

**LAND USE / LAND COVER
CHANGES IN THE PERIOD
OF GLOBALIZATION**

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Editors: Ivan Bičík, Pavel Chromý, Vít Jančák, Helena Janů

Charles University in Prague

Faculty of Science

Department of Social Geography and Regional Development

Albertov 6, 128 43 Praha 2

Czechia

Tel.: +420-2-21952198; Fax: +420-2-21953311

www.geography.cz/socgeo/

Head of department: doc. RNDr. Zdeněk Čermák, CSc.

IGU-LUCC

International Geographical Union

Study Group on Land Use and Land Cover Change

IGU-LUCC Chair: Prof. Yukio Himiyama

himiyama@atson.asa.hokkyodai.ac.jp

<http://www.natur.cuni.cz/LUCC2001/>

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CONTENTS

Himiyama Yukio: Land use/cover change studies in the period of globalization	5
Winwarter Verena, Sonnelechner Christoph: Cultural landscape development in Europe: taking the long view on european history and its landscapes	15
Mather Alexander: The reversal of land-use trends: the beginning of the reforestation of Europe	23
Bičík Ivan, Kupková Lucie: Long-term changes in land use in Czechia based on the quality of agricultural land	31
Jelčák Leoš: Historical development of society and LUCC in Czechia 1800-2000: major societal driving forces of land use changes	44
Doucha Tomáš: Multifunctionality of the czech agriculture	58
Singh Ran Babu: Environmental degradation and its impact on land use/ land cover changes in agriculturally developed regions of India	67
Bai Zhang: The change of swampy wetland in northeast China	75
Milanova Elena, Sennikova Maria, Soltsev Vladimir, Alexeev Boris, Kalustskova Natalia: Methodology of land use/cover study in Russia	81
Balázs Katalin, Ángyán József, Podmaniczky László: Evaluation agricultural potentials and environmental sensitivity for sustainable land use planning	88
Feranc Ján, Oľahel Ján, Pravda Ján, Husár Karol, Cebečaner Tomáš: Map presentation of the landscape changes assessment of Slovakia	95
Oľahel Ján, Feranc Ján, Šíri Marcel, Husár Karol: Land cover of Slovakia: assessment of its changes	100
Štěpánek Vít: Czech frontier in the 20 th century: major political shifts reflected in changing land use structure	110
Kressler Florian P., Köstl Mario, Steinnocher Klaus T.: Monitoring suburban developments from space: an application from the greater Vienna region	116

Conclusion

In this paper a texture analysis is used in order to derive a settlement mask from panchromatic satellite images. By means of visual interpretation this mask was further subdivided into the classes residential, industry/commerce, transportation, urban green and water. As a sample application two satellite images, one from 1968 and one from 1999, covering the Greater Vienna region were analysed. A comparison of the resultant settlement mask makes it possible to highlight where changes have taken place.

It is also possible to integrate the settlement mask with any kind of socio-economic data. This kind of data are usually only available on an aggregated level, especially outside large cities, e.g. on a census unit or municipality level. The areas tend to increase as one gets further away from large cities, distorting the spatial reference of the statistical data. As an example the settlement mask was integrated with population data to show how land use per capita has changed in different municipalities over time.

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Florian P. Kressler, Mario Kösl, Klaus T. Steinnocher

Austrian Research Centers Seibersdorf, Department for Environmental Planning
A-2444 Seibersdorf, Austria, Tel.: +43-(0)50550-3878, Fax: +43-(0)50550-3888

E-mail: florian.kressler@arcs.ac.at

A historical trajectory of land use and land cover change in the Sierra de Lacandón National Park, Guatemala

