

Final Activity Report



SPATIAL DATA AND INFORMATION FOR LAND USE AND FOREST ASSESSMENT AND MANAGEMENT (APN 2001-09)

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ACKNOWLEDGMENT

On behalf of Dr. Dave Skole, and the scientists at the Basic Science and Remote Sensing Initiative, at Michigan State University, I wish to thank the Asia Pacific Network for Global Change Research (APN) for this opportunity to further our understanding of global environmental land use and land cover change using new techniques in geo-spatial science, and for the opportunity to continue the scientific collaboration between researchers at BRSR/MSU and colleagues in seven Southeast Asian countries. Furthermore, I would like to thank all of the SEARRIN countries teams for participating in the two meetings sponsored by this APN project in Thailand and in particular:

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- Mr. Hounghet Chantavong, Mr. Sithong Thongmanivong and Mr. Segkham Inthiravongsy (SEARRIN-Lao PDR),
- Ms. Pum Vicheth and Mr. Touch Vina (SEARRIN-Cambodia), and
- Dr. Iwan Gunawan and Mr. Hartanto Sanjaya (SEARRIN-Indonesia)

for their assistance in the field data collection campaigns.

Without such support in global change research from institutions like the APN and from valuable science colleagues engaged in similar research in Southeast Asia, the project outcomes and results presented in this final report would not have been possible.

With the utmost respect and a hope for continued progress in sustainable environmental management practices that find value in the application of our efforts here, I thank you.

Sincerely,



Jay H. Samek
Project Coordinator
APN 2001-09 (BRSR/MSU)

28 February 2002



***SEARRIN Science Team
APN Project 2001-09 Field Training in Fractional Cover
Data Collection
Doi Inthanon National Park
Chiang Mai, Thailand
August 2001***

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ACRONYMS

AIT	Asian Institute of Technology (Thailand)
APN	Asia Pacific Network for Global Change Research
BIOTROP	Southeast Asian Regional Centre for Tropical Biology (a SEAMEO center in Indonesia)
BPPT	Agency for the Assessment and Application of Technology (Indonesia)
BSRSI	Basic Science and Remote Sensing Initiative (at Michigan State University, United States)
BTIC	BIOTROP Training and Information Center (Indonesia)
EOC-UKM	Earth Observation Centre – Universiti Kebangsaan Malaysia
EOS	Earth Observation Satellite
ERIC	The Environmental Research Institute, Chulalongkorn University (Thailand)
ETM+	Enhanced Thematic Mapper Plus (Landsat 7 satellite sensor)
<i>FC</i>	<i>Fractional Cover</i>
FIPI	Forest Inventory and Planning Institute (Vietnam)
GEF	Global Environment Facility
GISTDA	Geo-Informatics and Space Technology Development Agency (Thailand)
GOFC / GOLD	Global Observations of Forest Cover / Global Observations of Landcover Dynamics
ICLARM	International Center for Living Aquatic Resources Management (Malaysia)
IGBP LUCC	International Geosphere-Biosphere Programme on Land Use and Cover Change
IHDP	International Human Dimensions Programme
LAI	Leaf Area Index
LAPAN	National Institute of Aeronautics and Space (Indonesia)
MEA	Millennium Ecosystem Assessment
MSS	Multi Spectral Scanner (Landsat satellite sensor)
NAMRIA	National Mapping and Resource Information Authority (Philippines)
NASA ESIP	National Aeronautics and Space Administration Federation of Earth Science Information Partners (United States)
NASA LCLUC	National Aeronautics and Space Administration Land Cover and Land Use Change Program (United States)
NOUL	National University of Laos
NRCT	National Research Council of Thailand
PAGASA	Philippine Atmospheric, Geophysical and Astronomical Service Administration
PPPTISDA-BPPT	Remote Sensing Center - BPPT
SARCS	Southeast Asia Regional Committee for START
SEARRIN	Southeast Asian Regional Research and Information Network
SEARRIN-DISS	Southeast Asian Regional Research and Information Network – Data and Data Information Systems and Services

SEA START RC	Southeast Asia START Regional Center
SEAMEO	Southeast Asian Minister of Education Organization
START	Global Change SysTem for Analysis, Research and Training
TM	Thematic Mapper (Landsat satellite sensor)
TRFIC	Tropical Rain Forest Information Center (a NASA ESIP at BSRSI, MSU, United States)
UKM	Universiti Kebangsaan Malaysia
UNDP	United Nations Development Program
UNOPS	United Nations Office for Project Services

PROJECT SUMMARY

APN project 2001-09 awarded to the Basic Science and Remote Sensing Initiative at Michigan State University successfully met its planned objectives of acquiring new EOS data sets, developing and testing an algorithm for assessing forest fractional cover, developing new data sets derived from EOS data, establishing the foundation for a regional data and data information system (SEARRIN-DISS), and continuing a collaboration with global change scientists in Southeast Asia through capacity building and data sharing. The project supported two meetings (one that included a training), five field data collection campaigns, and the development of new data products for natural resource management applications. While a great deal was accomplished over the period of nine months, the development of the fractional cover algorithm is on going. A greater number of field collection sites and samples throughout the region are needed. As these new methods and products are refined and developed the link to policy makers needs to be stronger. We will seek a continuation of this project with these aims in the next APN call for proposal.

INTRODUCTION & BACKGROUND

This project has been conducted by researchers at the Basic Science and Remote Sensing Initiative, at Michigan State University, under the directorship of Dr. David Skole, and in collaboration with global change scientists in seven Southeast Asian countries (Cambodia, Indonesia, Lao PDR, Malaysia, Philippines, Thailand and Vietnam). The work from this project builds upon previous land use and land cover change research completed under the IGBP LUCC core group and IHDP (funded by UNDP/GEF and UNOPS), the NASA Pathfinder project and a NASA LCLUC project in Southeast Asia. This work compliments the studies conducted under APN project 2000-09/2001-09, led by Dr. Sharifah Mastura S. A. at the Universiti Kebangsaan Malaysia.

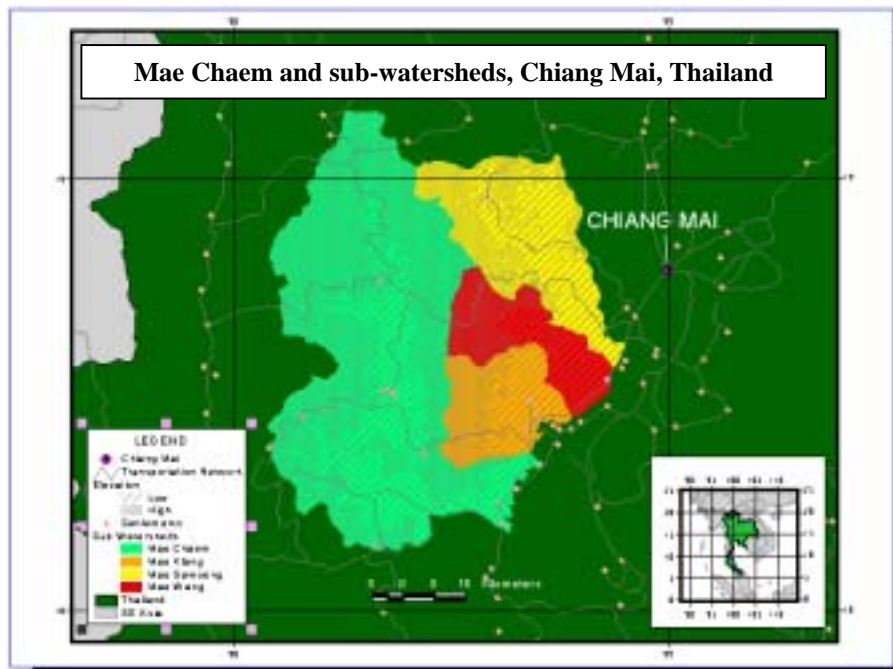
The project has focused on three activities to support the development and distribution of new data and data products for land use and forest monitoring and management. These efforts are designed to support global change science in general and in particular, two recent global initiatives: the Global Observations of Forest Cover / Global Observations of Landcover Dynamics (GOFC/GOLD) and the Millennium Ecosystem Assessment (MEA). The three activities conducted under this project included: 1) the acquisition and of new course- and fine-resolution satellite datasets and the development of new data products derived from the analyses of these datasets, 2) product validation, evaluation, and outreach to assess the quality and value of these new product, and 3) the implementation of the Tropical Rain Forest Information Center (TRFIC) to support GOFC/GOLD and Millennium Ecosystem Assessment data requirements and a growing community of global change scientists in the region. In addition, the project has facilitated the continued regional collaboration and coordination of a network of scientists in SE Asia and North America, which is now formalized to become the Southeast Asia Regional Research and Information Network (SEARRIN). This work has

allowed for continued capacity building of regional scientists in remote sensing and geographic information systems techniques.

DETAILED INFORMATION OF ACTIVITIES CONDUCTED

Fractional Cover Training and SEARRIN Science Meeting

A training in field data collection methods for the validation and calibration of fractional cover data products as well as continued training in the application of fractional cover methods for analyzing Landsat ETM+ data was held in Chiang Mai, Thailand 9th – 14th August 2001. Dr. Jianguo Qi, a professor in Geography at Michigan State University (and a member of the BRSI faculty) with expertise in remote sensing analysis led the training.



Twenty-seven SEARRIN scientists from seven Southeast Asian countries participated in the training, along with five SEARRIN-US scientists including Dr. Qi. The field training took place in Doi Inthanon National Park in the Mae Chaem and sub-watersheds of Chiang Mai, with assistance from park rangers and foresters from the Royal Forest Department of Thailand.

