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EFFECTS OF SPATIAL RESOLUTION AND LANDSCAPE STRUCTURE ON LAND COVER CHARACTERIZATION

by

Wenli Yang

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 James W. Merchant

Lincoln, Nebraska

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DISSERTATION TITLE

Effects of Spatial Resolution and Landscape Structure on Land Cover Characterization

BY

Wenli Yang

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GRADUATE COLLEGE
UNIVERSITY OF NEBRASKA

EFFECTS OF SPATIAL RESOLUTION AND LANDSCAPE STRUCTURE ON LAND COVER CHARACTERIZATION

Wenli Yang, Ph.D.

University of Nebraska, 1997

Advisor: James W. Merchant

This dissertation addressed problems in scaling, problems that are among the main challenges in remote sensing. The principal objective of the research was to investigate the effects of changing spatial scale on the representation of land cover. A second objective was to determine the relationship between such effects, characteristics of landscape structure and scaling procedures. Four research issues related to spatial scaling were examined. They included: 1) the upscaling of Normalized Difference Vegetation Index (NDVI); 2) the effects of spatial scale on indices of landscape structure; 3) the representation of land cover databases at different spatial scales; and 4) the relationships between landscape indices and land cover area estimations.

The overall bias resulting from non-linearity of NDVI in relation to spatial resolution is generally insignificant as compared to other factors such as influences of aerosols and water vapor. The bias is, however, related to land surface characteristics. Significant errors may be introduced in heterogeneous areas where different land cover types exhibit strong spectral contrast. Spatially upscaled SPOT and TM NDVIs have information content comparable with the AVHRR-derived NDVI. Indices of landscape structure and spatial resolution are generally related, but the exact forms of the

relationships are subject to changes in other factors including the basic patch unit constituting a landscape and the proportional area of foreground land cover under consideration. The extent of agreement between spatially aggregated coarse resolution land cover datasets and full resolution datasets changes with the properties of the original datasets, including the pixel size and class definition. There are close relationships between landscape structure and class areas estimated from spatially aggregated land cover databases. The relationships, however, do not permit extension from one area to another. Inversion calibration across different geographic/ecological areas is, therefore, not feasible. Different rules govern the land cover area changes across resolutions when different upscaling methods are used. Special attention should be given to comparison between land cover maps derived using different methods.

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