DAVID L. CARR

Abstract

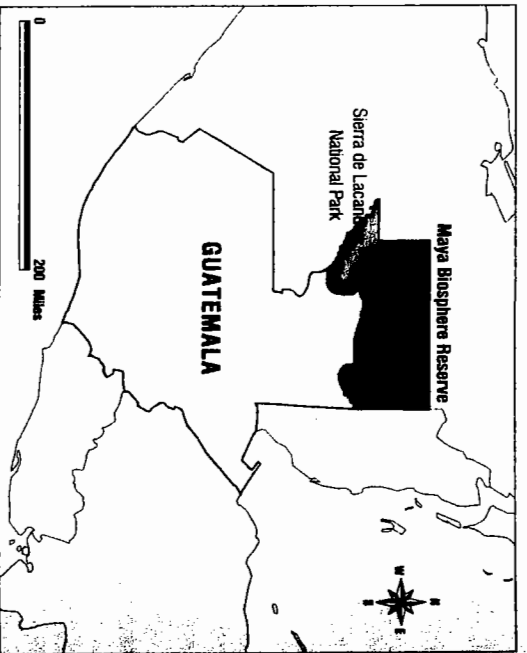
Widely deforested by Maya agriculturists from 1500 BC to AD 900, the Petén was virtually depopulated by AD 900 (West 1964). During the 1990s the Sierra de Lacandón National Park (SLNP) was a pole of agricultural colonization in the Petén. During this time, ten percent of the SLNP's forest canopy was converted to agricultural fields - mostly for maize production and, increasingly, for livestock grazing. This paper discusses some of the historical antecedents to colonization and deforestation in the SLNP. Data sources include a selected literature review on the topic and fieldwork by the author in 1998 and 1999. Enhancing the geographical and historical scope of the research by combining LUCC and migration research highlights how changes in the human and physical geography in one place and time may lead to LUCC in another place and time.

KEY WORDS: internal migration - deforestation - Guatemala - LUCC - Latin America.

Introduction

What historical events and processes anteceded the outcome of small farmer colonization and deforestation in the Sierra de Lacandón National Park, Guatemala (see Fig. 1)? In recent years, virtually all deforestation has occurred in the tropics, and no place more rapidly than in Central America (FAO 1997). Forest clearing tends to be concentrated in remote agricultural frontiers where migrant farmers are escaping poverty in search of land for subsistence (Carr 2001). To study farmer land use once they have settled at the frontier tells us something of the direct cause of forest clearing. But it tells us little about the historical political, ecological, and economic factors that caused migration to the frontier in the first place, and that constrain farmers to manage land extensively once at the frontier.

FIGURE 1 ■ Guatemala, Maya Biosphere Reserve and the Sierra de Lacandón National Park



Historical antecedents to colonization and deforestation in the SLNP

Widely deforested by Maya agriculturists from 1500 BC to AD 900, the Petén was virtually depopulated by AD 900 and the forest regained its thick cover in the following centuries (West 1964). Called the "inhospitable immensity" by naturalist novelist Virgilio Macal, colonial and republican governments grappled with land pressures for hundreds of years while 40% of its national territory remained a vast uninhabited forest.

Yet the Maya supported dense populations throughout the "marginal lands" of Petén for hundreds of years. Despite rapid population growth in recent years, at under 20 persons per km² the population density of the department remains notably lower than during the Classic Maya era when several hundred persons per km² were thought to inhabit the region (Whimmore, Turner et al. 1990). To compensate for such high rural population densities, the Maya engaged in intensive agricultural practices such as terracing and raised wetland agriculture (Turner, et al. 1990).

Since the Spanish conquest of the region in 1697 until the early 1960s, the population had hovered between 12,000 and 25,000 (Schwartz 1990). In the 1950s and 1960s, temporary workers and chicleos flew in to the Petén's capital, Flores. By the 1960s, mounting population and land pressures, civil unrest, and a national mandate to stimulate export agriculture, unleashed an accelerated colonization of the Petén. In 1959 the Economic Development and Promotion Company (FYDEP in Spanish) was established with the mission of integrating the vast natural riches of the department into the national economy. Until 1959 only 71 farms were registered in Petén, occupying only 1% of its territory (Clark 1996). Since the 1960s, Petén's population has exploded from a few isolated chicle extractors to a teeming population of approximately 600,000 farmers and labourers (INE 1998). At least 6% of Petén's 9% annual population growth

(since the mid 1960s) has been from in-migration. In 1971 the government promulgated laws that essentially subsidized the national rural oligarchy to convert the great forests of Petén to cattle pasture. El Decreto #38-71, "El Uso, Tenencia, y Adjudicación de la Tierra de Petén" sought to grant lands of up to 675 hectares (with a minimum of 45 hectares) for the development of livestock ranching. In order to cope with the enormous influx of colonists, the National Institute for Agrarian Transformation (INTA in Spanish) replaced FYDEP in 1990.