Lowland deciduous forests, mid-elevation pine and transitional forests, and high elevation moist, evergreen forests characterize Doi Inthanon National Park. The area also has a diverse pattern of forest use including plantation forests, logged over regenerating forests, and old-growth forests. The field training covered sampling and data collection methods using the following equipment:

- Digital camera with a fish-eye lens atop a tripod to capture a 180 degree photo of the forest canopy,
- Global Positioning System (GPS),
- Hand level for ensuring the fish-eye lens is positioned facing vertical,
- Range finder and compass for measuring distances and relative locations between sample points within a site,
- Timber cruise tools and diameter at breast height (DBH) tapes used to calculate biomass estimates, and
- Clinometer to measure tree heights

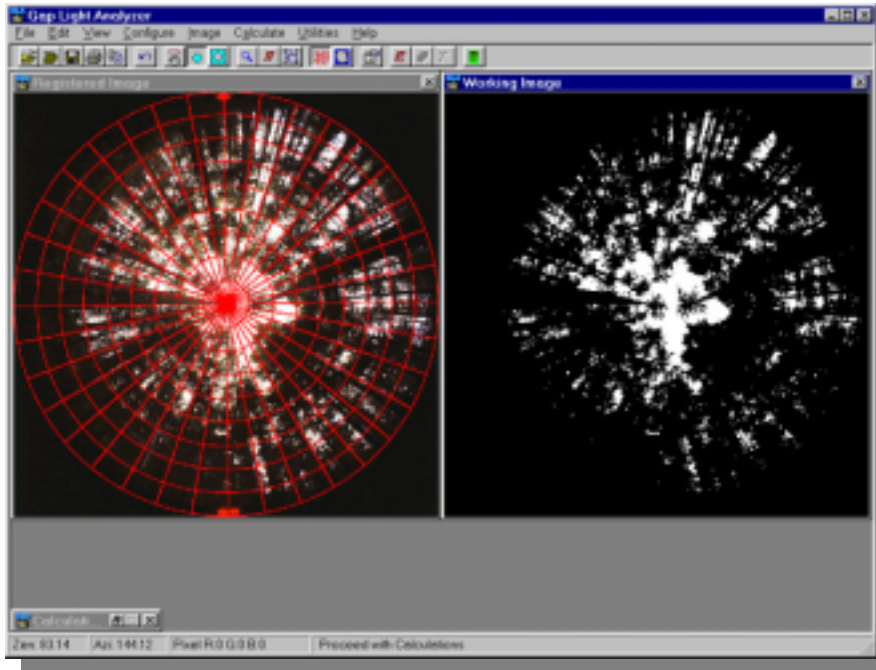


Fish-eye lens photo of Dr. Qi and SEARRIN Participants during Field Training in Doi Inthanon National Park



Doi Inthanon, moist, evergreen forest – DBH measurement

Participants also received training in using, and copies of, Gap Light Analyzer Version 2.0 software (a freeware developed at Simon Fraser University, British Columbia, and the Institute of Ecosystem Studies, New York; <http://www.rem.sfu.ca/forestry/gla/>) to



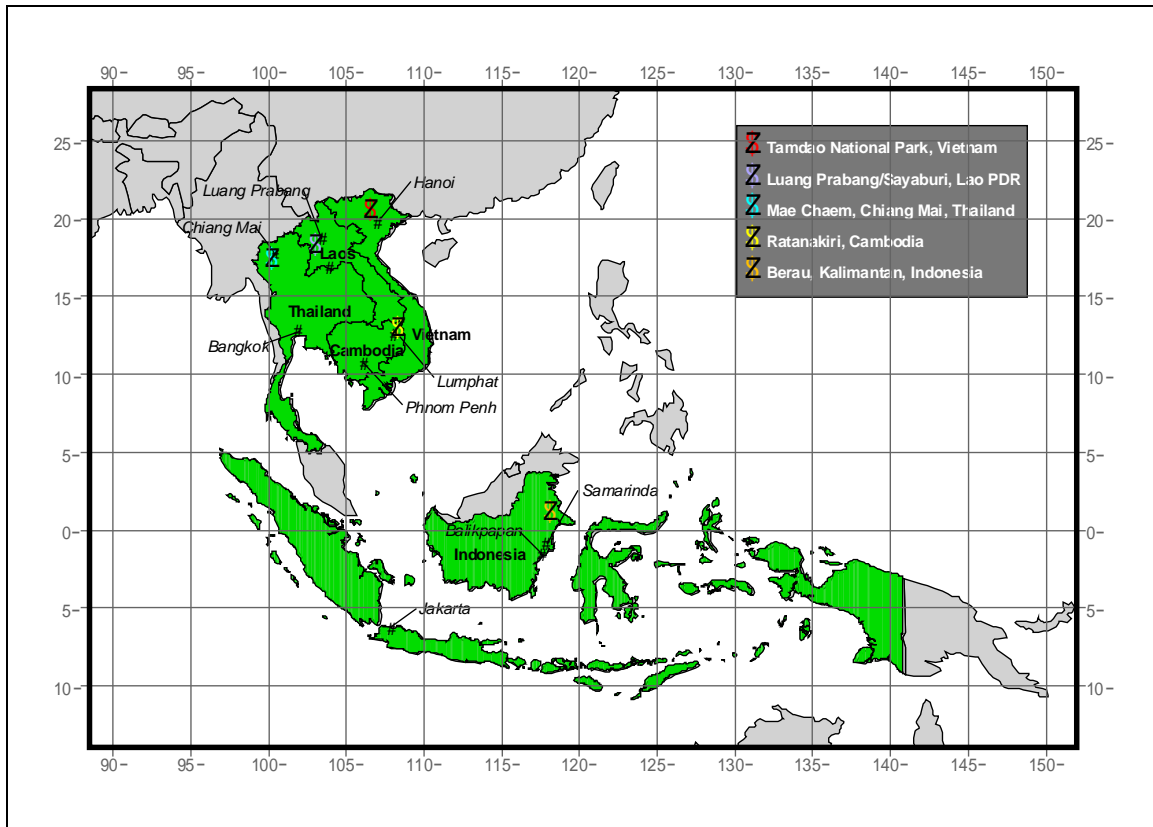
analyze the digital canopy photos. The training included discussions on using the results from the ground measurements to calibrate and validate the estimated fractional cover derived from the analysis of the Landsat ETM+ data.

Example of GLA Software and Forest Canopy Photo

Field Data Collection in Five Countries for validation and calibration of fractional cover data products:

- Mae Chaem Watershed and sub-watersheds, Chiang Mai, Thailand (August 2001)
- Tamdao National Park, Vietnam (August 2001)
- Luang Prabang – Sayaburi, Lao PDR (November 2001)
- Ratanakiri, Cambodia (November 2001)
- Berau, East Kalimantan, Indonesia (January 2002)

A period of three to five days was spent at each site collecting field data for the validation and calibration of the fractional products derived from the analysis of Landsat ETM+ data. These sites, collectively, represent geographic, biophysical and human-environmental gradients. Geographically, the sites are distributed between 2 degrees and 22 degrees north latitude and 98 degrees and 117 degrees east longitude. Biophysically they range from plantation to natural forests and include bamboo, teak, rubber, pine, eucalyptus, dipterocarp, deciduous, mixed-deciduous, evergreen, and moist evergreen forests. The five sites also have diverse human impacts or uses that include slash and burn or shifting agriculture, permanent agriculture, logged over but protected forests, selectively and clear-cut logged areas, and plantations. These sites, therefore, represent a suite of gradients throughout the region.



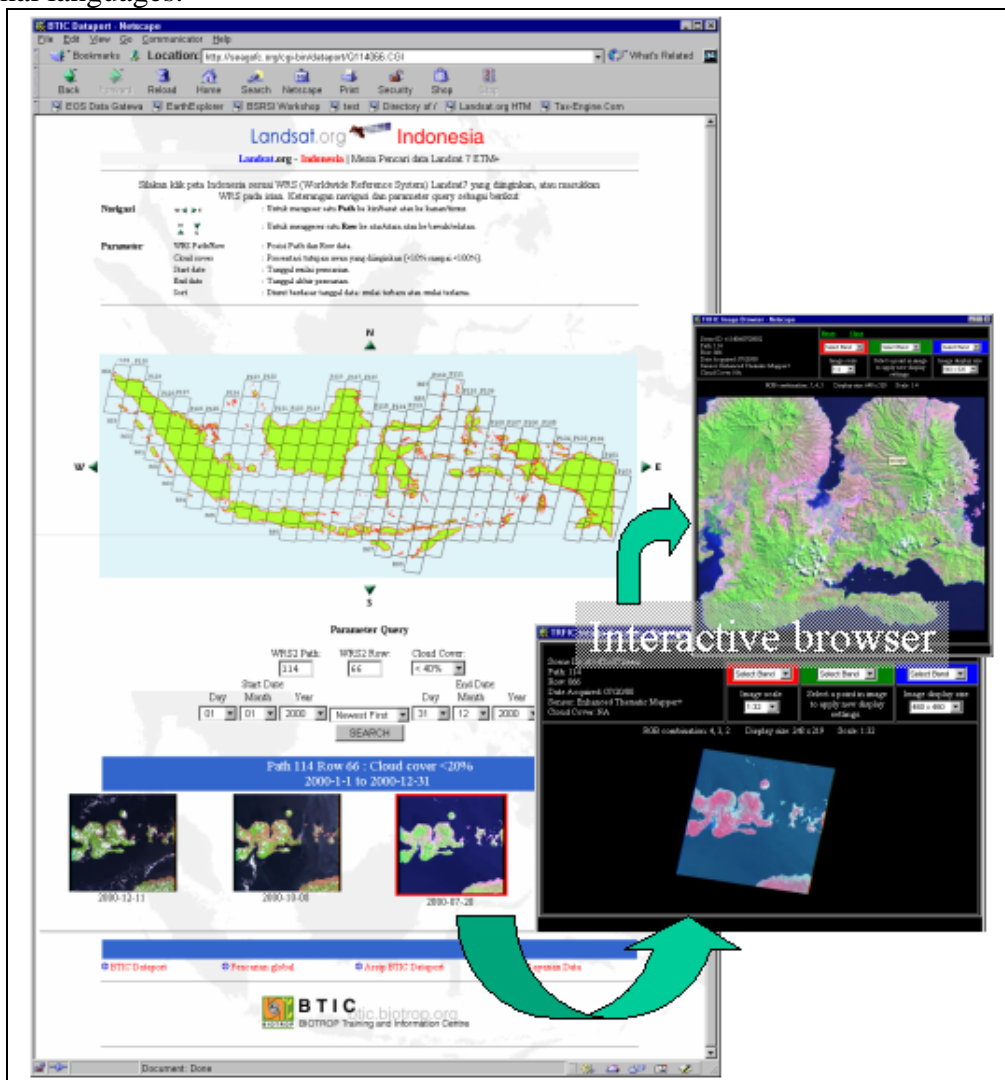
Regional Map Showing the Location of Five Fractional Cover Field Data Collection Sites

Final Project Meeting and Technical Workshop

A final project meeting was held 17th - 21st January 2002 in Bangkok, Thailand, hosted by the Environmental Research Institute (ERIC) at Chulalongkorn University. The meeting included a two-day technical workshop for the implementation of the Tropical Rain Forest Information Center (TRFIC) and the creation of a SEARRIN DISS – an on-line, distributed, regional data and data information system providing access to earth observation satellite data and information to a global community in support of natural resource management. Participants at the workshop included representatives from the Earth Observation Centre of the Universiti Kebangsaan Malaysia (EOC-UKM), the BIOTROP Training and Information Center (BTIC) in Indonesia, the Indonesian National Institute of Aeronautics and Space (LAPAN), the Philippine National Mapping and Resource Information Authority (NAMRIA), and the Thailand Geo-Informatics and Space Technology Development Agency (GISTDA).

