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Re: Progress Report
NASA Research Grant NAG5-6259 – "Accuracy Assessment of the IGBP Fast-Track 1 Km Land Cover Data Set"

In response to your request I am sending to you this summary of our progress to date on the above Land-Cover and Land-Use Change Research Grant. This report briefly summarizes our activities to date on the project.

The overall goal of this study is to assess the accuracy of the IGBP Global 1-km Land Cover Data Set. We are examining the Version 1.0 DISCover Data Set (previously referred to as the "Fast Track" Data set). This data set, completed for the entire globe on 30 June 1997, from 1-km AVHRR NDVI data recognizes 17 types of land covers. Accuracy of the Fast Track product will be assessed by interpretation of high resolution Landsat Themtic Mapper and SPOT imagery covering a core sample of approximately 425 samples drawn by stratified, systematic, unaligned sampling. This procedure will yield confidence limits on the accuracy of classification as well as on specific probabilities of misclassification. In addition, the core sample will be expanded into larger regions around each sample center that will be used for "tests" and "experiments" as specified in the IGBP-DIS protocol that further characterize the Fast Track data and land covers at each site. These confidence sites will also form the vanguard of an ongoing global network of test sites for accuracy assessment of successive land cover maps by the IGBP and the global land cover community at large.

Our progress to date under this Grant will be summarized in three areas: 1) Data Search and Acquisition; 2) Data Processing, and; 3) Project Coordination. Specific activities ongoing in each of these areas will be briefly described.

1) Data Search and Acquisition

- *High resolution (Hi-Res) Validation Data* -- Landsat TM imagery covering 289 samples has been provided for this project by the United States Geological Survey EROS Data Center (USGS/EDC). These images are archived at UCSB/RSRU and validation subscenes (centered on each sample point) are being extracted from each image.

- *SPOT imagery Acquisition* -- An order has been placed by IGBP-DIS with SPOT Image for 150 scenes to cover most of the remaining samples. The current schedule calls for delivery of three monthly increments of 50 scenes, beginning May 15. Existing "C" programs (developed

to automate the process of TM subscene extraction) are currently being modified to locate and extract interpretation subscenes from SPOT data in an automated fashion.

- *Replacement Hi-Res TM Image Search* -- We are making an effort to identify alternate Hi-Res data to replace the SPOT imagery in the event that the SPOT data are not available to us. We have implemented an additional image search of the EDC archives using slightly relaxed date and image quality parameters. We expect this search to be complete by 15 May. We will make contingency plans to acquire these data beginning 1 June (with the expectation that delivery of all scenes will be complete by 15 June).

2) Data Processing

- *TM Subscene Extraction* -- 40x40 Km interpretation subscenes are being extracted from the TM imagery current in-house. At this date 100 subscenes have been generated and archived on CD-ROM. At the current rate, the 289 subscenes will be completed by 1 June. All subscenes will be in web accessible softcopy format and will include locational information and annotations for reference during the Global Validation Workshop.

- *Validation Database Compilation* – A comprehensive relational database is being compiled to include a number of variables relevant to each of the 425 validation samples. This database will be completed and accessible by 15 May. It will allow users to query a number of important locational and thematic characteristics for each sample and sort samples by class, validation region, locational parameters, or continent (or other relevant geographic descriptor). When completed, the database will also include validation information and be utilized for statistical processing following the Global Validation Workshop.

- *Interpretation Key Compilation* – The compilation of a set of interpretation keys for each IGBP Land Cover class is ongoing and will continue until 15 August when they keys will be finalized and a set of hard copies produced for interpreter use. This set of keys will consist of up to four TM subscenes for each class as it appears in different locations on the globe. The land cover classes shown on each key will be rigorously documented by field investigation, ancillary data or through interpretation of aerial photography.

- *Precision TM Data Geometry Test* – Standard National Landsat Archive Production System (NLAPS) TM products are the bulk of our Hi-Res validation dataset. We are testing these data to determine whether significant systematic positional error is present. We are comparing the geometry of eleven systematic LTM scenes (covering the U.S.) with identical Multi-Resolution Land Characteristics (MRLC) scenes that have been precision geometrically corrected at EDC. Although the results of this test will not be statistically valid due to the small number of scenes tested, we are confident that if significant systematic positional bias is present within the systematic data it will be evident through this analysis. Technical problems (related to reprojecting TM datasets in Goodes Interrupted Homolosine projection) have prevented us from completing this test as scheduled, although work is ongoing and we expect complete this test by 1 June.

