LCLUC in the Southern Yucatán Peninsular Region

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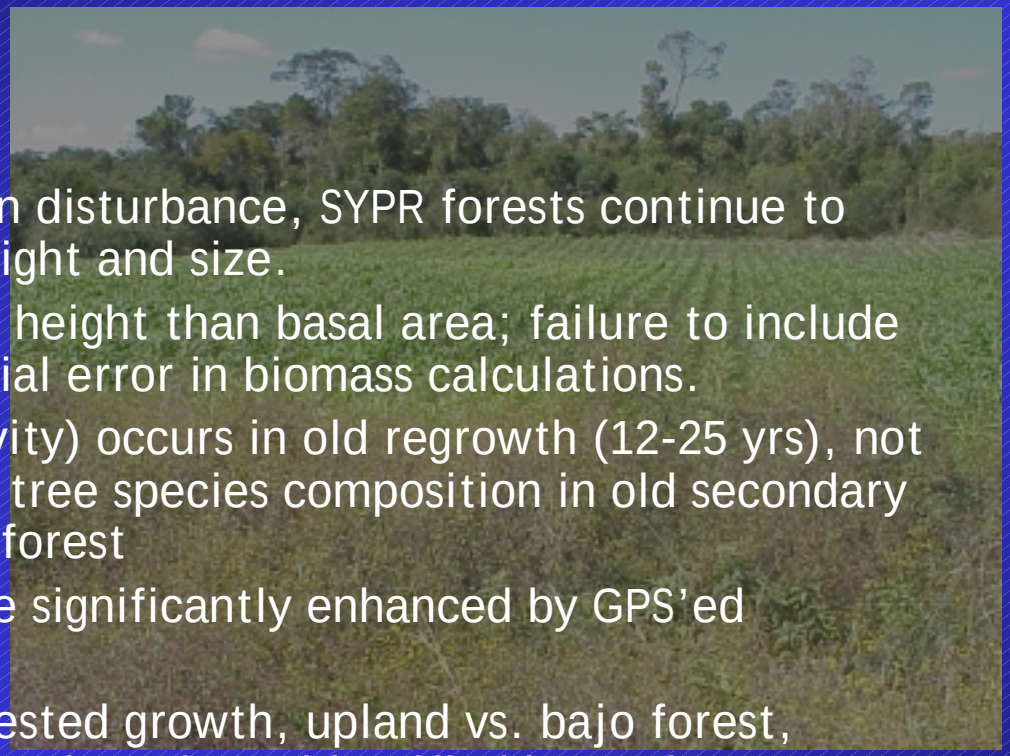
GOALS: To advance understanding of the human-environment conditions leading to tropical deforestation through integrative approaches and of the biophysical and social implications of the deforestation

QUESTIONS: What are the kind, pace, and scale of land-use/cover change in the region, especially deforestation and agriculture? What are the causes of these changes and can they be developed into integrative explanatory models that are geographically explicit? what are the implications of these changes on forest structure and function, the Calakmul Biosphere reserve, and regional carbon cycle.

APPROACHES: Historical reconstructions, household surveys, econometric analysis, imagery classification and analysis, GIS data bases, forest ecology studies, nutrient cycling studies, hurricane impacts reconstruction, and three kinds of model development

MAJOR FINDINGS TO DATE



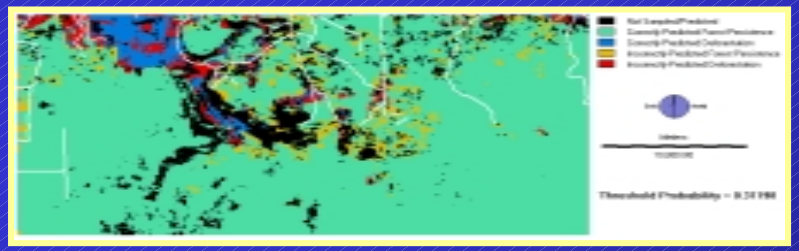
- Responding to 100 yrs of modern disturbance, SYPR forests continue to increase in biomass and tree height and size.
- Biomass gained more by canopy height than basal area; failure to include both measures creates substantial error in biomass calculations.
- Peak litter fall (forest productivity) occurs in old regrowth (12-25 yrs), not mature forest; after 25-30 yrs, tree species composition in old secondary forest is the same as in mature forest
- TM imagery classification can be significantly enhanced by GPS'ed historical sketch maps.
- 3 stages of forest regrowth, arrested growth, upland vs. bajo forest, cultivation, grasslands vs. pasture have been identified by TM image analysis.
- Agricultural expansion initiated (ca. 1967) and reduced (ca. 1995) by Mexican development policy.
- Land managers (smallholders) do not behave as ideal market entrepreneurs, but as mixed subsistence-market farmers; thus mixed responses to market infrastructures (e.g., roads).
- "Sponsored" projects repeatedly failed to generate market cultivation, but local adaptations have stimulated significant marketing of chili.