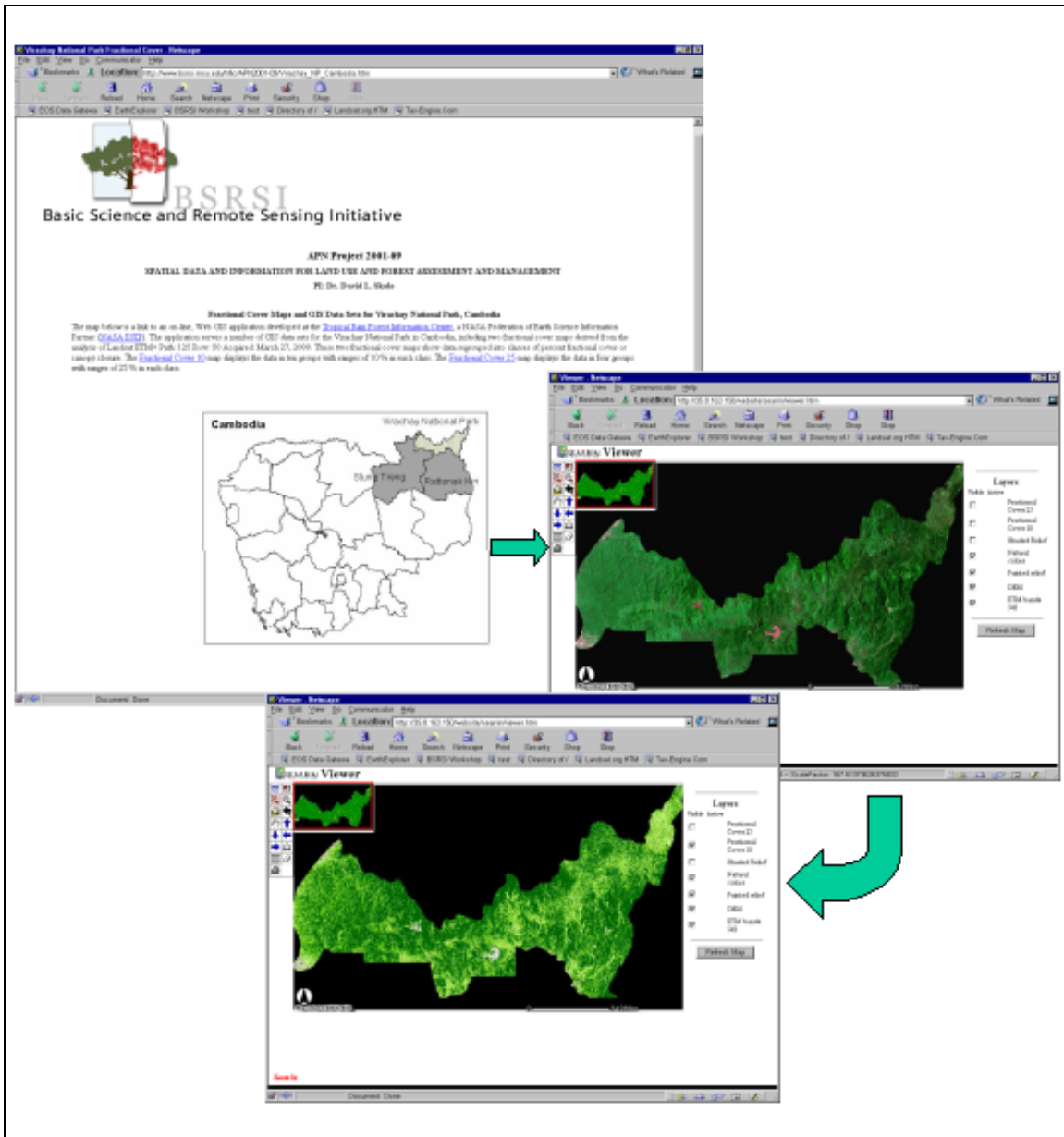
Two web applications were presented and discussed at this workshop; one, a system that allows users the ability to search for, browse and order Landsat ETM+ data, and a second application that uses web-GIS functions for displaying spatial data. The search, browse

and order system is platform independent and browser independent – that is it can be installed on either UNIX/IRIX or Windows operating systems and will work in Netscape, Explorer and other Internet browsers. The application is available in both perl (for UNIX/IRIX) and visual basic (for Windows) scripts. These applications work within a distributed system. For example, a client in Southeast Asia can log into a web site that is located in Indonesia (BTIC), set up a search routine for Landsat data and the application connects to a database in the United States (BSRSI/MSU). The application then returns results to the client’s browser. These applications can be installed in multiple “nodes” and can access multiple databases. To date, there is a prototype version of this installed at BTIC (<http://seagofc.org/dataport/>). The BTIC version offers an English and a Bahasa Indonesia site. We plan to implement these also at NAMRIA (Philippines – Tagalog), GISTDA (Thailand – Thai) and EOC-UKM (Malaysia – Malay) with their respective national languages.



Search and browse system in Bahasa Indonesia at BTIC, Bogor, Indonesia with interactive browser allowing user-defined band combinations and zoom levels. This application is accessing the database at BSRSI/MSU.

The web-GIS application needs ArcIMS 3.0 software, which is not available to all SEARRIN-DISS partners. NAMRIA in the Philippines has ArcIMS 3.0 installed and operating and EOC-UKM in Malaysia has the software, but to date is experiencing problems with the installation. BRSI/MSU is currently using the software. An example of it's application can be seen at: http://www.bsrsi.msu.edu/trfic/APN2001-09/Virachay_NP_Cambodia.htm (click on the map of Cambodia to launch the web-GIS application with spatial data for Virachay National Park, Ratanakiri, Cambodia, including fractional forest cover data).



Web-GIS application launched from an Internet browser displaying spatial data for Virachay National Park, Ratanakiri, Cambodia

A more complete description of the SEARRIN-DISS is available on the Bangkok 2002, Proceedings CD-ROM in the presentation prepared by Mr. Oscar Castaneda and Mr. Chris Barber (BSRSI/MSU) titled, “HTML to Web-GIS”.

The meeting also included a day of reports from the field collection campaigns and calibration/validation efforts for the fractional products derived from Landsat ETM+ data. The final two days of the meeting were devoted to the SEARRIN efforts in supporting the GOFD/GOLD and the Millennium Ecosystem Assessment initiatives through continued development of data products and advances in analytical methods. In all more than 25 people participated in the meeting.

The proceedings from this meeting, which include the power point and the papers presented is on our project website (http://www.bsrsi.msu.edu/trfic/APN2001-09/pdf_files/SEARRIN_Report_No_7.pdf) and is included on the CD-ROM that accompanies this report.

On-going work throughout the duration of this project has included:

- the acquisition and archival of new EOS data sets
 - SPOT4 Vegetation – daily acquisition for year 2000 for China and Southeast Asia
 - Landsat 7 ETM+ - target year 2000, leaf on season
 - Geocoded (orthorectified) Landsat 5 TM data
 - IKONOS data for select case study sites in Southeast Asia
- the testing and development of new data products
 - Forest fractional cover derived from Landsat 7 ETM+ (Virachay National Park, Ratanikiri, Cambodia the first test product)
 - Fine-resolution, regional land cover maps derived from Landsat 7 ETM+
 - Regional, co-registered Landsat MSS – TM and ETM+ data
 - Regional, edge-matched mosaic developed using 15-meter panchromatic Landsat 7 ETM+ data.

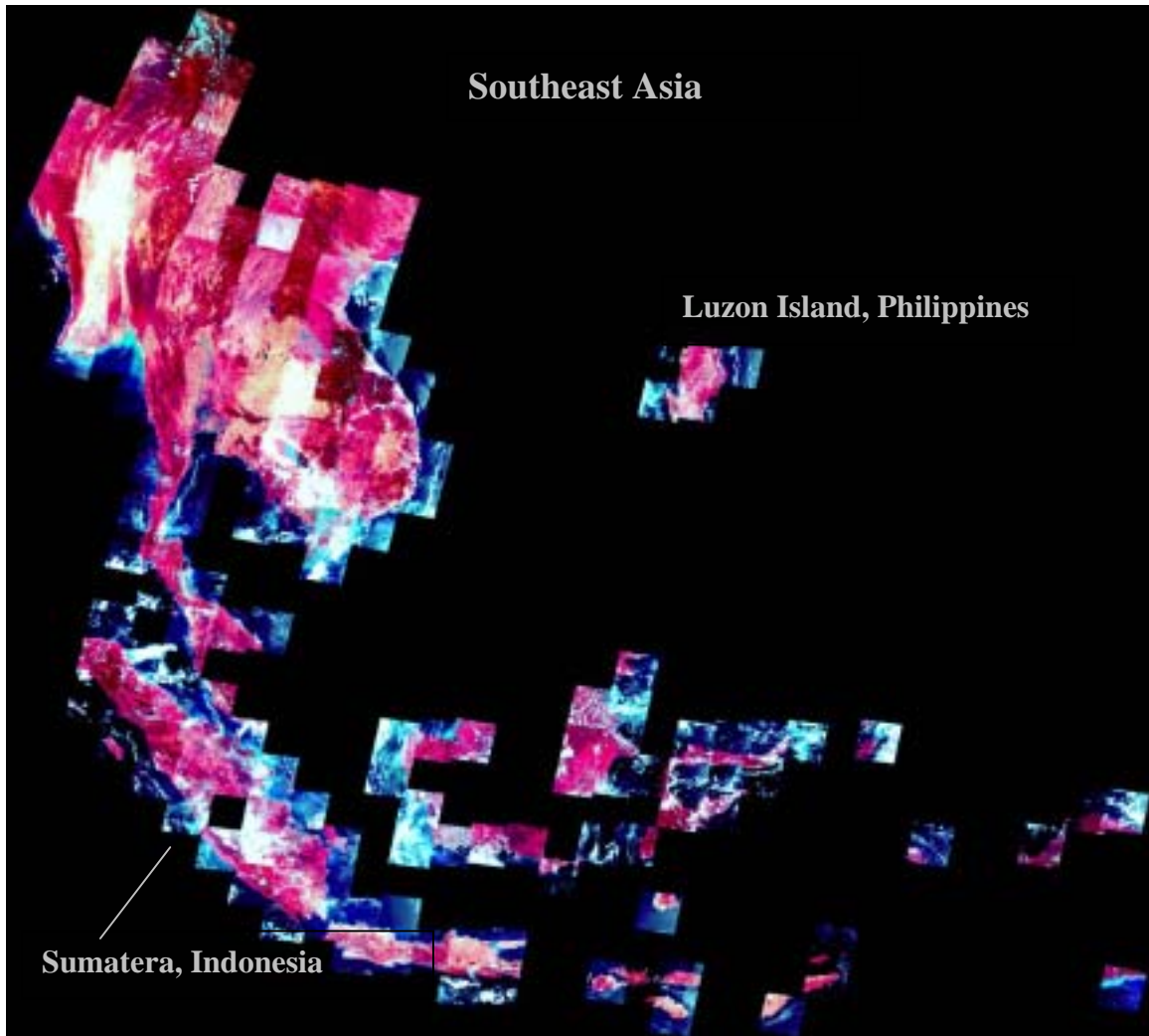
OUTCOMES/PRODUCTS

As mentioned in the section above, “DETAILED INFORMATION OF ACTIVITIES CONDUCTED”, this project supported a number of activities that resulted in tangible outcomes and products. Some of these are presented above. Below are examples and further descriptions of the projects outcomes and products. Many of these can be accessed on-line and we have listed the website URL for these products. Some products will come on-line over the course of the next three to six months as we continue development.

