PROGRESS REPORT

Title: Modeling and Forecasting Effects of Land Use Change in China Based on Socioeconomic Drivers

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1. INTRODUCTION

This project seeks to model and forecast land use change in the Pearl River Delta of Southern China. To do so, we will quantify the historical rates of land use change, relate these changes to economic development, and project these changes to forecast future rates of land use change. This project report covers the first ten month period, July, 1997 - April, 1998**.** During this period, we have focused on: 1) data acquisition (both satellite imagery and socioeconomic data); 2) preprocessing of satellite images (geometric correction, registration, radiometric calibration, and atmospheric correction); 3) field work; 4) preliminary analysis of the socioeconomic data; and 5) identification and acquisition of model data sets for vegetation cover types in the Pearl River Delta. This report describes the progress made in each of these areas during this period.

2. DATA ACQUISITION

We have been working closely with our collaborators at the Institute for Remote Sensing Applications, Chinese Academy of Sciences (IRSA-CAS) to assess the quality (e.g., cloud cover) of images for the study region and to acquire images that are deemed suitable. To date, we have acquired nine MSS scenes and eight TM scenes (Table 1). Following our field work in Guangdong (section 4), we traveled to Beijing and met with our collaborators at the Institute for Remote Sensing Application. From our collaborators at IRSA, we obtained digital sub-provincial county boundary data and satellite imagery. We also had a meeting at the Ground Receiving Station in Beijing to establish possible future collaborations and data acquisition.

Table 1. Acquired Satellite Imagery

PATH	ROW	SCENE ID	DATE	SOURCE
131	44	LM1131044007335990	12/25/73	GLIS
131	44	LM2131044007535890	12/24/75	GLIS
131	44	LM2131044007704190	02/10/77	GLIS
131	44	LM2131044007830690	11/02/78	GLIS
131	44	LM3131044007833390	11/29/78	GLIS
131	44	LM3131044007931090	11/06/79	GLIS
131	44	LM3131044008028790	10/13/80	GLIS
122	44	LT4122044009035810	12/24/90	GLIS
122	44	LT5122044009103310	02/02/91	GLIS
122	44	D881210.T022232.L5TM	12/10/88	IRSA-CAS
122	44	D891213.T021538.L5TM	12/13/89	IRSA-CAS
122	44	NA	10/30/90	IRSA-CAS
122	44	D920120.T021631.L5TM	01/20/92	IRSA-CAS
122	44	D931224.T021307.L5TM	12/24/93	IRSA-CAS
122	44	NA	11/08/94	IRSA-CAS
122	44	NA	12/30/95	IRSA-CAS
122	44	NA	03/03/96	IRSA-CAS

We also have been working with our collaborators in China to collect sub-provincial data for potential economic and demographic drivers of land use change. While in Beijing, we met with Wang Tongsan of Chinese Academy of Social Sciences and Liang Youcai of the State Information Center. Both Institutes have expressed a great deal of interest in the project, and are using their considerable resources to compile the requisite data from a series of published (e.g., Statistical Yearbook of Guangdong) and unpublished sources. These meetings also provided an opportunity for our collaborators to give input on model specification.

3. DATA PREPROCESSING

The images listed in Table 1 have been registered to a geometrically corrected master image provided by our collaborators at the Institute for Remote Sensing Applications. To prepare for our field trip to China, we ran a two date principal component transformation as an exploratory method to determine areas of change. Preliminary results indicate that land conversion is focused primarily along the Guangzhou-Shenzhen corridor. These results were used to organize field work, that is described in section 4.

Currently, we are evaluating a method for atmospheric correction of the satellite images. Initial studies from the Landsat Science Team (NASA Grant NAS5-3439) indicate that a relative cosine correction (Chavez, 1996) provides good results. Because this procedure is based entirely on images and requires no in-situ field measurements, it may be the most appropriate method for our images.

4. FIELD WORK

The preliminary analysis of the satellite imagery was used to organize a two week field campaign. The purpose of this field trip was to collect examples of land cover types and land conversion types (Table 2). Lu Jinfa, from the Institute of Geography and Huang Xiuhua, from the Institute of Remote Sensing Applications, flew in from Beijing and assisted with the field work. A total of 160 sites were visited throughout the study area.

Table 2. Field work: January 31 - February 11

Forest/Natural	Agriculture	Urban	Confounding Factors
Broadleaf	Rice	Residential	Bare ground
Mixed	Sugar cane	Commercial	Quarry mines
	Mixed vegetables	Roads	Abandoned projects
	Lychee		
	Bananas		
	Mixed fruit		

From our field work, the following observations were made:

- There is a geographic pattern to the location of land conversion, primarily the access to raw building materials
- Housing development is one of the main drivers of land conversion
- The role of crop phenology may be reduced, and thus we may be able to provide better temporal estimates of land use change
- There are high abandonment rates for construction projects
- Conversion of land for agriculture is primarily for lychee orchards

A laptop computer, GIS software, and GPS unit purchased by the Landsat Science Team (NASA Grant NAS5-3439; PI: Curtis Woodcock) were invaluable for the success of this field trip. Using a computer to display the satellite images during field work provided in-field interpretation of the images and comparison with the field sites. The GPS was a critical tool in helping us establish our location. In many of the regions, we were limited by access roads and reliable maps. As many of the newly developed areas and roads are not yet published on maps, the satellite images combined with the GPS proved to be essential navigational tools.

5. PRELIMINARY ANALYSIS OF SOCIOECONOMIC DATA

Once the data for land use change and socioeconomic drivers are available, they will be assembled into a panel data set and analyzed using a variety of statistical techniques. In preparation, we have started to write computer code that will perform these tests (Hsiao, 1986; Pesaran and Smith, 1995; Hall and Urga, 1996). We have written procedures that estimate fixed and random effects estimators. For the random effects estimator, the code will adjust for serial correlation. In addition, we have written code for a random coefficient model. Finally, we have developed a statistical algorithm that can be used to choose the modeling technique that is most appropriate for our data.

6. BIOPHYSICAL MODELING

Our investigation includes an examination of the biophysical and ecological consequences of observed and projected land cover changes, with primary attention to terrestrial carbon storage and productivity. The initial effort has focused on the identification and acquisition of available field and model data sets for vegetation cover types in the Pearl River Delta region. We now have field-based data for above and below-ground biomass for the subtropical evergreen broad-leaved forest in Guangdong Province. These data were collected at Heishiding Nature Reserve, located in our study area, by Dr. Chen Zhanghe of South China Normal University. Data collection is proceeding in parallel with the remote sensing and socioeconomic modeling elements of the study.

7. OTHER EFFORTS

We have applied for formal project status with the Land Use and Land Cover Change International Project Office (LUCC IPO). Successful application status will allow us access to the LUCC network of projects. In March, we participated in the GCTE-LCLUC Open Science Conference in Barcelona. The conference provided an opportunity for us to discuss our project with other researchers and to gain a better understanding of how our efforts contribute to international research goals. We have also constructed a working website (http://web.bu.edu/CEES/lcluc.html). We will update this website with project publications and reports as they become available.

REFERENCES

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