

Multi-resolution remote sensing data for characterizing tundra
vegetation communities on Boothia Peninsula, Nunavut

by

GITA JOAN LAIDLER

Thesis submitted to the Department of Geography
in conformity with the requirements for the degree of
Master of Science

Queen's University
Kingston, Ontario, Canada
July, 2002

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Abstract

Arctic tundra environments are thought to be particularly sensitive and responsive to changes in climate, whereby alterations in ecosystem functioning are likely to be expressed through shifts in vegetation phenology and species composition. Due to the remoteness and climatic challenges of the Arctic, remote sensing may provide a viable means for estimating and monitoring these large-scale, potentially rapid changes. Therefore, the objectives of this study are to explore the relationships between conventional and soil-adjusted spectral vegetation indices (VIs), vascular plant biomass, percent vegetation cover, and moisture regimes in a tundra environment where exposed soil and gravel till have significant influence on the spectral response, and hence, the characterization of vegetation communities.

IKONOS multispectral data (4m resolution) were compared to Landsat 7 ETM+ data (30m resolution) for a study area in the Lord Lindsay River watershed on Boothia Peninsula, Nunavut. The former is thought to improve the delineation of tundra vegetation communities, and biophysical properties, characterized by small scale variations in moisture and topographic gradients. Coincident with image acquisition, extensive field data (e.g. percent cover, above-ground biomass, surface spectral characteristics) were collected for twelve 100m x 100m study plots to determine community composition. The normalized difference vegetation index (NDVI), the soil-adjusted vegetation index (SAVI) and the modified soil-adjusted vegetation index (MSAVI) were also investigated to evaluate the utility of soil-adjusted VIs that compensate for high degrees of soil reflectance.

Results suggest that vegetation community composition follows similar trends, but with somewhat lower productivity values, to previous Alaskan and Scandinavian biophysical remote sensing studies. Landsat 7 ETM+ data maintains superior spectral resolution, yet the spatial resolving power of IKONOS data proves useful in delineating within-plot microsite

variations. The utility of soil-adjusted VIs seems limited to moist communities, as there is no significant difference from NDVI over a range of cover types. Vascular plant biomass cannot be related to VIs, but moisture and percent cover are highly correlated with both types (i.e., NDVI and soil-adjusted VIs). Linear regression analysis provides a useful means of modeling percent cover variations over the entire study area. Improving estimates of vegetation community composition, distribution, and biomass are essential to determining a baseline for monitoring or modeling future changes that may follow trends of global climate change.

Dedicated to Joan Guy, and Claire Rondeau...



...in memory of their lifelong perseverance and positive outlook.

Acknowledgements

There were so many people involved in the process of creating this thesis to whom I am forever indebted, and thankful for their time and support.

I wish to thank my supervisor, Dr. Paul Treitz, for providing me the opportunity to work on this project, and to experience the Arctic from a scientific, social scientific, and personal perspective. It was a life-altering experience that I will never forget. Much appreciation is also extended for his generous financial support, his patience, and all the effort he put in to ensure the timely completion of this project. Paul, I can't thank you enough.

I wish to thank Dr. Dennis Jelinski for providing comments from an ecological perspective. I also want to thank Dr. Scott Lamoureux for his suggestions on field campaign planning and providing valuable insight throughout this process. Dr. Gerry Barber and Dr. Mark Rosenberg provided much appreciated help with statistical analyses.

Many thanks go to Craig Sheriff, Andrew Forbes, and Paul Treitz for their field sampling assistance. The Queen's Department of Geography faculty members and students are acknowledged for their support, where notable individuals include: Valerie Thomas, Kevin Lim, Nicole Gombay, Dr. Brandon Beierle, Jaclyn Cockburn, Ian Caldwell, Mark Publicover, Dr. Peter Goheen, Dr. Harry McCaughey, and Dr. Evelyn Peters. The hospitality of Peter and Deborah Maguire and Maureen Tourino made the stay in Taloyoak, Nunavut, delightful, while working with Sarah Takolik, Gina Pizzo, and the Hamlet of Taloyoak was a tremendous learning experience and a great honour. Valuable methodological suggestions were provided by Dr. Phil Teillet (Canada Centre for Remote Sensing), Dr. Jerry Arp (SpaceImaging), Dr. Esther Lévesque (Université de Québec à Trois Rivières), and Dr. Donald Walker (University of Alaska – Fairbanks). Plant identification was greatly improved by Dawn Pier (formerly with Department of National Defense).

Financial support was provided by: a National Science and Engineering Research Council (NSERC) grant (Dr. Paul Treitz), a NSERC PGSA fellowship (Gita Laidler), a Natural Resources Canada (NRCan) Earth Systems NSERC Supplement, the Northern Scientific Training Program (NSTP), and Queen's University TAships. Logistical support was provided by: the Polar Continental Shelf Project (PCSP), and the Nunavut Research Institute (notably Rick Armstrong and John McDonald).

To my family and friends who have encouraged me throughout, thank you. To the Queen's University Women's Varsity Volleyball team, thanks for keeping me sane. To my parents, Chris and Gail Laidler, who have supported me through my loftiest of goals and all related tribulations, I am truly grateful. To Vladimir Ljubicic, who continues to be my rock, thanks for your unwavering support, inspiration, and understanding.

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