The list and examples are categorized under “the acquisition of new EOS datasets”, the development of new data products derived from EOS data,” “capacity building with regional scientists,” and “SEARRIN-DISS”.

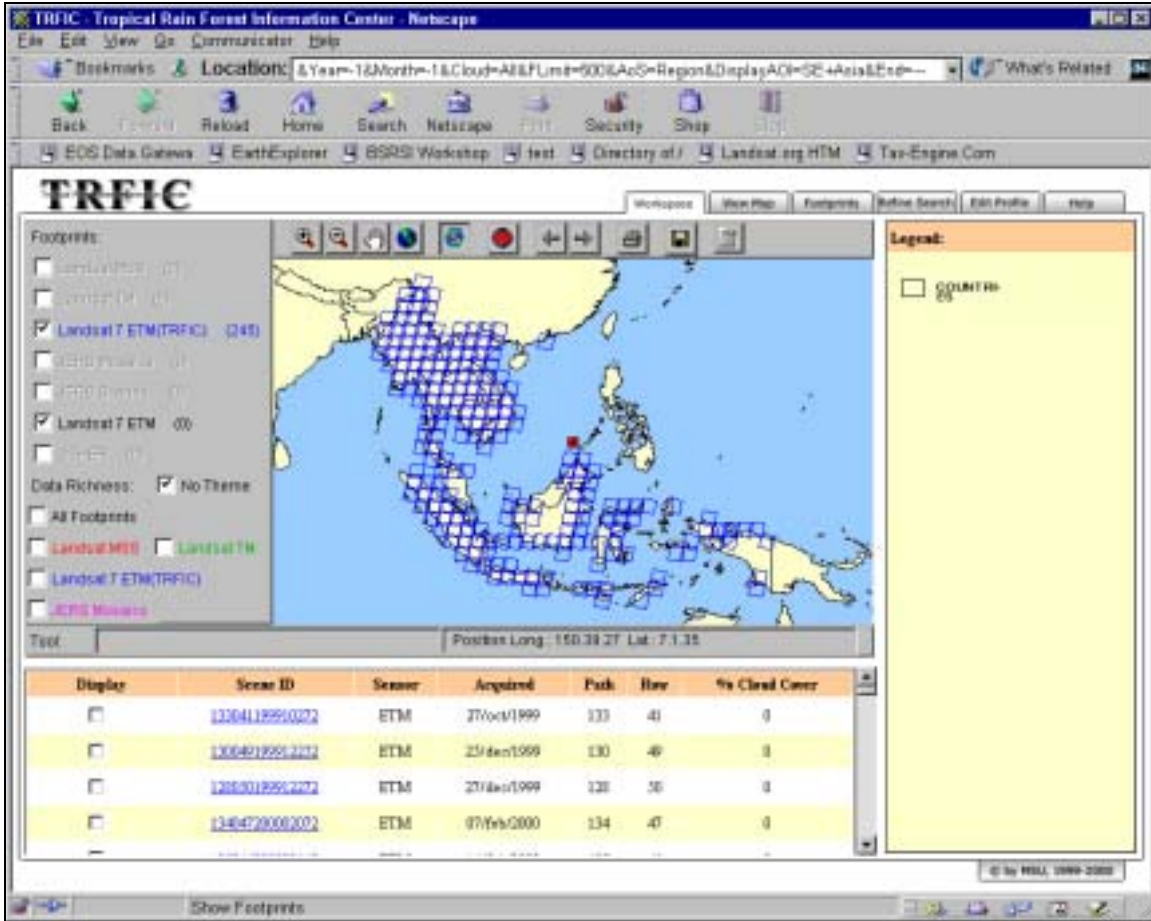
The acquisition of new EOS datasets:

A Southeast Asia regional **Landsat 7 ETM+** data set has been acquired and archived at TRFIC-BSRSI/MSU. There is complete coverage for Peninsular Southeast Asia (Cambodia, Lao PDR, Myanmar, Thailand and Vietnam), near-complete coverage for Malaysia and partial coverage for Indonesia and the Philippines. Year 2000, leaf on is the target year and season for acquisition of the data with a restriction of less than 20 % cloud cover.



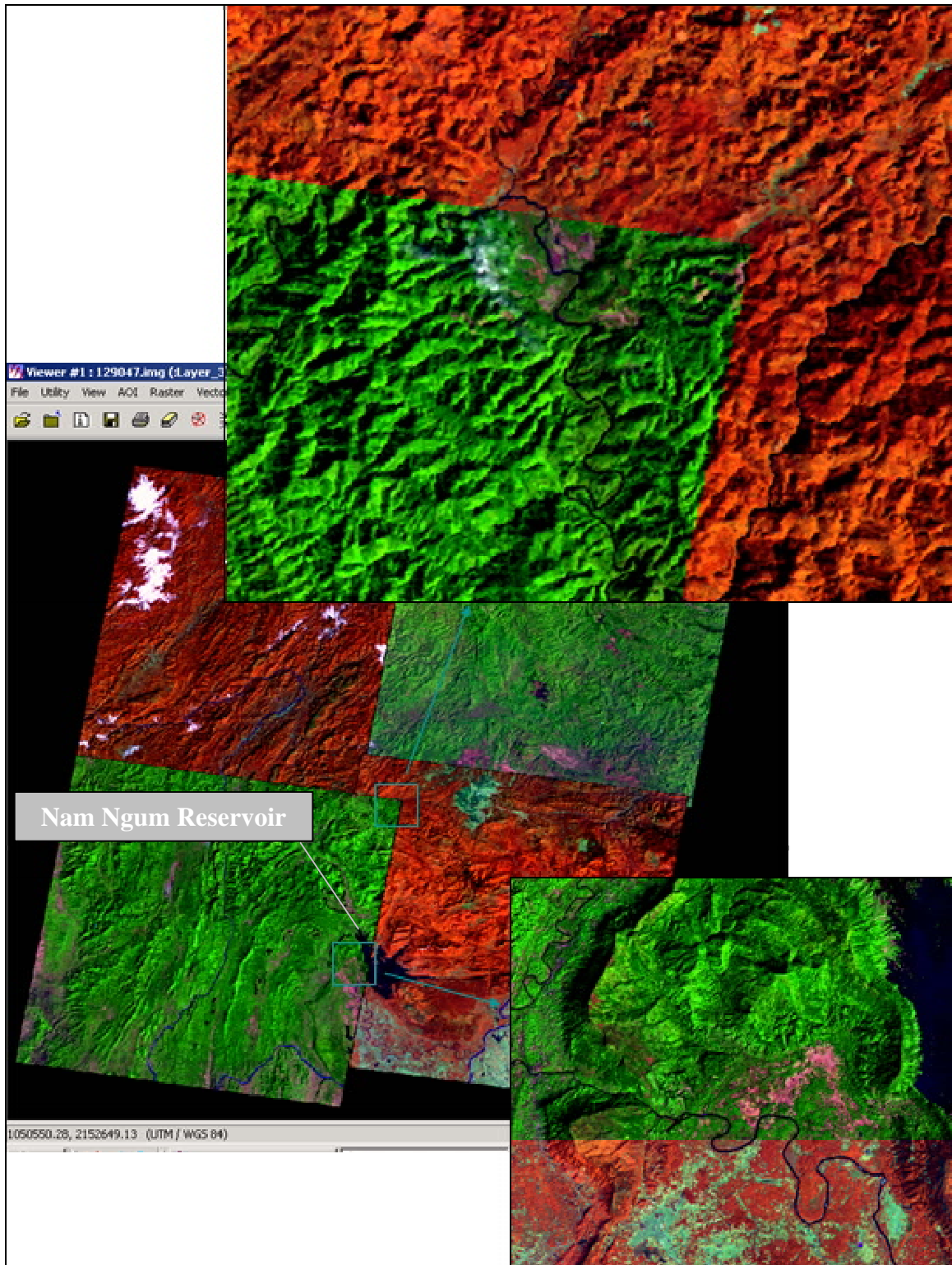
False-color composite, bands 4,3,2 (RGB), degraded mosaic of Landsat 7 ETM+ data for Southeast Asia archived at TRFIC-BSRSI/MSU

These data can be accessed through the TRFIC application at: http://foliage.geo.msu.edu/trficmap_wms/ or <http://www.bsrsi.msu.edu/trfic/> → Data Portal → Data Archive → Option 1.



