An Adaptive Landscape Classification Procedure Using Geoinformatics and Artificial Neural Networks
abstract

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The Adaptive Landscape Classification Procedure (ALCP), which links the advanced geospatial analysis capabilities of Geographic Information Systems (GISs) and Artificial Neural Networks (ANNs) and particularly Self-Organizing Maps (SOMs), is proposed as a method for establishing and reducing complex data relationships. Its adaptive and evolutionary capability is evaluated for situations where varying types of data can be combined to address different prediction and/or management needs such as hydrologic response, water quality, aquatic habitat, groundwater recharge, land use, instrumentation placement, and forecast scenarios. The research presented here documents and presents favorable results of a procedure that aims to be a powerful and flexible spatial data classifier that fuses the strengths of geoinformatics and the intelligence of SOMs to provide data patterns and spatial information for environmental managers and researchers.

This research shows how evaluation and analysis of spatial and/or temporal patterns in the landscape can provide insight into complex ecological, hydrological, climatic, and other natural and anthropogenic-influenced processes. Certainly, environmental management and research within heterogeneous watersheds provide challenges for consistent evaluation and understanding of system functions. For instance, watersheds over a range of scales are likely to exhibit varying levels of diversity in their characteristics of climate, hydrology, physiography, ecology, and anthropogenic influence. Furthermore, it has become evident that understanding and analyzing these diverse systems can be difficult not only because of varying natural characteristics, but also because of the availability, quality, and variability of spatial and temporal data. Developments in geospatial technologies, however, are providing a wide range of relevant data, and in many cases, at a high temporal and spatial resolution. Such data resources can take the form of high-dimensional data arrays, which can difficult to fully use. Establishing relationships among high-dimensional datasets through neurocomputing based patterning methods can help 1) resolve large volumes of data into a meaningful form; 2) provide an approach for inferring landscape processes in areas that have limited data available but that exhibit similar landscape characteristics; and 3) discover the value of individual variables or groups of variables that contribute to specific processes in the landscape.