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PREVIEW

**CHARACTERIZING THE IMPACT OF VEGETATION-WATER INTERFACES  
AS THEY AFFECT COMPOSITE SPECTRAL SIGNALS**

by

Stuart K. McFeeters

A DISSERTATION

Presented to the Faculty of

The Graduate College at the University of Nebraska

In Partial Fulfillment of Requirements

For the Degree of Doctor of Philosophy

Major: Geography

Under the Supervision of Professor Donald C. Rundquist

Lincoln, Nebraska

December, 2000

UMI Number: 9997014

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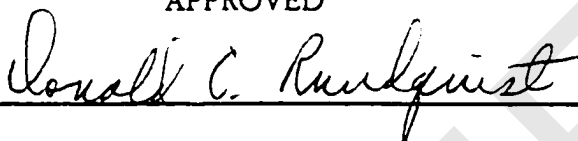
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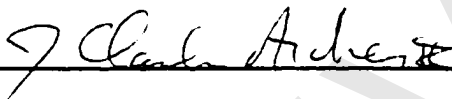
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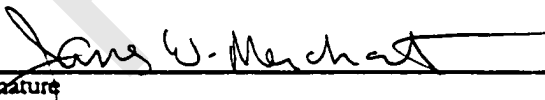
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GRADUATE COLLEGE  
UNIVERSITY OF NEBRASKA

# CHARACTERIZING THE IMPACT OF VEGETATION-WATER INTERFACES AS THEY AFFECT COMPOSITE SPECTRAL SIGNALS

Stuart K. McFeeters, Ph.D

University of Nebraska, 2000

Adviser: Donald C. Rundquist

Wetlands are important to the environment because they perform many hydrologic and chemical “cleansing” functions and provide habitat for a variety of plant and animal lifeforms. It seems essential to measure and to monitor the variable proportions of open standing water versus emergent macrophyte vegetation, to more effectively monitor environmental change, to better model its contribution to greenhouse gas production and to improve the accuracy of landcover classifications of wetland communities involving digital aircraft or satellite data.

The research focused on using both close-range spectral and satellite image data to innovate new methods to delineate emergent macrophyte vegetation within a water background.

The close-range experiments investigated the relationship between close-range, hyperspectral and broad, multi-band reflectance patterns and their derivatives associated with varying densities of selected species of potted emergent macrophyte vegetation over a water surface. The magnitude of the near infrared reflectance in both the hyperspectral and multi-band data was found to be

profoundly affected by the presence of water beneath the plant canopy.

Hyperspectral derivative spectra near 720 nm and multi-band derivative spectra centered near 745 nm were both found to be highly correlated to changing percent cover. A hyperspectral reflectance ratio composed of a NIR band divided by a red light band and two, broad-band, NDVI-based models and a broad-band NIR/RED reflectance ratio were also compared to percent cover of plant canopies and were shown to be very useful in delineating sparse stands of emergent macrophyte vegetation in a water background.

Satellite image data of a portion of the western Nebraska Sandhills (containing several freshwater wetland communities) were used in an unsupervised classification program (ISODATA) to determine how to best delineate emergent vegetation from a water background. In general, the unsupervised classification of first derivative bands best delineated emergent macrophyte vegetation from other aquatic and terrestrial classes, regardless of the values of selected user-defined program inputs. Using only reflectance data resulted in over-estimations of open water and possible over-estimations of certain emergent vegetation communities.

## **Acknowledgments**

In all of my studies, I have come to discover many truths. Some of these truths were found in books, some were found by experimentation, while others were found as the result of many hours of contemplation. One of the most important truths that I found is that no person who undertakes the pursuit of an educational degree, particularly an advanced degree, is able to obtain it on their own. It doesn't matter how skilled or talented the person is, he or she simply cannot do everything by him or herself, the person needs assistance. Some of this assistance to the student may be in the form guidance from faculty, help in data collection, or data analysis, or even in the writing of manuscripts, but I would suggest that the majority of the assistance comes from the students friends and family in the sharing of kind words over a cup of coffee, or the arm to lean on, or the prayers on behalf of the student for God's leading and strength to enable the student to finish their program. I have come to discover that I too needed such assistance to complete my degree program at UNL. There have been many people who have touched my life since my arrival here in Lincoln, Nebraska back in August 1990. I regret that I cannot include all of their names here, but I feel that it is necessary for me to express my thanks to several of the key individuals who have played such a large part in my pursuit of my doctoral degree.

I wish to express my gratitude to my committee members, Dr. Donald Rundquist, who served as Chair and who helped guide my dissertation research, Drs. Archer and Merchant who served as Readers, Dr. Blad who served as the



Outside Member and Dr. Dewey who has served the first Chair of my committee.