TRFIC application showing 245 ETM+ “footprints” for Southeast Asia for data archived at TRFIC-BSRSI/MSU

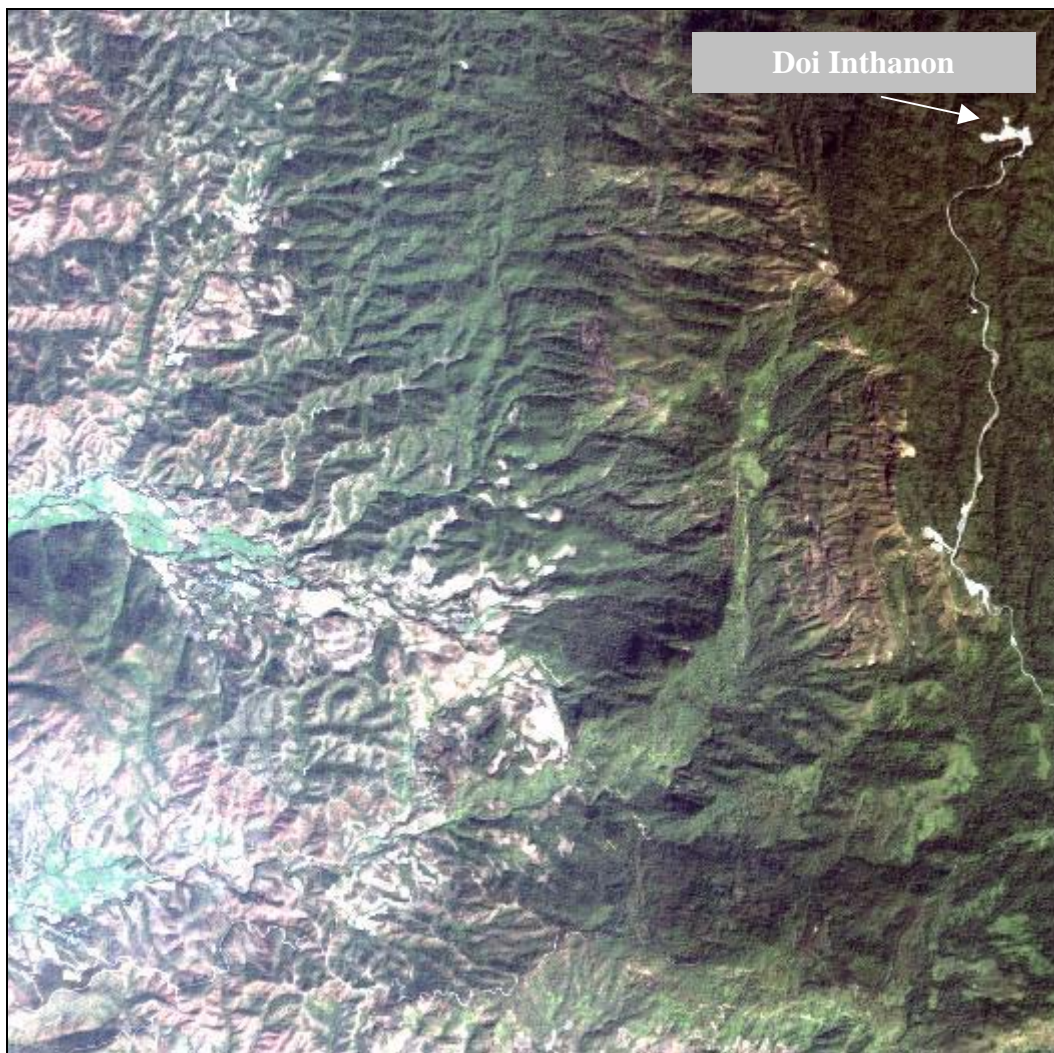
A **geocoded Landsat TM** data set has been acquired with coverage for Southeast Asia from the NASA STENNIS Space Center through the NASA Scientific Data Purchase program. These data were produced by EarthSat Incorporated and use 3-arc second DTM and GTOPO30 (30-arc second) digital elevation models and 6 to 12 photo-identifiable points with absolute positional accuracy not greater than 15.0 meters RMS. Each product has an overall positional accuracy of 50 meters RMS or less. The early 1990s was the target year of acquisition for this data set.



Example of four geocoded TM scenes in Laos – two scenes in 543 (RGB) two in 453 (RGB) to show contrasts

We have been able to acquire a number of **IKONOS** scenes for selected areas in Southeast Asia, also through the NASA Scientific Data Purchase program. IKONOS data are very high spatial resolution data with 4-meter multi-spectral and 1-meter panchromatic data. The area of coverage or “footprint”, however, is smaller than the Landsat data – 10.5 square kilometres as opposed to ~180 square kilometres. TRFIC-BSRSI/MSU has acquired six of these scenes for Southeast Asia:

- Tamdao National Park, Vietnam
- Ratanakiri, Cambodia (south of Virachay National Park)
- Mae Chaem, Chiang Mai, Thailand
- Bangkok, Thailand
- Kanchanaburi, Thailand
- Ratchaburi, Thailand



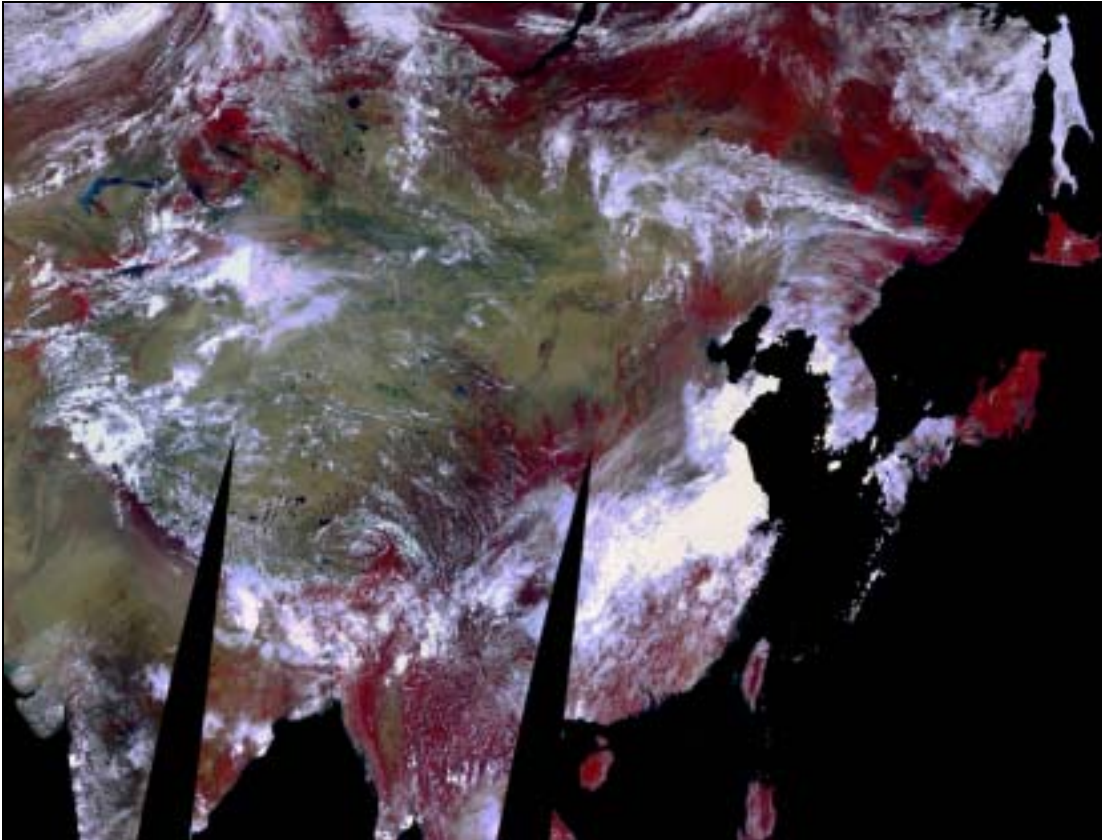
IKONOS data for Mae Chaem Watershed, Chiang Mai, Thailand

And, there are standing requests to acquire scenes for:

- The Magat Watershed, Philippines

- Berau, East Kalimantan, Indonesia
- Sempadi, Sarawak, Malaysia
- Luang Prabang, Lao PDR

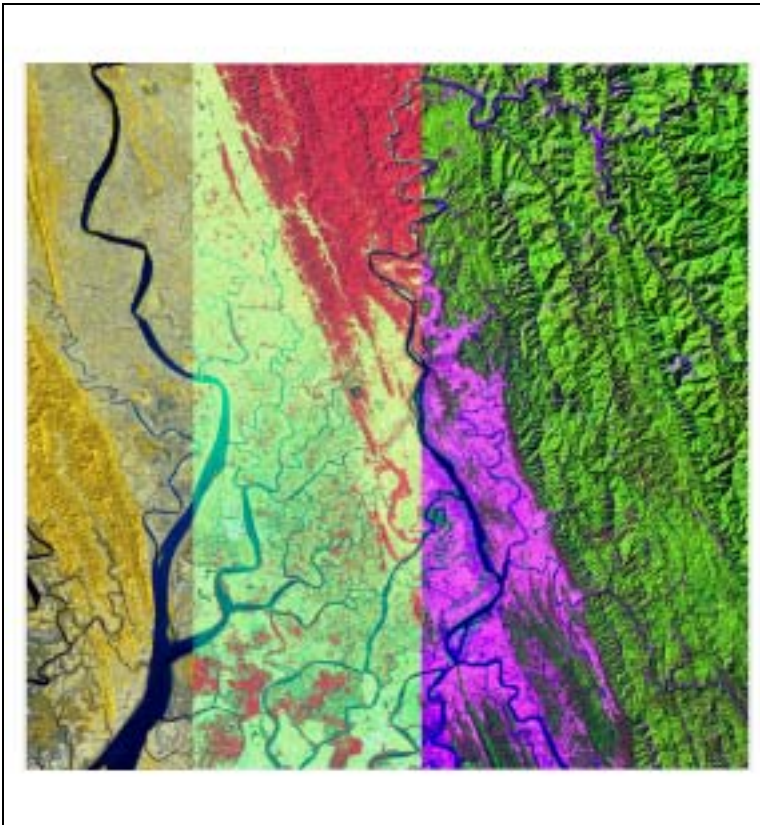
TRFIC-BSRSI/MSU has also acquired a regional data set of **SPOT4 VEGETATION** data. These are daily acquisitions for the year 2000 with regional coverage for each scene and a course-resolution pixel size of 500 square meters.



SPOT4 Vegetation Data for China and Northern SE Asia

The development of new data products derived from EOS data:

A set of **co-registered Landsat data** has been created under this project using the historic Landsat MSS and TM data previously archived at BRSI/MSU and the new acquisitions of Landsat ETM+ data. The process used three to five ground control points (GCPs) identified from common geographic features for a set of same path/row images (MSS, TM and ETM+). The MSS and the TM data are then co-registered to the ETM+ scene.



Co-registered Data Set

WRS Path: 135 Row: 46

MSS (4,3,2) 21 Dec. 1985

TM (4,3,2) 31 Jan. 1992

ETM+ (5,4,3) 14 Feb. 2000

A **land cover data** set has been developed from the analysis of Landsat 7 ETM+ data for Peninsular SE Asia. The mapping analysis uses remote sensing and geographic information systems (GIS) technology to derive land cover (forest, non forest, water, cloud and cloud shadow) from Landsat data. Each image is geo-referenced to UTM coordinates and then processed using an unsupervised classification algorithm to 45 clusters. These clusters are classed to their respective land cover type and then recoded. This thematic raster data is then converted to a polygon coverage which undergoes a series of edits in a GIS environment to correct any inconsistencies produced by the unsupervised classification. The final vector plots are converted back to raster data and re-projected to sinusoidal, then edge-matched. Merging all of the individual path/row tiles to a single raster data set creates regional maps. This work updates and supplements the land use analysis of historic Landsat data for the same region – Landsat MSS 1973, Landsat MSS – 1986, Landsat TM – 1992.

