

Land Use and Land Cover Change for South East Asia (APN 2000-13)

Project Leader:

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APN Funding

Year 1 (2000/01) US \$67,200

Year 2 (2001/02) US \$31,500

Participating countries

Cambodia, Indonesia, Laos, Malaysia, the Philippines, Thailand, Vietnam

Introduction/Background

SARCS Land Use and Land Cover Changes (LUCC) Project was initiated in 1994 to cover four countries, i.e. Malaysia, the Philippines, Thailand and Indonesia. This research project focused on applying remote sensing and GIS technologies and socioeconomic data to explain land use and land cover changes. The first phase of this project under GEF funding was a success and with it the SARCS-LUCC interdisciplinary team was established and the regional research network formed.

Phase 2 of the project, which was sponsored by NASA and SARCS, proceeded with annual data analysis and application of socio-economic modelling. The activities under phase 2 include:

- Developing case studies to determine deforestation dynamics;
- Determining whether annual rates of deforestation are significantly different from the decadal mean rate over the selected study areas; and
- Developing diagnostic models of the deforestation process to better understand and quantify the differential controls on rates of deforestation and abandonment.

Phase 1 and 2 emphasized only four case studies. There is now a need to expand the LUCC research network to cover the whole region. The new countries proposed to join the present network are Vietnam, Cambodia and Laos. They require assistance in acquiring the capacity to conduct research in global change. The present team members will assist in training the new participants with relevant LUCC methodologies and bring them to the current level of capabilities. Thus APN funding is required to implement the aforementioned expansion of the network. The fund is also needed to support advance training on global change research in all seven countries.

Outline of activities conducted

The activities conducted under the sponsorship of APN are as follows:

- 1) Capacity building to new member countries (Cambodia, Laos, Vietnam). Funding was provided to equip these countries with hardware (PC, Printer, CD Writer) and software (Erdas Imagine, Arc View, Spatial Analysis). The provision of equipment to new members is extremely critical to the success of LUCC research. New members are now able to carry out the following:

- Processing of resource satellite data from Landsat TM and SPOT VGT images. The results obtained are land use change detected from two selected dates;
- Processing and converting maps to digital maps for interfacing with remote sensing data;
- Processing socio-economic data as input to selected LUCC model;
- Producing relevant graphic analysis;
- Applying statistical analysis to LUCC data; and
- Producing hard and soft copy reports as output to LUCC research.

The newly trained scientists are now able to build up their research capabilities enabling them to undertake new global change research in future. Few proposals have been submitted to various sponsors to further strengthen their regional research network.

- 2) With all the software/hardware equipment in place, the new members underwent a basic training course in Remote Sensing, GIS and socio-economic data analysis. The workshop was held in Kuala Lumpur and provided the following:

Training on land use change detection using remote sensing method and acquiring database maps using GIS methods. The training models consisted of: Introduction to resource satellite; Landsat and SPOT; Interactive Image Processing; Information extraction and Land use change detection. The GIS training emphasised spatial and 3D analysis; map layout and data integration. Training on socio-economic aspects focused on acquiring data set and identification of socio-economic parameters relevant to LUCC research. Socio-economic modelling was taught with econometric modelling, logistic regression and LIMDEP modeling. Socio-economic, remote sensing and GIS data integration were also given.

The workshop recommended:

- Method of detecting LUCC;
- Method of integrating remote sensing and GIS data sets;
- Method of validating data;
- Relevant socio-economic parameters to be acquired;
- Relevant variables to be applied as input to the model; and
- Relevant statistical and graphic analysis.

All the above recommendations are useful to new members and can be adopted into their own LUCC research.

- 3) Advance remote sensing training for all seven countries held in Manila based on important aspects of the LUCC research. Which included:

- Fractional forest covers and green leaf area mapping using ETM+ and SPOT 4 vegetation images.

SEA team members would be able to produce a new set of research products, which is derived from new and useful techniques recommended. The unmixing method presented such as linear and non-linear spectral unmixing, geometric modelling neural network and fuzzy inference system and radiative transfer modelling taught in the workshop exposed members with a state-of-the-art method. The update in the new analysis allowed researchers to be current and well informed. SPOT vegetation sensor is a low-resolution data that also has the ability to be combined with high resolution HRVIR and ETM+ data and thus improves the quality of LUCC research.

- The Land Transformation Model (LTM)

LTM develop a spatial temporal model that would predict land use change within the selected watershed chosen in SEA. It creates a model for the region undergoing transformation and incorporates policy, socio-economic and environmental factors that cause land use change. The workshop developed a pilot LTM that could proof demonstrate the concept. The model would also be used to generate spatial and temporal data. LTM applies a system approach model that can test various policy scenarios related to land transformation.

The workshop recommended an alternative model to explain and predict LUCC. This was very useful for members prior to the introduction of LTM; the team was using regression and econometric models.

Another feature of LTM is the downstream application. LTM can be used as indicators of ecological integrity and economic sustainability. The result of the model could be used to quantify the nature of changes in landscape and also reflect the qualitative aspects of landscapes. It therefore provides input to the decision making process in watershed management.

Outcomes/Products

- Seven country reports (hardcopy as well as CD);
- Regional meeting/workshop proceedings in CD;
- Regional synthesis results;
- LUCC results in posters;
- Brochures on the network; and
- Publications in relevant Journals on Global Change Research.

The network scientists are now training locally in areas of RS and GIS. They also contributed to policy development in their own country. The researchers have established the Southeast Asia Research and Information Network (SEARIN). The network is dedicated to the scientific understanding of human-environmental interactions. SEARIN conducts research on LUCC in an integrated science framework that includes Remote Sensing, GIS technology, econometric and system models and fieldwork.

Each country has their own URL. The Malaysian address is: [http:// www.eoc.ukm.my](http://www.eoc.ukm.my)

Future directions/Follow-up work

The future direction for the regional network is to continue to expand global change research in the region, to include more pertinent issues such as policy implications on LUCC, forest fire and its associated transboundary haze and pollution, downstream impact on LUCC and others.

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