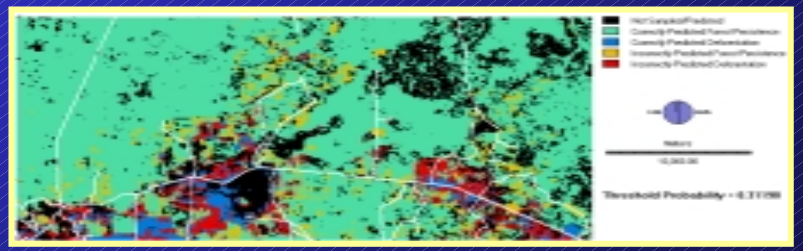
CONCLUSIONS

- SYPR forests have been highly disturbed over the past 100 yrs, although the relative roles of human and biophysical factors have yet to be determined.
- Major episodes of human disturbance are related to major Mexican policy changes about the course of development in the region, not population or market growth independent of policies
- Where disturbance involves medium to long-fallow cultivation, the species composition of the forest recovers and maximum litter fall shows potential to regenerate soil fertility.
- Invasive species inhibit forest regeneration, interrupt the crop-fallow cycle of swidden cultivation, reduce fallows on other lands, and contribute to less standing biomass.
- TM imagery can be pushed to a classification specificity to address critical ecological and socioeconomic issues.
- Trials indicated that geographically explicit models that predict and project different kinds of land change are possible.
- These models require the integration of environmental and human data that are not usually available, but once established can be linked to satellite imagery to monitor and assess land change and its various impacts.

FUTURE STEPS

- Determine the carbon balance by forest uses episode; identifying changing sources and sinks.
- Address possibility of forest recovery under intensifying, capital input cultivation and increasing forest fragmentation.
- Address landscape-scale impacts on precipitation.
- Explain the distribution of invasive species that inhibit cultivation regrowth.
- Refine and improve the imagery classification with added field measures, experimental techniques (e.g., use of texture analysis), and added images.
- Calculate the amount and rates of changes in all major land uses and covers.
- Determine the role of land-tenure institutions and NGOs on land uses.
- Assess the long-term viability and impacts of chili marketing.
- Address the LUCC impacts of El Maya Mundo archeo-ecotourism program.
- Undertake “second generation” geographically explicit models of land change, both disaggregate and aggregate in kind.
- Fully develop an integrated land-change, scenario model.





PUBLICATIONS ON PROJECT RESULTS

Forthcoming

Integrated Land History and Global Change Science: The Example of the Southern Yucatán Peninsular Region Project. *Land Use Policy.* Peter Klepeis and B. L. Turner II.

Frontiers Reclaimed: Land-Cover and Land-Use Change in the Southern Yucatán Peninsular Region. Oxford: Oxford University Press. B. L. Turner II, et al., eds. [contract signed as part of the Claredon Lecture Series on the Environment]

Mapa de Cobertura de la Vegetación de la Selva Maya. *Conservation International.* [SYPR project results used for southern Quintana Roo and Campeche sections]

Invited submissions under review

Deforestation and Agricultural Change in the Southern Yucatán Peninsular Region: Integrative Land Change for Global Change Studies. *Forestry, Ecosystems, and Management.* B. L. Turner II, Sergio Cortina Villar, David Foster, Jacqueline Geoghegan, Eric Keys, Peter Klepeis, Deborah Lawrence, Pedro Macario Mendoza, Steven Manson, Yelena Ogneva-Himmelberger, Diego Perez Salicrup, Rinku Roy Chowdhury,Basil Savitsky, Laura Schneider, Birgit Schmook, and Colin Vance.

Modeling Tropical Deforestation in the Southern Yucatán Peninsular Region: Comparing Survey and Satellite Data. *Agroecosystems and Environment* Jacqueline Geoghegan, Sergio Cortina Villar, Peter Klepeis, Pedro Macario Mendoza, Yelena Ogneva-Himmelberger, Rinku Roy Chowdhury, B.L. Turner II, and Colin Vance.

PUBLICATIONS IN WHICH PROJECT IS REVIEWED/DISCUSSED

1998. "Socializing the Pixel" and "Pixelizing the Social" in Land-Use/Cover Change" In *People and Pixels: Linking Remote Sensing and Social Science*. Committee on the Human Dimensions of Global Environmental Change, National Research Council. Washington, D.C., pp. 51-69. Geoghegan, J., L. Pritchard, Jr., Y. Ogneva-Himmelberger, R. Roy Chowdhury, S. Sanderson, and B. L. Turner II.

2000. *Forest Landscape Dynamics in New England. Ecosystem Structure and Function as a Consequence of 5000 years of Change*. Synthesis Volume of the Harvard Forest LTER Program. Oxford University Press. D. R. Foster, and J. Aber.

2000. From Bobolinks to Bears: Interjecting Geographical History into Ecological Studies, Environmental Interpretation, and Conservation Planning. *J. of Biogeography*. In Press. D.R. Foster.

1999. Forests the way they used to be. *New York Times OpEd*. June 26. C-4. D.R. Foster.