The image is a composite of three screenshots from a GIS software interface, likely ArcView, showing the progression of land cover analysis. The top screenshot displays a false-color satellite image with a legend table titled 'Cluster Attribute Editor'. The table lists various clusters with their corresponding colors and codes. The middle screenshot shows the same satellite image with a grid overlay, representing the final vector plot. The bottom screenshot shows the final land cover product, where the land is categorized into three main classes: Forest (green), Non-Forest (yellow), and Water (blue). A legend on the left side of the bottom screenshot identifies these classes.

Row	Hexagon	Color	Symbol	Cluster Name
8	522779	Red	1	non-forest
9	594360	Red	1	non-forest
10	290811	Green	1	Forest
11	117099	Red	1	non-forest
12	118744	Red	1	non-forest
13	292541	Yellow	1	non-forest
14	140242	Red	1	non-forest
15	909961	Green	1	Forest
16	102076	Red	1	non-forest
17	794576	Red	1	non-forest
18	284800	Red	1	non-forest
19	117990	Red	1	non-forest
20	914460	Red	1	non-forest
21	801176	Red	1	non-forest
22	243080	Red	1	non-forest
23	429627	Red	1	non-forest
24	320961	Red	1	non-forest
25	130278	Red	1	non-forest
26	203044	Red	1	non-forest
27	118786	Red	1	non-forest
28	820991	Red	1	non-forest
29	192384	Red	1	non-forest
30	419687	Red	1	non-forest
31	644781	Red	1	non-forest
32	900576	Red	1	non-forest
33	100109	Green	1	Forest
34	180010	Red	1	non-forest
35	170010	Red	1	non-forest
36	170010	Red	1	non-forest
37	170010	Red	1	non-forest
38	170010	Red	1	non-forest

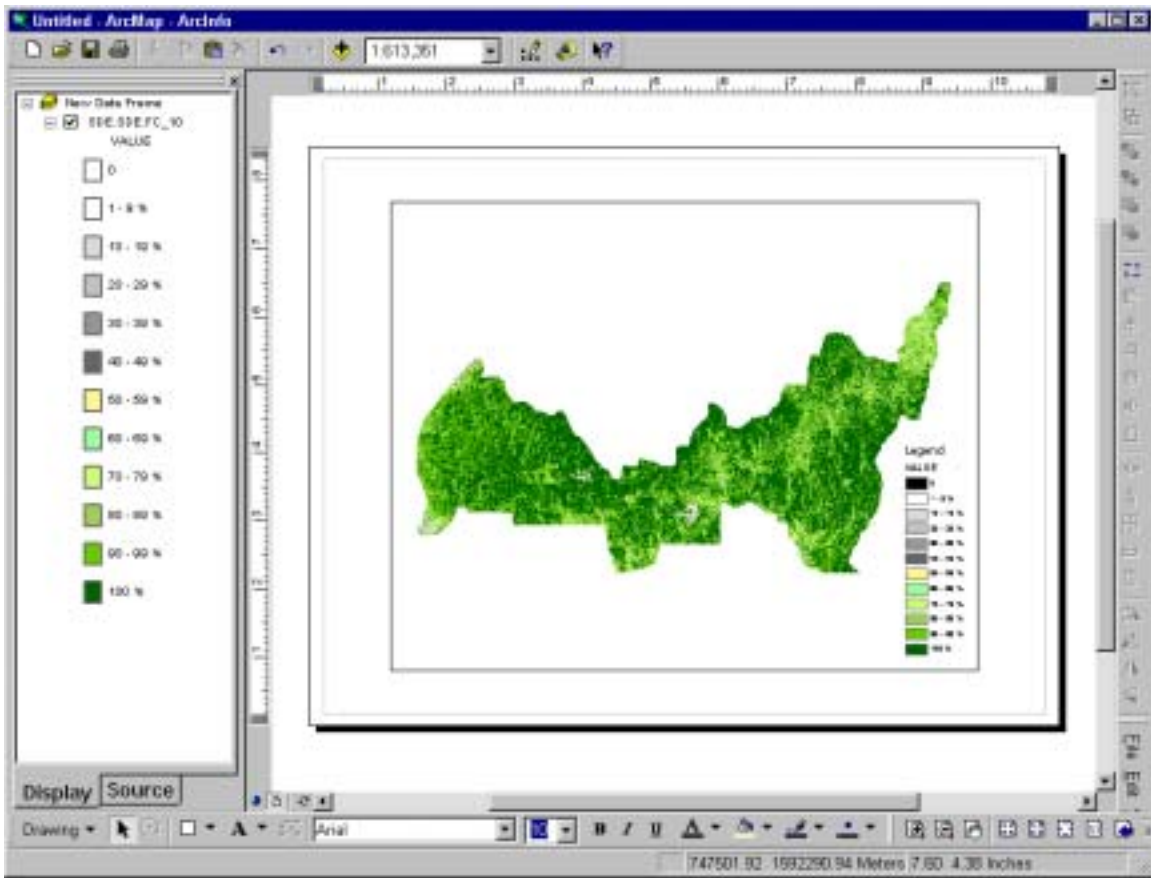
Example of classification and coding the clusters for a scene in Myanmar

Overlay of the final vector plot and the image showing bands 4,3 2 (RGB)

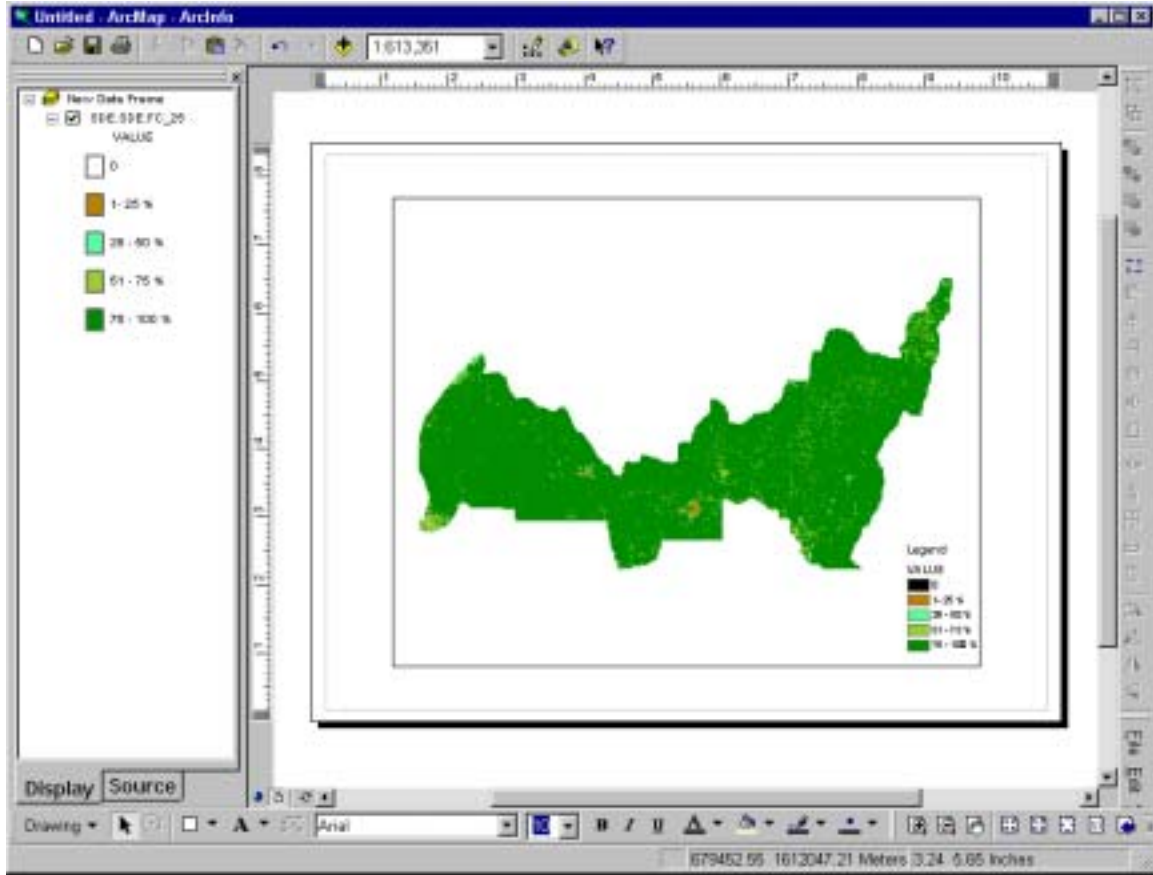
A final Land cover product for a scene in Myanmar

Processing and products from land cover analysis of Landsat 7 ETM+ data

A **forest fractional cover data** set has been created for Virachay National Park, Ratanakiri, Cambodia derived from the analysis of Landsat 7 ETM+ data. The data set is available recoded to two levels: 1) ten groups with ranges of 10 % in each class and 2) four groups with ranges of 25 % in each class. These data have been developed using a series of three algorithms: one to correct for atmospheric influences on the spectral values, one to create a modified soil adjusted vegetation index output data layer, and one using a soil end-member and a vegetation end-member to create the thematic fractional cover data product. This data set is available on-line through the APN2001-09 website (<http://bsrsi.msu.edu/trfic/APN2001-09/>). We hope to add new products for other areas within Southeast Asia to this application.

