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

**REFINING MODELS & PROJECTIONS OF DEFORESTATION WITH APPLICATION
TO THE CARBON CYCLE, BIOTIC DIVERSITY & REGENERATION CAPACITY,
SUSTAINABILITY & VULNERABILITY**

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Abstract

The LCLUC-SYPR project is an ambitious undertaking that advances "integrated land-change" study focused on one of the last tropical forest frontiers remaining in Mexico containing the Calakmul Biosphere Reserve and elements of the Mesoamerican Biological Corridor, but labled by international organizations as a hotspot of deforestation. The project seeks to develop spatially explicit land-change models whose empirical findings inform an agent-based, dynamic spatial simulation model to be used for multi-purpose integrated assessments Phase 2 of this project: [1] continues ecological, socio-economic, and remote sensing studies that provide the empirical basis for synthesis and modeling; [2] adds uncertainty and subpixel classification analysis; [3] link to MODIS-Comparative Reserve LCLUC study; [4] add studies of institutions and species invasion; [5] rework and refine models; [6] .couple the extant and new data and findings to generate [a] refined estimates of the magnitude, location and rates of deforestation-forestation in the region, [b] fine-tuned estimates of carbon (sink-source) and the costs of carbon sequestration, and [c] determination of the loss biota (ECOSUR unit of the project) and model projections of locations most vulnerable to further losses.

QUESTIONS, GOALS, APPROACHES

The LCLUC-SYPR project seeks to document the land conditions and changes underway in the region down to the Landsat pixel level, explain the changes as function of the coupled human-environment systems operating there, and assess-project the consequences of the changes on the coupled system. It attempt to do this by the direct examination of certain problems (e.g., carbon flux) and by creating explanatory and scenario (integrated assessment) models that address the magnitude and location (pixel) of the changes and persistence underway.

The project is truly "integrated land-change science" in the sense the expenditure of funds, research personnel, and actual research is roughly 1/3rd, respectively, social science, natural science, and remote sensing/GIS science.

The year one goals of Phase 2 of the project were: [1] to link to and supplement ECOSUR's work on biodiversity and land change in the region; [2] supplement the nutrient dynamic work, working toward carbon assessment; [3] reassess the Phase 1 classification and improve upon it; [4] add on invasive species and institution work; [5] complete the SYPR IA (integrated assessment model); [6] improve the regional binomial logit model; [7] link to the LCLUC Comparative Reserve Study; [8] advance funding for vulnerability assessment. These goals are addressed numerically below.

1. Biodiversity work maintained by ECOSUR, with plot and transect studies altered to fit the land classification of the SYPR project. Data collections underway.
2. New plot-transect work on biomass and soils; data gathering underway.
3. The entire Phase 1 classification scheme and procedure has been redone under the supervision of Eastman (new to project), with extensive observation-testing in the field of the results using sub-pixel and fuzzy classifier approach. New imagery assessment currently in progress.
4. Doctoral research students returning from multiple year work on species invasion and on landscape use-fragmentation following different land institutions. Data collected and analysis to begin in the Fall.
5. SYPR IA Phase 1 model completed this year, and plans underway to field test it.
6. Work on 2nd-3rd phase binomial logit model placed on hold, awaiting results of the new imagery classification. New data sets (census) placed into GIS.
7. Fieldtrip taken with Montana-Maryland group, working on comparative study design and MODIS imagery.
8. The advances made across all these fronts, link to other sources of funding, including other NASA units, were used to develop a "vulnerability" project based on SYPR IA model. Proposal being vetted to foundations.

The largest "gap" in this year's work is that on the regional model (logit), which followed from the problems found in the Phase 1 imagery classification. The new or revamped classification appears to be quite robust and more detailed than that developed in Phase 1. New logit models will begin shortly.

New Findings
The combination of survey and imagery classification data indicates that PROCAMPO, a neoliberal Mexican program which seeks to promote the intensification of cultivation in the region, actually increased deforestation by 6% to 34% because farmers used PROCAMPO subsidies to clear forests rather than intensify cultivation.

By including small stems (<10 cm) into analysis, biomass recovery after cultivation rises from 40-65 years to 55-90 years. No studies have included small stems in such analysis.

New Methods
The first functional SYPR agent based and spatially explicit integrated assessment model is complete. This model permits scenario assessments of land change under different sets of conditions, delivering a spatial as well as magnitude answer.

New soft classifiers and uncertainty techniques have been demonstrated in imagery classification, portending to enhance land change detection.

New Products
A new, fine resolution classification is nearly complete and portends to raise significantly the detail of land covers that can be identified using TM Landsat imagery. New land-change maps will be produced in late summer.

Conclusions

The SYPR project is making major headway in all fronts: stronger than ever partnerships in Mexico; major new-version classification; almost complete IA model; new work on institutions, ecosystem fragmentation, carbon, nutrient cycling, invasive species, womens's groups impact on cultiavtion, and chili cultivation underway; and preparation of new modeling efforts.

Publications during 2001-02 or In Press

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