Since the 1980s, virtually all of the in-migrants to Petén have been land poor corn farmers, a disproportionate number of them Q'eqchi' Maya. Approximately half of the department's population is now comprised of Q'eqchi' farm families. Migrants are generally under 35 years of age, with the most important interdepartmental streams being from the eastern departamentos to Petén (Schroten 1987). They have been the agents of dramatic landscape change. From the 1960s to the mid-1990s, half the Petén's forests were eliminated (World Bank 1995). At the recent rate of 40,000 hectares cleared per annum, the department's last forests would be erased by 2015.

The Establishment of the Maya Biosphere Reserve and the SLNP

With heightened preoccupation among donor countries of the western world that Guatemala would exterminate its forests within a generation, in 1989 the Maya Biosphere Reserve (MBR) was established (Decreto #5-90) with an area of 2,113 km², occupying almost 60% of Petén and 20% of national territory. The heart of La Selva Maya, (the largest tropical forest in Central America), the Maya Biosphere Reserve serves as a pan-continental biological bridge, a cardinal repository of global biodiversity, and a cache of hundreds of archeological sites, including Tikal, the magnificent ancient Mayan city state.

Reserve boundaries were drawn in apparent disregard to the chaotic matrix of private property, squatter farms, and cooperatives scribbled about the landscape. Since the SLNP is the only extension of the MBR whose majority of land (90%) lies south of 17 degrees 10' the southern boundary of what was considered national land by FYDEP, only a small fraction of the park remained within FYDEP's forest reserve. The creation of the core zone (Decreto Ley #5-90) superinscribed on these properties created a still unresolved conflict. A tension exists between the right of private property established in the Constitution and Decreto Ley #5-90 that created the MBR. Park denizens were not granted permanence, nor was a relocation negotiated. On the contrary, inconsistent and lax national laws and the inertia of FYDEP have stagnated conservation and development efforts to provide sufficient land outside of the reserve to the voluminous arrivals of landless families. Consequently, the forests of the MBR, and the Sierra de Lacandón National Park in particular, are contracting at alarming rates.

Deforestation in the SLNP

Established in 1990 as one of four core zones (area of strict conservation) within the MBR (the other three are Tikal, Laguna del Tigre, Mirador-Río Azul), with an extension of 202, 865 hectares, the Sierra de Lacandón National Park (SLNP) is the second largest national park in Guatemala (the first is the Sierra de las Minas Biosphere Reserve). The PNSL has a perimeter of 290 kilometers. Approximately half of the perimeter constitutes a border with the Mexican states of Chiapas and Tabasco. The SLNP is separated from Chiapas to the west by the largest river in Central America, the Usumacinta. Tabasco to along the park's 48 kilometer border in the northeast corner of Petén.

The SLNP boasts the richest biodiversity in the MBR and is the sole biological corridor linking the MBR and the Montes Azules Biosphere Reserve – the largest protected lowland tropical forest in Mexico (The Nature Conservancy 1997). It also forms a conservation corridor with the Laguna del Tigre National Park (despite a buffer zone between the two parks that has been largely converted to pastureland). Lastly, only 20 kilometers separate the The MBR's southern buffer zone extends 20 kilometers to the south of the PNSL and the northern buffer limit of the Multiple Use Zone of the Cahabón Dos Pilas – Aguateca conservation complex.