I wish to thank my fellow "CALMITeers" Deb DeMarey, Bryan Leavitt, Dave Derry, Rick Perk, Brian Tolk, and Asad Ullah for their assistance in data collection and processing.

I also wish to express my gratitude to my other Lincoln friends, Dan and Natalie Becker, Veva Cheney, Marie Dvorak, and Amy Richert for all of their support during my journey.

I would also like to thank Bernice Goeman and Jerry Leach (presently affiliated with the Conservation and Survey Division at UNL) and James Wier (formerly of CSD) for their support and willingness to answer my seemingly endless questions.

I wish to express my heartfelt thanks to my family in Fresno, CA. my father, James McFeeters, Sr., my sister Peggi and her husband Jim Mitchell, their children Joshua, Benjamin Katie and Jeffrey, and also my brother James McFeeters, Jr. They have not seen very much of me during the period of my studies here in Lincoln, but I am very grateful for all of the support that they have given me during that time. I would also like to thank my aunt Peggy Berg who loaned me enough money so that I could stay in Lincoln and finish my degree. I wish to thank my friends from UNL, Darla Juhl, Cheryl Kapa, Deirdre Collins, MaLinda Hill and Faisal Hussain, for all of the support that they have given to me over the years and for also showing me that the truth is indeed out there. I wish to thank my friends from Fresno, CA., Everett Chesnut, Uri Cohen, Gordon Ewy and John Trauger, for all of the support that they

have given to me and for always believing that I would be a 'Chosen One'. A special thanks to my friend Kris Lynn who seems to have made it a habit of helping me to get a job once I've graduated from college with another degree.

I wish to extend my thanks to my church family at First Mennonite Church in Lincoln, NE. who opened their hearts and let me share my life with theirs. I wish to extend special thanks to Marvin Gerritse, a man of simple, yet profound faith in God, who showed me what true friendship is all about.

I also extend my thanks to my church family at Mennonite Community Church in Fresno CA. who have always supported me in all of my educational endeavors from my attendance at Theodore Roosevelt High School to my doctoral program here at UNL. Special thanks to Nancy Wienbrenner who not only has been my very good friend, but who has also kept me informed about what has happened at the church.

I would also like to thank Dr. Jack Paris (CSU-Monterey Bay, The Spatial Information, Visualization and Analysis Resources Center) who first introduced me to remote sensing, Dr. Stanley Norsworthy (CSU-Fresno, Geography) who instructed me in my first college-level geography course and who has provided me with one of the best examples of devotion to family and to his "Professional Calling", Dr. Donald "Doc" Morgan (formerly of CSU-Fresno, Geography) who was so very helpful to me in my Master of Arts program and who was also a source of inspiration to me as to what it means to be a good teacher. William Slusser (CSU-Fresno, Geography) a technical wizard who was always one step ahead of

everyone in everything that he did.

It is often said that nothing good comes cheap and such is especially true when it comes to the pursuit of a college degree.

I wish to express my thanks to Dr. Donald Rundquist who has provided me with all of the resources that I needed to complete my dissertation research. I am also grateful to the folks at the Conservation and Survey Division the support that they provided to me during my graduate program.

I wish to acknowledge funding support that was provided to me during the early stages of my dissertation research by the Nebraska Space Grant Consortium and also by the National Institute for Global and Environmental Change.

I also wish to extend my thanks to Bob Lonn (formerly of UNL Engineering Library) who not only gave me a job working at the library when I really needed one in 1996, but who also provided me with many words of encouragement as I progressed through my program. I also wish to thank Dave DeLashmutt, the Assistant Manager at the Selleck Residence Hall Facilities Operations, for going out of his way to make sure that I had a job at the Abel-Sandoz Residence Complex during the summer of 2000 working for Jolene Deinert, his counterpart there, and also a job working for him at Selleck during the fall of 2000. I would have had a much more difficult time finishing my dissertation without such financial support and the flexibility in my work schedule made it very easy to arrange meetings with my graduate committee members. I would also like to thank the many people of the Abel-Sandoz and Selleck Facilities Operations Custodial Staff from whom I learned

much, including the right way to clean stains from carpets. It was certainly a “Break-Thru” in my education and an “Unbelievable!” experience. I shall always remember my times with all of you with great fondness.

I am also grateful to the musician Stevie Nicks for sharing her music with the world and for providing me with hours of listening pleasure as I wrote this dissertation.

I wish to offer my special thanks to Deb DeMarey for being such a good friend and also for being so willing to share her botanical expertise with me. I am very grateful to her for the many hours that she spent helping me get my dissertation done.

PREVIEW

This dissertation is dedicated to the memory of my mother, Marion McFeeters, who had always wanted me to “..go to school and learn all that you can so that you can become a doctor.”

PREVIEW

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