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LaDy: software for assessing local landscape diversity profiles of raster land cover maps using geographic windows

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Abstract

Landscape ecology starts from the assumption that diversity and spatial arrangement of ecosystem mosaics have ecological implications and tries to understand the interactions between diversity and structure of large spatially heterogeneous areas and their ecological functions. These assumptions imply effective use of earth observation techniques and geographic information systems, enabling a global view of the landscape mosaics. In this paper, a software, LaDy (Landscape Diversity Software), for computing Rényi's local landscape diversity profile on raster land cover maps is presented. LaDy is based on the use of Merchant's adaptive geographic window, which is designed to operate on a neighborhood of patches instead of a fixed rectangular neighborhood of pixels (the conventional approach in image analysis).
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1. Introduction

Diversity is an essential factor in maintaining landscape function, so its conservation and management are important issues of landscape planning. However, quantifying coarse-scale biological diversity is a complex task. Direct measures of species diversity over broad areas are neither possible nor meaningful. For large regions, it is unlikely that we will ever have a complete species list, even for sedentary organisms such as plants. This is partly because the species in a region change with time, but also because researchers cannot possibly inspect all the individuals in a region.

Instead, since species diversity is correlated, though in a complex and noisy way, to environmental variables (Whittaker, 1972; Austin, 1999), the issue may be addressed through indirect indicators of species diversity. In general, a high diversity of environments will lead to a high diversity of species. This phenomenon is so intuitively clear that it is difficult to dispute. Although the number of environmental variables that can influence species distributions is potentially infinite, a number of studies have demonstrated the importance of land cover as a major determinant of type and number (Harner and Harper, 1976; Tonn and Magnuson, 1982). In this respect, it is widely recognized that land cover maps as derived from remote sensing data can be used as powerful indirect indicators of species distribution providing increased opportunities to develop quantitative models on the relationship between species diversity and the diversity of the land cover (Bibby, 1986; Palmeirim, 1988; Avery and Haines Young, 1990; Noss, 1990). As a result, there are now literally dozens of indices to quantify various aspects of landscape diversity from grid-based land cover maps (Baker and Cai, 1992; MacGarigal and Marks, 1995; Riitters et al., 1995).

However, although on an intuitive basis, landscape diversity would apparently seem the most unambiguous and easily studied of ecological concepts, nonetheless,

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