Despite its biological importance and its designation as a core conservation zone, the SLNP suffers some of the highest rates of population growth and agricultural expansion in Petén. Indeed, current trends threaten to extinguish the park's forest canopy in less than twenty years (Sader, Sever et al. 1994). Approximately 11% of the park's forest canopy has been eliminated, 9% since 1990. As in the rest of Petén, the proximate cause of this galloping deforestation has been the colonization of the park by swidden and farmers who have flooded the area following the construction of an oil road in the early 1980s (Carr 1999). Farms on the eastern side of the road were claimed first. Even though the SLNP was not declared a core zone of the MBR until 1990, the first colonists to arrive in the 1980s were aware, at least vaguely, that the land to the southwest of the Naranja road was federal land on which settlement was not permitted.

I undertook a survey of community leaders in twenty-eight communities in the SLNP and 279 household heads in nine communities selected as a statistically representative sample. Data collection confirmed the following trends: Farmers engage in shifting agriculture. Plots are quite large, averaging over thirty hectares per household. Most households arrived during the 1990s. Land is infrequently used for another purpose other than maize, frijol, cattle, and fallow. Maize is grown by virtually all farmers in the park. One-third of the farmers crop frijol and another third own cattle. On average, farmers have cleared only about one half of their farms, suggesting that deforestation will continue to be substantial within farms (internal frontier) as well as on newly settled farms at the frontier's edge. Expansive farming is reasonable given the conditions in the area. Farmers take advantage of abundant resources available to them, namely, land compensating for scarce resources, namely, labor, technology, and the financial and technical wherewithal to invest in agricultural intensification. Plot insecurity due to the inefficiencies of INTA and other government organizations, and the threat of squatting

from new colonists, may further encourage rapid forest clearing to demonstrate ownership.

As long as road infrastructures improve (the government has invested in paving much of the major access road to the park), colonists will have easier access to the area and may be more encouraged to settle there due to improved access to markets. Currently the Guatemalan government in collaboration with USAID and other European donor agencies have invested in sustainable farming practices in the buffer zones of the Maya Biosphere Reserve. Still, lack of funding has meant that little attention has been provided to farmers in the form of technical assistance, credit, or market strategies. Policy efforts to change current production systems must be grounded in information on farm level conditions for resource use. Nevertheless, successful policy formulas will also be sensitive to the structural inequalities in origin areas and the infrastructure developed in destination areas i.e. roads that foment frontier colonization in the first place.

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David L. Carr

University of North Carolina at Chapel Hill

Department of Geography and Carolina Population Center

C. B. 3220 Department of Geography

UNC-CH, Chapel Hill, NC 27516

E-mail: david_carr@email.unc.edu

Land use as an indicator of the anthropogenic impact on the landscape

LUCIE KUPKOVÁ

Abstract

The territory of the Czech Republic in the center of Europe that was exposed to the impact of many historical events and turns is an ideal area for the research of the nature-society interactions and their development. It is possible to describe and to study development of anthropogenic impact on the landscape based on the unique long term cadastral land use dataset (8 land-use categories for more than 12000 cadastral units in the years 1845, 1948, 1990, 2000). Using this dataset the coefficient of the degree of the anthropogenic impact on the landscape (CAI) was defined as the ratio of areas with a high intensity of use (under great anthropogenic pressure) including arable land, built-up areas and other areas, and of areas with a lower intensity of use (under a lower anthropogenic pressure) including forests, meadows, pastures and water areas. CAI development for the territory of Czechia and in the detailed level for three model cadasters in the different landscape types was evaluated.

KEY WORDS: land use – anthropogenic impact – landscape – development – Czechia.

Introduction

The introduction of the term *land use* is connected with the research of the changes in the land use in Great Britain, the aim of which was to ascertain possible reserves of land resources in view to cover the food consumption in case of a blockade of food imports from abroad (Stamp 1945, 1950). The analyses of land use and of its development in the second half of the 20th century became progressively one of the principal methods of evaluation of the development of the nature–society interactions. Today there exist large international projects dealing with these issues. A recent example is for instance the activity of the IGU study group Land Use/Land Cover Change, which culminated in 2001 by publication of the international atlas Land Use/Cover Changes in Selected Regions in the World (Himiyama, Mather, Bičík, Milanova [eds.], 2001).

There are numerous definitions of the term land use. For instance for Bie and Zuidema (1995), *land use* is a series of operations by which man tends the soil (land) with