A Comparative Study of Forest Mapping Methods/Algorithms: Towards Optimal Solutions for Operational Global Forest Mapping/Monitoring

Progress Report
July 1, 2000 – April 15, 2001

Principal Investigator
Youngsinn Sohn
Department of Geography & Environmental Systems
University of Maryland, Baltimore County (UMBC)
1000 Hilltop Circle
Baltimore, MD 21250
410-455-3149 (phone)
ysohn@umbc.edu

First Phase Collaborators:
Guoquing Sun
Department of Geography
University of Maryland, College Park
NASA/GSFC
Code 923, Biosphere Sciences Branch
Greenbelt, MD 20771 USA

William Clerke
Remote Sensing Specialist
USDA Forest Service
Southern Region
1720 Peachtree Rd
Atlanta, GA 30309

Possible Future Collaborators:
Ruth DeFries, University of Maryland
Janet Franklin, San Diego State University
Jiague Qi, Michigan State University
Paul Desanker, University of Virginia

I. Background

The research conducted under this project focuses on the acquiring optimal solutions for developing operational forest monitoring systems at regional and global scale using TM data through collaborative works among the LCLUC science team members. The mapping algorithms and methods will be tested in US, China, Africa, and Southeast Asia. Scale issues involved in forest mapping at regional/global scales will be addressed in relation to TM, MODIS, and AVHRR data.

II. Goals and Objectives

The goal of the project is to evaluate different forest mapping/monitoring algorithms and methods at regional and global scales through collaborate efforts among LCLUC science team members. The objectives of the project include: (i) evaluation of different forest mapping/monitoring algorithms and methods using TM data of different regions based on a common framework; (ii) addressing conceptual/technical issues involved in different mapping algorithms; and (iii) acquiring optimal solutions for developing operational forest mapping/monitoring systems based on the evaluation results. The evaluation will be based on the accuracy of mapping/monitoring results, operational efficiency, and robustness of the mapping algorithms.

The major theme of the project is the evaluation of forest mapping/monitoring algorithms and methods at regional and global scale using Thematic Mapper (TM) data and acquiring agreeable forest mapping methods for operational forest monitoring.

1) Progress made for the report period

The following is the summary of progress made during the report period:

(1) Development of supervised and unsupervised spectral angle classifiers was completed and preliminary tests results were submitted to PE&RS. According to the test results, the supervised spectral angle classifiers performed far better than the maximum likelihood classifier that is considered as one of the most accurate and most commonly utilized classifiers.

(2) Through the collaborative work with Guoqing Sun at University of Maryland, College Park/NASA GSFC, mapping forest types in northeastern China and comparison and evaluation between the spectral angle classifiers and decision trees are in progress. Once field work is done during the month of June 2001 for verifications and accuracy assessment, the forest mapping results and comparative evaluation results of the mapping algorithms will be submitted to peer reviewed journals such as PE&RS, Remote Sensing of Environment, International Journal of Remote Sensing.

(3) For testing the developed mapping algorithms/methods at an operational dimension, the arrangement is made with the USDA Forest Service, Southern Region in Atlanta, Georgia. Landsat 5 Thematic Mapper (TM) data of the Oconee and Chattahoochee National Forests were acquired from the USDA Forest Service Regional Office.

2) Plan for the second phase: July 2001 – June 2002

During the second phase, I will focus on addressing the issues involved in operational forest monitoring, and testing the developed methods at an operational dimension in addition to the further testing of the mapping methods and algorithms. Once the collaborator(s) is selected, the mapping methods developed will be further tested in different regions.

The following is the summary of major tasks that will be performed:

(1) Forest mapping result and the evaluation result of the spectral angle classifier and decision trees will be wrapped up and submitted to peer reviewed journals.

(2) In July 2001, field works for identifying and locating field plots for collecting data at the Oconee and Chattahoochee National Forests will be performed.

(3) ANN classifiers will be tested along with the spectral angle classifier, maximum likelihood classifier, and decision trees classifiers.

(4) Addressing conceptual/theoretical issues involved in major mapping algorithms: maximum likelihood, spectral angles, decision trees, and ANN

(5) Scale issues involved in regional/global mapping in relation to TM, MODIS, and AVHRR.

3. Plan for the third phase: July 2002 – June 2003
During the third phase, I will focus on implementation and testing of operational forest monitoring system using TM data in collaboration with other science team members involved.

III. New Findings and Potential

1. New findings and expected contributions

▪ Development of supervised and unsupervised spectral angle classifiers

▪ If the supervised spectral angle classifier is proved to be robust through further experiments, it will be a valuable tool for multispectral classifications for land cover/use mapping. Also the findings of this investigation would benefit the forest mapping and deforestation assessment in general and it may provide agreeable forest mapping for Kyoto Protocol implementation.

2. Publications submitted and in progress
The following publication list includes manuscripts that is submitted and will be submitted to peer reviewed journals within 2-3 months.

Sohn, Y. and S.N. Rebello, Supervised and Unsupervised Spectral Angle Classifiers (submitted)

Sohn, Y., G. Sun, D. Williams, and B. Tan, Forests in Northeastern China: Mapping Forest Types using an Improved Classifier and TM Data (in progress)

Sohn, Y. and G. Sun, Forest Mapping Algorithms: Multispectral Angle Classifier and Decision Trees (in progress)