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IN SITU ESTIMATES OF FOREST LAI FOR MODIS DATA VALIDATION

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Description:

Satellite remote sensor data are commonly used to assess ecosystem conditions through synoptic monitoring of terrestrial vegetation extent, biomass, and seasonal dynamics. Two commonly used vegetation indices that can be derived from various remote sensor systems include the Normalized Difference/Vegetation Index (NDVI) and Leaf Area Index (LAI). Detailed knowledge of vegetation index performance is required to characterize both the natural variability across forest stands and the intra-annual variability (phenology) associated with individual stands. To assess performance accuracy, in situ validation proocedures can be applied to evaluate the accuracy of remote sensor-derived indices. A collaborative effort was established with researchers from the U.S. Environmental Protection Agency (EPA), National Aeronautics and Space Administration (NASA), academia, and non-governmental organizations to evaluate the Moderate Resolution Imaging Spectroradiometer (MODIS) NDVI and LAI products across six validation sites in the Albemarle-Pamlico Basin (APB), in North Carolina and Virginia.

The significance of LAI and NDVI as source data for process-based ecological models has been well documented. LAI has been identified as the variable of greatest importance for quantifying energy and mass exchange by plant canopies and has been shown to explain 80 to 90% of the variation in the above- ground forest net primary production (NPP). LAI is an important biophysical state parameter linked to biological productivity and carbon sequestration potential and is defined here as one half the total green leaf area per unit of ground surface area. NPP is the rate at which carbon is accumulated by autotrophs and is expressed as the difference between gross photosynthesis and autotrophic respiration.

NOVI has been used to provide LAI estimates for the prediction of stand and foliar biomass and as a surrogate to estimate stand biomass for denitrification potential in forest filter zones for agricultural non- point source nitrogenous pollution along riparian waterways. Interest in tracking LAI and NDVI changes includes the role forests play in the sequestration of carbon from carbon emissions and the formation of tropospheric ozone from biogenic emissions of volatile organic compounds naturally released into the atmosphere. The NDVI has commonly been used as an indicator of biomass and vegetation vigor. NDVI has been applied in monitoring seasonal and interannual vegetation growth cycles, land-cover (LC) mapping, and change detection. Indirectly, it has been used as a precursor to calculate LAI, biomass, the fraction of absorbed photosynthetically active radiation (fAPAR), and the areal extent of green vegetation cover.

Purpose/Objective:

Our research objectives are to: (a) develop new methods using satellite remote sensor data for the rapid characterization of LC condition and change at regional to national scales; (b) evaluate the utility of the new NASA-EOS MODIS (Moderate Resolution Imaging Spectrometer) leaf area index (LAI) measurements for regional scale

application with landscape process models (e.g., biogenic emissions and atmospheric deposition); (c) provide remote sensor derived measurement data to advance the development of the next generation of distributed landscape process-based models to provide a predictive modeling capability for important ecosystem processes (e.g., nutrients, sedimentation, pathogens, etc.); and (d) integrate in situ monitoring measurement networks with UAV and satellite based remote sensor data to provide a continuous environmental monitoring capability.

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