Special Issue on the Remote Characterization of Vegetation Structure and Productivity: Plant to Landscape Scales

Alistair M.S. Smith[1], Randy Wynne[2], and Nicholas Coops[3].

[1] Forest and Rangeland Measurements Laboratory, University of Idaho, www.RemoteEarth.net
[2] Virginia Tech, Department of Forestry
[3] Canadian Research Chair in Remote Sensing, Department of Forest Resource Management University of British Columbia.

Recent advances in geospatial (*remote sensing and geographical information systems*) technology and analytical approaches have enabled new research that can quantify vegetation structure and plant production attributes from plant to landscape scales. These attributes, which include plant height, crown architecture and shading, leaf area index, and gross primary production, have the potential to act as inputs in landscape-scale ecological, biophysical, hydrological, and radiative transfer process models. These advances have in a large arisen from substantial research applying light detection and ranging (LiDAR or laser altimetry) and radar-based (SAR, IfSAR, SRTM, etc) datasets to forestry, hydrological, and geological applications. A recent result of the increase in LiDAR research in forestry has seen the transfer of LiDAR from the research realm to operational forest management. Further datasets from flux towers and the application of object-orientated methods to historical digital-aerial photography have enabled the remote characterization of plant growth and spatial plant patterns over large spatial and temporal scales.

The metrics derived from such research have the potential to be used as new inputs in landscape-scale process models that in turn may improve the estimates and uncertainties of biogeochemical pools and fluxes. In forestry, these metrics include statistics derived from LiDAR height distributions and research is ongoing by many of the contributors in this special issue to evaluate whether they can be used to develop remote sensing aware allometric relationships. These relationships hold the promise of predicting biomass, hydrological, and biogeochemical stocks directly from remote sensing metrics, as compared to the traditional ground-based forestry reliance on stem diameter measures. Knowledge of vegetation structure and productivity can further evaluate vegetation functional group classification, wildlife habitats, ecological successional dynamics, light and water interception, and their effects on radiative transfer and water budgets, among other topics.

This special issue arose from two years special sessions focusing on the "*Remote Characterization of Vegetation Structure*" that were held at the fall meeting of the American Geophysical Union (AGU) in both December 2006 and 2007. These sessions were highly attended with more than 40 abstracts in each year encompassing algorithm development and a range of ecological and biogeochemical applications. These sessions included the application of ground-based LiDAR, SAR, and SRTM data, in addition to productivity applications. A further session is planned for December 2008, which will also feature research to inform the planned NASA Deformation, Ecosystem Structure, and Dynamics of Ice (DESDynI) mission. The contributions in this special issue highlight how recent advances in active and passive remote sensing technologies, data acquisition methods, and analytical techniques could be used to characterize vegetation structural and plant productivity metrics at multiple scales. The contributions include participants from the AGU sessions in addition to open submissions from the wider scientific community. A companion special issue focusing on the application of vegetation structure and productivity metrics to landscape-regional processes has been organized in the *Biogeosciences* section of the *Journal of Geophysical Research* and is due to be published in the fall of 2008.

The papers in this special issue of the *Canadian Journal of Remote Sensing* reflect the wide breadth of research presented at the AGU sessions in addition to contemporary research in the wider scientific community. Special thanks to all the attendees and session chairs of the AGU sessions and the authors for their contributions to this special issue. The efforts of the many anonymous reviewers and the Editorial Board are greatly appreciated for their efforts in bringing this special issue together with the highest level of scientific rigor. A final special thanks to the researchers at the Geospatial Laboratory of Ecosystem Dynamics (GLED) at the University of Idaho, whom in many cases served as tireless additional reviewers throughout the process.