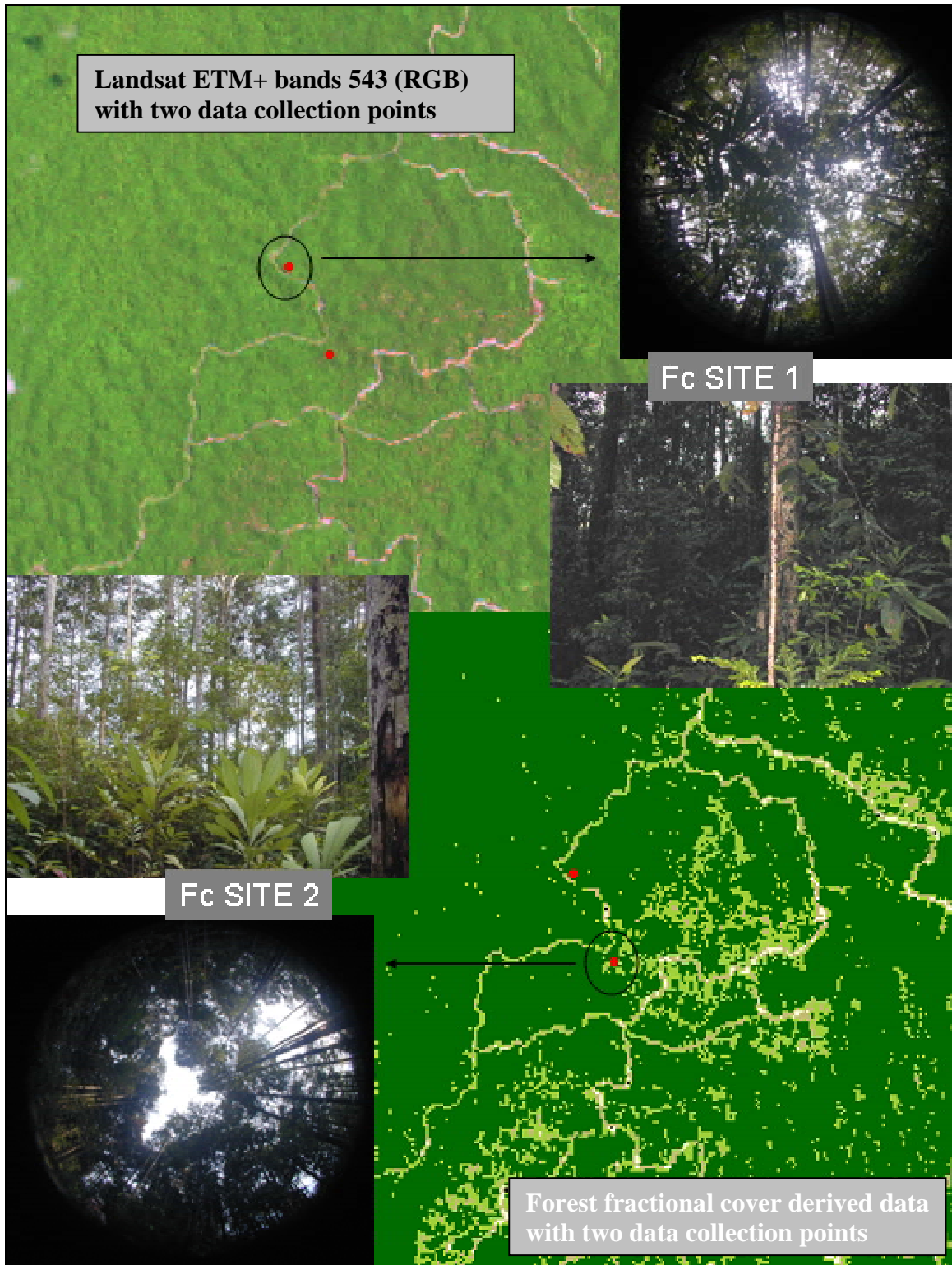


Forest Fractional Cover Data Re-classed to 10 groups with a range of 10 % in each group



Forest Fractional Cover Data Re-classed to 4 groups with a range of 25 % in each group

New forest **fractional cover data** are being **calibrated and validated** using the field data collected from the five case study sites in Southeast Asia. The canopy closure data derived from the GLA analysis of the digital, fish-eye forest canopy pictures are regressed against the estimates of the derived from the fractional cover estimates from the Landsat 7 ETM+ data. Depending on the regression outputs the algorithm may be altered to create a better product based on the field data.



Example of GPS points where digital fish-eye canopy pictures were taken in Berau, Indonesia, the estimated fractional cover data, and the field pictures

Capacity building with regional scientists:

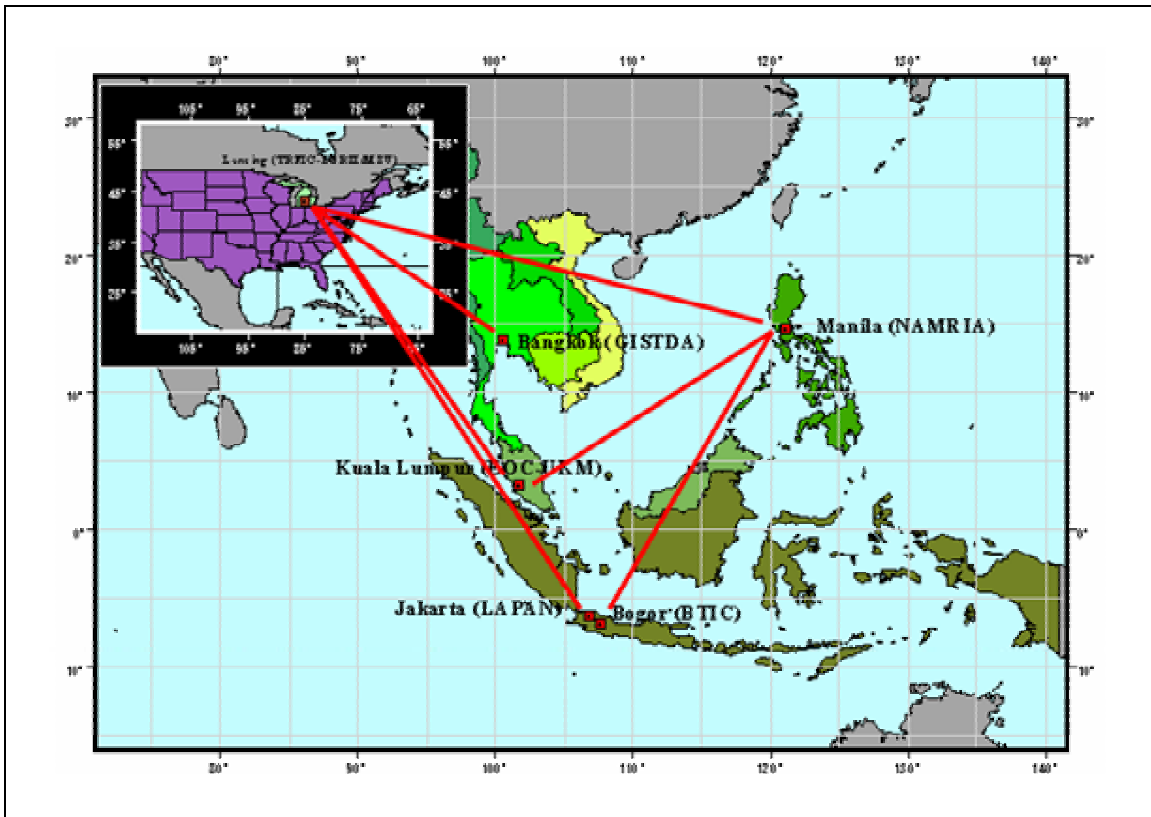
Through the meeting in Chiang Mai (August 2001) and the meeting in Bangkok (January 2002), three efforts in capacity building with regional scientists have centred on three areas:

1. In the theory behind, the development of and the application of fractional cover algorithms for Earth Observation Satellite data,
2. Field data collection for validation and calibration of fractional cover products derived from Earth Observation Satellite data, and
3. Applications of fractional cover assessments of forest cover (forest quality) linked to human impacts (selective logging and fire) as well as to forest biophysical attributes (biomass, LAI, etc.).

SEARRIN-DISS

The final outcome under this project has been the initial steps toward developing an on-line, web-based GIS data and data information systems and services within a distributed archive framework that includes the following organizations:

- | | |
|---------------------|----------------------------|
| NAMRIA, Philippines | GISTDA, Thailand |
| LAPAN, Indonesia | BTIC, Indonesia |
| EOC-UKM, Malaysia | TRFIC-BSRSI, United States |



Example of SEARRIN-DISS Distributed Architecture

(See examples above of the implementation of the search and browse application at BTIC, Bogor, Indonesia, (<http://seagofc.org/dataport/>) and the web-GIS application providing access to spatial data for Virachay National Park, Ratanakiri, Cambodia available at TRFIC-BSRSI/MSU.)

FUTURE DIRECTIONS/FOLLOW-UP WORK

With additional funding (we plan to apply for year two funds in the next APN call for proposals) we hope to:

- Develop routine field data collections for fractional cover validation with all six regional SEARRIN country teams
- Develop bi-weekly, regional fractional cover data sets using fourteen-day composites with the SPOT VEGETATION Data.
- Continue the development of an operational, on-line, web-GIS, SEARRIN-DISS, allowing regional scientist and policy makers, access to EOS data, data products and information for natural resource management and monitoring.
- Hold a regional meeting with particular emphasis on inviting regional policy makers and natural resource managers to gather feedback on the application of *FC* products.
- Develop regional operational forest monitoring with a focus on resource accounting (MEA)

PROJECT WEBSITE DETAILS

BSRSI has created a project website hosted as part of the Tropical Rain Forest Information Center (TRFIC, a NASA ESIP). The website includes links to:

- the project proposal,
- information on selected activities completed as part of the project,
- examples of selected project products including an on-line web-GIS application with data sets for the Virachay National Park in Cambodia,
- future proposed activities, and
- project contacts

The URL for the site is: <http://www.bsrsi.msu.edu/trfic/APN2001-09/>. Please note that while the project is officially completed, we will continue to work on up-dating the website to be more complete and to support our commitment to the overall, long-term objectives of the project and our desire to seek year two funding in the 2002 APN Call for Proposals.

AVAILABLE PROJECT CD-ROMS

Meeting proceedings from the final meeting in Bangkok, Thailand (17th – 21st January 2002). This is also available from the project website at: http://www.bsrsi.msu.edu/trfic/APN2001-09/pdf_files/SEARRIN_Report_No_7.pdf.

WORKSHOPS/CONFERENCES

Two regional meetings were held as part of this project, one sponsored completely by this APN project and another co-sponsored by a NASA LCLUC grant and APN project 2001-13.

