Indiana Impervious Surface Mapping Initiative (INISMI)

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Objectives: The long-term goals of this project are two folds: (1) to develop a general approach to map impervious surface in Indiana by employing satellite multispectral imagery and monitor the changes over time; and (2) to provide state and local officials with the impervious surface data and with the technical support and knowledge to integrate imperviousness into their water quality management and urban planning measures. This Initiative (INISMI) focuses on mapping of impervious surface in the metropolitan area of Indianapolis, establishing partnership with relevant government agencies, and developing methodology for statewide mapping in the future. The Initiative is a result of inter-institutional collaboration between Indian State University, Indiana University, and Purdue University. Traditional method of assigning percent impervious surface coefficients as a function of land cover type has clear limitations: inability to provide continuous data for the functional classes and data inconsistency. This research develops a methodology for direct estimation of percent impervious surface at the pixel level of satellite multispectral imagery. This project will be implemented in the following steps. First, spectral mixture analysis of satellite imagery will be conducted. Then, impervious surface will be estimated based on the spectral relationship between albedo and impervious surfaces. Next, land use/cover information will be extracted. Finally, different types of impervious surfaces will be separated by analysis of image texture. Fieldwork will be carried out to provide "ground truth" data on land use/cover types and impervious surfaces.

Significance: The proposed research will expand knowledge of urban development, and improve understanding of the significance of impervious surface in water quality, surface runoff, and interface energy exchange. The establishment of the relationships between urban morphology and environmental and biological processes makes it possible for better scientific understanding of how human and physical environment have interacted to drive global environmental changes. The scientific procedure developed is applicable to other cities in the world. Remote sensing technology will be demonstrated to be capable of providing consistent, continuous impervious surface estimates over the space and time. The imperviousness information derived from remote sensing data for rapidly growing cities has direct applications to urban planning. The data sets generated will also be of value for civic and environmental applications, and for management of the effects of urban related activities. This research will enhance post secondary education by developing a class module for undergraduate and graduate students and by involving them in the project. Through collaborations between Indiana State University, Indiana University, Purdue University, and government agencies, the proposed research will strengthen already strong research in earth system science and applications in the participating organizations.

Impervious surface maps of Indianapolis (A: the map based on addition of high-albedo and low-albedo fraction images; B: the refined map by using land surface temperatures)