MAPPING VEGETATION LEAF AREA INDEX USING LANDSAT/GLOBAL LAND SURVEY DATA

R. Nemani[1], S. Ganguly[2], W. Wang[3], F. Gao[4], P. Votava[3], A. Michaelis[3], J. Dungan[1], F.Melton[3], H. Hashimoto[3], C. Milesi[3], and R. Myneni[5]

[1]NASA Ames Research Center, Moffett Field, CA
[2]BAERI/NASA Ames Research Center, Moffett Field, CA
[3]CSUMB/NASA Ames Research Center, Moffett Field, CA
[4]NASA Goddard Space Flight Center, Greenbelt, MD
[5]Boston University, Boston, MA

1. INTRODUCTION

The Global Land Survey data[1] from Landsat provide the best source of information about global landscapes as they evolved since the 1970s. These carefully constructed datasets are ready for further analysis, though lack of computing resources so far precluded comprehensive global analyses. With increasing interest in biological sequestration of CO_2 into vegetation biomass, we believe these data offer a valuable resource for characterizing global vegetation. The ability to locate physical features on the ground as well as a long publication record showing many successful attempts at converting Landsat data into vegetation biophysical variables such as LAI and biomass make these data highly suitable for promoting Clean Development Mechanisms (CDM) negotiated under UNFCCC.

By adapting algorithms and products from EOS/MODIS, we created a first generation global LAI product at 30m. Our methodology consists of 1) applying atmospheric corrections to Landsat data to produce surface reflectances[2], 2) producing a 30m land cover map by downscaling the 500m MODIS land cover data, 3) estimating vegetation leaf area index for each 30m pixel using the MODIS LAI/FPAR algorithm with a customized look-up-table for Landsat red, near-infrared and shortwave infrared reflectance data[3].

2. MAPPING GLOBAL LEAF AREA INDEX

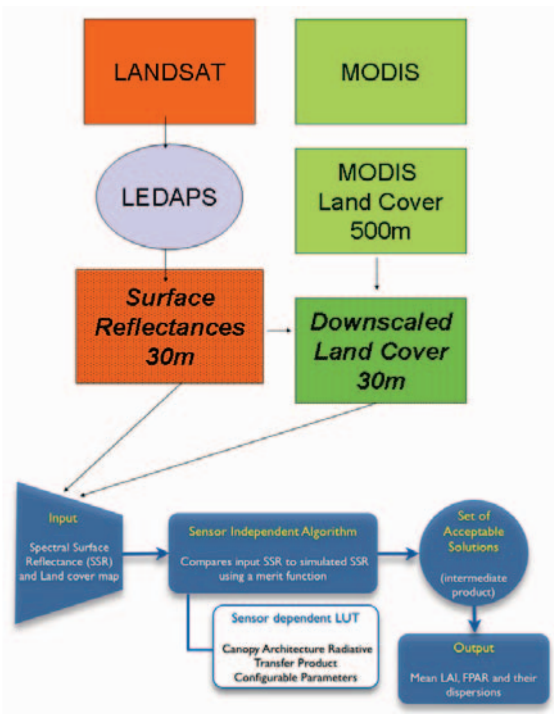

Figure 1 Following MODIS example, we created biome-specific look-up-tables for Landsat characteristics (spatial and spectral). Using the downscaled MODIS landcover (30m), we apply the algorithm using the LEDAPS-generated surface reflectances. The LAI retrieval process begins with a three band inversion scheme, when it fails it uses the two-band retrieval process. If both fail, a backup NDVI-based algorithm is used.

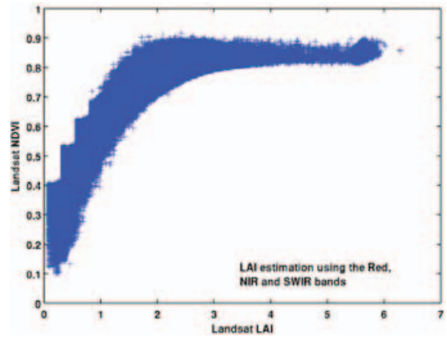

Figure 2 We extended the MODIS LAI/FPAR algorithm in two ways: 1) adjusted the LUT for Landsat resolution (1000 to 30m), 2) spectrally enhanced by introducing the SWIR wavelength into LAI retrievals.

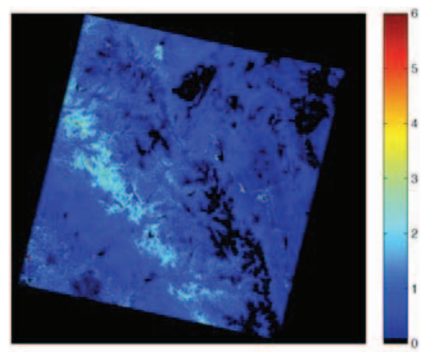

Figure 3 The Landsat-based LAI captures land surface variability better than the coarse resolution MODIS, an important consideration for applications such as ecosystem carbon sequestration.

Using the approach outlined in Fig 1, we processed nearly 9000 scenes from GLS to produce a global coverage of vegetation leaf area index at 30m. We are in the process of further tuning the LUT with field observations. Nearly 4 TB of LAI data are now available for the community.

3. REFERENCES

[1] Gutman et al., 2008. Towards monitoring land cover and land use changes at a global scale. The Global Land Survey 2005. PERS, 6-10.

[2] Masek et al.,. (2006). A Landsat surface reflectance dataset for North America, 1990-2000. IEEE Geoscience and Remote Sensing Letters, 3:68–72.

[3] Ganguly et al., 2008. Generating vegetation leaf area index earth system data record from multiple sensors. Part 1: Theory. Remote Sensing of Environment, 112, 4333-4343.