinary and multi-institutional project (involving more than twenty-five researchers), attention here is given to phase one of project.²

2. BACKGROUND

The southern Yucatán peninsular region is the last tropical forest-agriculture frontier in Mexico. Encompassing about 22,000 km² (as defined by the project—see Figure 1) and spanning the states of Quintana Roo and Campeche, the region is a karstic upland, ranging from 100 to 300 m amsl (above mean sea level).³ Precipitation varies north-south from 900 mm to 1,400 mm per annum, with a pronounced dry season during the winter. The karstic terrain promotes subsurface drainage of water with deep water tables (in excess of 200 m). Surface water flows only along the edges of the region, usually after prolonged rains or during extreme rainfall events (hurricanes). The rolling hills and ridges are dominated by rich but thin mollisols (a soil type). Dispersed among the uplands are large solution features (*poljes*), locally known as *bajos*, that infill with clay-rich vertisols (soil) and hold water during the wet season. The uplands and *bajos* (about 20 percent and

80 percent of the region, respectively) maintain seasonal tropical forests distinguished not so much by different species but by their relative abundance and structural appearance. Locally the forest on the uplands is known as *bosque mediano* and those in *bajos* as *alkache*; here we distinguish them as upland forest and *bajo* forest, respectively. Save for special development projects, most cultivation takes place on lands formerly under upland forest—the same lands possessing the better drained soils, as opposed to the poorly drained and massive clay soils of the *bajos*.

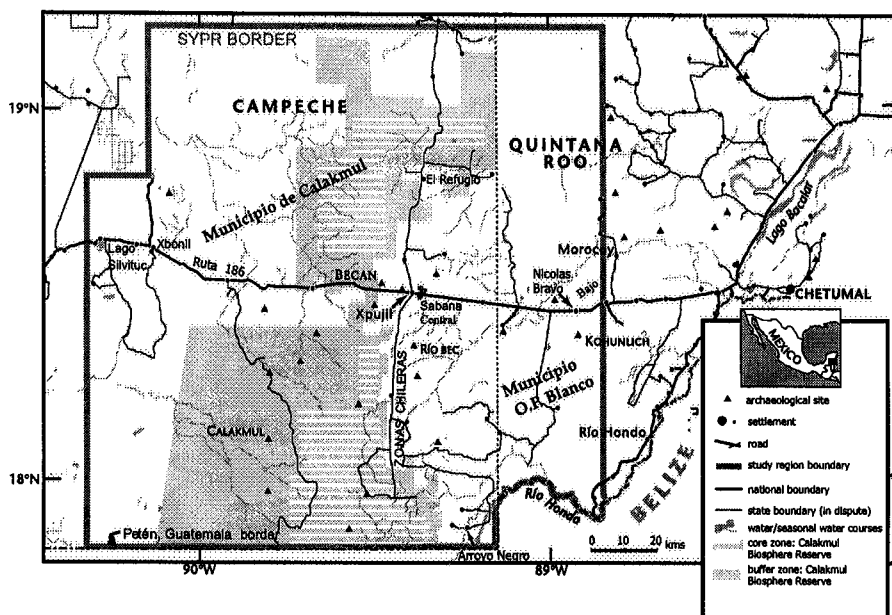


Figure 1. Summary of land areas and population densities

This region was once the northern part of the central Maya lowlands, and during the Late Preclassic and Classic periods, a large majority of the upland forests was obliterated for occupation and cultivation, as were parts of *bajo* forests in the east (Turner 1983). With the Classic Maya collapse (ca. A.D. 850–1000 locally), the region was abandoned and the forest returned, albeit modified in species abundance, remaining relatively untouched until the twentieth century. In the early part of that century, various logging schemes were planned but poorly implemented. By World War II, however, migrant camps of *chicleros* dotted the landscape to collect chicle (resin from the chicle tree) for American chewing gum. With the end of the war, this activity dissipated and was overtaken by serious logging of mahogany and Spanish cedar, which was abundant in the region (Lundell 1934). By the

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