- *Ancillary Data Acquisition* – As a result of the Validation Test Workshop (see following) Workshop, several datasets were identified important for interpreter use during the Global Validation Workshop. Most important among these are:

    1. Digital Elevation Models (DEM)
    2. Digital Line Graphs (DLG)
    3. Digital Chart of the World (DCW)
    4. As broad as possible a variety of vegetation maps

5. Normalized Difference Vegetation Index (NDVI) monthly profiles for the region around each sample images and time series

Several of these data sets are available directly from EDC where they are archived as standard companion products to the 1Km global land cover data set. Acquisition, subsetting, and recompilation of these data set is underway in order to provide these ancillary layers coregistered to the Hi-Res subscenes.

3) Project Coordination

Validation Test Workshop -- The IGBP Validation Test Workshop was held on 1-3 February 1998 at RSRU in Santa Barbara, California. The objective of this workshop was to test validation methods and procedures to be used in the Global DISCover Validation Workshop.

A number of specific technical issues were of particular interest during this workshop. IGBP Validation Regions 1, 2, and 3 were used for this test. These regions include Canada, the US, Mexico, Central America and a portion of northern South America.

Two principal activities were performed during the Test Workshop:

- The core sampling procedure was evaluated. 37 DisCover Data Set samples were validated by interpretation o LTM imagery. In accord with the IGBP Validation Procedure, each sample was interpreted by three separate interpreters and statistics summed for each point.

- To evaluate confidence site mapping, 15 LTM subscenes, each approximately 40x30 kilometers in size and centered on a DISCover sample, were manually mapped and classified using the DISCover legend. Mapped polygons were also coded with several specific vegetation cover parameters of interest to confidence site investigators. Mapping times and comments were recorded during completion of each subscene.

Following these activities, discussions were held among participants to address the procedures and technical issues relevant to the validation. Four topics were of greatest interest:

1. Global Validation Workshop Schedule (including data acquisiton)
2. DisCover/ Hi-Res (LTM-Spot) Registration Issues
3. Validation Interpretation Issues
4. Confidence Mapping Issues

A detailed summary report was produced following this workshop and is available upon request. This document is also available at the IGBP DISCover Validation website at:

http://rsrunt.geog.uscb.edu/igbp.html

Expert Image Interpreter Recruitment – Recruitment of Expert Image Interpreters (EII) is ongoing. An invitation letter has been prepared and distributed to over 100 perspective EII's by the IGBP-DIS office and replies will be received at RSRU/UCSB. We are maintaining the option of recruiting additional EII's through the August timeframe in order to assemble the most expert team possible. We are currently soliciting additional potential EII's from a number of the Validation Regional Advisors.

WWW Site Maintenance – The world wide web site which has been implemented for this project continues to be updated on an ongoing basis. All data sets, as well as ancillary and documentary data will be accessible at this site.

Project Timeline – The current timeline for this project is as follows:

Date	Milestone
15 May 1998	▪ Delivery of 50 SPOT Image Hi-Res data (Increment 1) ▪ Expanded GLIS search complete and alternate Hi-Res data identified ▪ Validation Database completed
1 June	▪ TM Hi-Res data subscene extraction complete (289 samples) ▪ TM Geometry test complete ▪ Order complete for replacement Hi-Res TM scenes (if required)
15 June	▪ Delivery of 50 SPOT Image Hi-Res data (Increment 2) ▪ Target data for receipt of replacement TM scenes (if required)
15 July	▪ Delivery of 50 SPOT Image Hi-Res data (Final Increment)
15 August	▪ SPOT Hi-Res data subscene extraction complete (150 samples) ▪ Replacement TM subscene extraction complete (if required) ▪ Interpretation keys complete
1 September	▪ Completion of all validation data sets ▪ Delivery of data to EDC
7 September	▪ Global Validation Workshop begins; EDC - Sioux Falls, SD
17 September	▪ Global Validation Workshop ends
15 October	▪ Validation Statistical Analysis Complete ▪ Preliminary Results
1 December	▪ IGBP-DIS meeting; validation review (Ispra, IT or Toulouse, FR)
15 December	▪ Draft Validation Workshop Report completed
15 March 1999	▪ Advanced statistical analysis developed (to accomodate data set changes