Meeting Title: **SEARRIN Science Meeting**
Date: **9 – 14 August 2001**
Venue: **Lotus Pang Suan Keaw Hotel, Chiang Mai, Thailand**

AGENDA

THURSDAY, AUGUST 9, 2001 (DAY 1): OPENING AND SCIENCE SYNTHESIS

8:30 – 9:00 Registration

9:00 – 10:00

- Opening address: Ms. Wandee Chinesawadi, National Research Council of Thailand
- SEARRIN Project Overview, Dr. Dave L. Skole, Michigan State University
- Agenda review

10:00 – 10:20 Science Paper Presentations Session I (20 minutes each)

Chair: Dr. Dave Skole

- “Large-Area, Rapid Assessments of Forest Cover Using Landsat ETM+ Data: Myanmar 1999/2000”, Mr. Jay Samek, MSU, SEARRIN-US

10:30 – 10:50 *Coffee break*

10:50 – 12:00

- “Integration of GIS and Statistical Analysis for Forest Cover Change Modelling of the Upper Magat Watershed,” Mr. Benjamin P. Balais, NAMRIA SEARRIN-Philippines
- “Data and Data Information Systems: TRFIC,” Dr. Dave Skole, MSU, SEARRIN-US

12:00 – 13:00 *Lunch*

13:00 – 13:20 Keynote Address: Dr. Pong-In Rakariyathum, Chiang Mai University

13:20 – 15:00 Science Paper Presentations Session II

Chair: Dr. Dave Skole

- “Tam Dao National Park: Policy Implication and Forest Re-growth,” Mr. Nguyen Vinh Thu, National Center for Hydro-Meteorological Forecast, SEARRIN-Vietnam
- “Land Use and Land Cover Change in Kampong Cham Province, Cambodia,” Mr. Touch Vina, Ministry of Environment, SEARRIN-Cambodia
- “Land Use and Land Cover Change in Nam Theung Watershed, Laos PDR,” Mr. Sengkham Inthirivongsay, National University of Laos, SEARRIN-Laos

15:00 – 15:30 *Coffee break*

15:30 – 16:45 Science Paper Presentations Session III

Chair: Dr. Dave Skole

- Land Use and Land Cover Change in Sempadi Forest Reserve, Sarawak, Malaysia,” Dr. Asmah Ahmad, UKM, SEARRIN-Malaysia

- “Spatial Analysis of Forest Cover Change in Puerto Princesa, Palawan,” Ms. Alma Arquero, NAMRIA, SEARRIN-Philippines
- “Land Use and Land Cover Change in Thailand: Five Sites,” Dr. Chaowalit Silapathong, GISTDA, SEARRIN-Thailand
- Chiang Mai Watershed Geospatial Database

16:45 – 17:30 Fractional Cover and Field Validation Presentation, Dr. Jaiguo Qi and Mr. Jay Samek Michigan State University

Dinner Reception: Kantok Restaurant. Hosted by National Research Council of Thailand

FRIDAY, AUGUST 10, 2001 (DAY 2): FIELD VALIDATION TRAINING / TECHNOLOGY TRANSFER (FULL DAY)

8: 45 am departure Field Training: fractional cover transect at Doi Inthanon. Transport by van. Box lunch.

SATURDAY, AUGUST 11, 2001 (DAY 3): SYNTHESIS WRITING AND TECHNICAL PRODUCTS DEVELOPMENT

AM departure: Dr. J. Qi, C. Wang to Mae Chaem for 2 days fractional cover validation field work in Mae Chaem watershed with Thai Foresters.

CONCURRENT SESSIONS

	Group 1	Group 2
	Synthesis writing:	Technical breakout sessions:
<i>10:30 – 10:50 am Coffee Break</i>	<ul style="list-style-type: none"> ▪ APN-LUCC ▪ NASA LCLUC 	<ul style="list-style-type: none"> ▪ Harmonized forest cover maps
<i>12:00 – 1:00 pm Lunch</i>	Science Papers drafting	<ul style="list-style-type: none"> ▪ SEARRIN Web Sites ▪ SEARRIN Brochure ▪ SEA-TRFIC Nodes
<i>3:00 – 3:30 pm Coffee break</i>		

SUNDAY, AUGUST 12, 2001 (DAY 4): SEARRIN POLICY FORUM PLANNING, SEARRIN-MILENNIUM ECOSYSTEM ASSESSMENT DOCUMNET AND TECHNICAL PRODUCTS DEVELOPMENT CONTINUED

CONCURRENT SESSIONS

	Group 1	Group 2
9:00 am start (full day working meetings)		
	AM: Policy Forum	Technical breakout sessions:
<i>10:30 – 10:50 am Coffee Break</i>	<ul style="list-style-type: none"> ▪ planning & ▪ presentation devel. 	<ul style="list-style-type: none"> ▪ Harmonized forest cover maps
<i>12:00 – 1:00 pm Lunch</i>	<i>(Nov./Dec. Meeting in Thailand)</i>	<ul style="list-style-type: none"> ▪ SEARRIN Web Sites ▪ SEARRIN Brochure ▪ SEA-TRFIC Nodes
<i>3:00 – 3:30 pm Coffee break</i>	PM: Drafting of SEARRIN-MA Document	

MONDAY, AUGUST 13, 2001 (DAY 5): SEARRIN SCIENCE ACTIVITIES

AM: Dr. J. Qi, C. Wang, and Thai Foresters return from Mae Chaem field work

- 9:00 – 10:30 am GOFc Activities: Status Reports
- International GOFc Program: Priorities and SEARRIN Participation, Dr. Iwan Gunuwan, BPPT
 - Harmonization Project of Regional Forest Cover, Dr. Sharifah Mastura S.A., UKM
 - SEARRIN-GOFc Information Technology Systems, Mr. Jay Samek, MSU
 - SEARRIN-GOFc Fire Implementation, Dr. Mastura Mahmud, UKM
 - Regional mapping, Mr. Chetphong Butthep
 - GOFc Products, Dr. Jiaguo Qi, MSU

10:30 – 10:50 am *Coffee Break*

- 10:50 – 12:00 noon APN Activities
- Land Use and Land Cover Change for Southeast Asia (UKM), Dr. Sharifah Mastura S.A.
 - Spatial Data and Information for Land Use and Forest Assessment and Management, (MSU), Jay Samek
 - Forest Fire Monitoring in Southeast Asia (IC-SEA/BIOTROP), Dr. Iwan Gunuwan

12:00 – 1:00 pm *Lunch*

- 1:00 – 3:00 pm Future Planning and Additional Activities
- ECE Linkage, Dr. Hoang Minh Hien, Hydro-Met Vietnam
 - NSF – Fire Proposal, Dr. Mark Cochran, MSU
 - FAO-Asia Watch

3:00 – 3:30 pm *Coffee break*

Afternoon free or time to tie up loose end (Synthesis report(s), SEARRIN MA Document, Products Development, SEARRIN Web sites, Policy forum, etc.)

TUESDAY, AUGUST 14, 2001 (DAY 6): WRAP UP AND CLOSING

9:30 – 10:30 am Synthesis and Wrap-up

10:30 – 10:50 am *Coffee Break*

10:50 – 12:00 noon Close of meeting

12:00 – 1:00 pm *Lunch*

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Meeting Title: **Southeast Asia Regional Research and Information Network (SEARRIN) Science Meeting and Workshop on Fractional Cover Analysis of Remotely Sensed Data**
Dates: **17 – 21 January 2002**
Venue: **Environmental Research Institute (ERIC), Chulalongkorn University, Bangkok, Thailand**
Web Site: http://bsrsi.msu.edu/trfic/SEARRIN/01_2002/index.html

AGENDA

Day 1: January 17, 2002 SEARRIN-DISS

8:30	Meet in Lobby of Pathumwan Princess Hotel to walk over to ERIC
9:00 – 9:30	Opening Address: Dr. Sharifah Mastura SA
9:30 – 9:45	Meeting Overview: Mr. Jay Samek
9:45 – 10:15	SEARRIN DISS Overview: Mr. Jay Samek
10:15 – 10:35	Tea Break
10:35 – 11:00	EOC UKM - Dr. Othman Karim, SEARRIN-Malaysia
11:00 – 11:25	BTIC/SEAMEO BIOTROP - Mr. Hartanto Sanjaya, SEARRIN-Indonesia
11:25 – 11:50	NAMRIA - Mr. Sunday Lingad, SEARRIN-Philippines
12:00 – 13:30	Lunch
13:30 – 13:55	LAPAN - Mr. Muchamad Muchlis, SEARRIN-Indonesia
13:55 – 14:25	HTML to Web GIS - Mr. Oscar Castaneda, SEARRIN-US
14:25 – 14:45	Open discussion, questions, feedback - Mr. Jay Samek, SEARRIN-US
14:45 – 15:10	Tea Break
15:10 – 16:30	SEARRIN DISS Application Demonstrations - Mr. Oscar Castaneda,
SEARRIN-US	
16:30 – 17:00	Open discussion and review of next day's work – Chair, Mr. Jay Samek,
SEARRIN-US	
18:30	Meet in lobby of Pathumwan Princess Hotel, SEARRIN dinner (venue tba)

Day 2: January 18, 2002 SEARRIN-DISS

9:00 – 10:30 SEARRIN-US	Design working group for TRFIC Nodes in SE Asia - Oscar Castaneda,
10:30 – 10:50	Tea Break
10:50 – 12:00 SEARRIN-US	Design working group for TRFIC Nodes in SE Asia - Oscar Castaneda,
12:00 – 13:30	Lunch
13:30 – 15:00	Document working group on SEARRIN DISS (Strategies and Requirements) – Jay Samek, SEARRIN-US

15:00 – 15:20	Tea Break
15:20 – 17:00	Document working group on SEARRIN DISS (Strategies and Requirements) – Jay Samek, SEARRIN-US

Day 3: January 19, 2002 Fractional Cover

9:00 – 9:30	Overview of Fractional Cover Analysis - Mr. Jay Samek, SEARRIN-US
9:30 – 10:00	GOFCC Report - Ms. Cuizhen Wang (for Dr. Jiaguo Qi) SEARRIN-US
10:00 – 10:20	Report back on Field Validation of <i>FC</i> in SE Asia - Mr. Jay Samek, SEARRIN-US
10:20 – 10:40	Tea Break
10:40 – 11:00	Mae Chaem Case Study - Ms. Cuizhen Wang, SEARRIN-US
11:00 – 11:20	SEARRIN Report on <i>FC</i> Applications to Meet National Natural Resource Management Needs: Malaysia
11:20 – 11:40	SEARRIN Report on <i>FC</i> Applications to Meet National Natural Resource Management Needs: Indonesia
11:40 – 12:00	SEARRIN Report on <i>FC</i> Applications to Meet National Natural Resource Management Needs: Philippines
12:00 – 13:30	Lunch
13:30 – 13:50	SEARRIN Report on <i>FC</i> Applications to Meet National Natural Resource Management Needs: Thailand
13:50 – 14:10	SEARRIN Report on <i>FC</i> Applications to Meet National Natural Resource Management Needs: Laos
14:10 – 14:30	SEARRIN Report on <i>FC</i> Applications to Meet National Natural Resource Management Needs: Cambodia
14:30 – 14:50	SEARRIN Report on <i>FC</i> Applications to Meet National Natural Resource Management Needs: Vietnam
14:50 – 15:20	Tea Break
15:20 – 17:00	Document working group on National/Regional Applications for Fractional Cover Analysis

Days 4 - 5: January 20 – 21, 2002 SEARRIN Executive Committee Meetings

Schedules to be announced. Focus of days 4 and 5 are the following:

- SEARRIN Strategic Plan (science plan, future funding, PR – web sites, brochures, etc)
- Millennium Ecosystem Assessment
- General SEARRIN Business

Dr. Walter Reid from the Millennium Ecosystem Assessment will join us for at least part of the day on 21 January.

There will be lunch and tea breaks as usual on these two days.

We will also host a dinner the last evening, January 21, for all to attend. Details tba.

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