The shadowing of avian density: scalar effects of vegetation on bird abundance

Erica Schwartzmann¹ and Jason Walker²
Arizona State University
Global Institute for Sustainability
ericaschwartzmann@asu.edu

Abstract
In this study we analyzed the scalar effects of vegetation coverage on avian density across the CAP LTER study region, encompassing desert and urban ecosystems. We expect based on our preliminary work that there is a specific scale that birds are more likely to exploit vegetation abundance. Bird diversity and density were surveyed at 40 sites quarterly during 2003. We compiled overall bird count estimates in order to estimate general avian density. Buffers were constructed to around these points, each with increasing radius of 0.5km. Within these buffers, vegetation coverage was extracted by an object-oriented remote sensing classification scheme conducted on high-resolution (0.6m²) aerial photography captured in April 2003. This classification was subset at a variety of scales in order to determine which scale of vegetation best determines avian density. Findings from the analysis suggest: (1) there is a significant relationship between vegetation coverage and avian density at all scales and; (2) birds react to vegetation coverage at localized more so than regionalized scales.

Analysis
We employed an object-oriented approach to classify urban vegetation through a hybrid of image segmentation and rule-based classification. To more accurately estimate real world objects, the image was apportioned into basic units for analysis at the object-appropriate scale before classification can occur through a process of segmentation (b). Segmentation was conducted based on contextual information (i.e. within-pixel spectra values and patch texture) as well as neighborhood characteristics making possible the extraction of real-world objects, proper in shape, as the basic units for analysis. Following segmentation, the objects were subjected to an urban forest classification scheme (c) developed for high-resolution (0.61m), true-color (red, green, blue), aerial photography. The outset of this procedure produces a binary matrix where the entire raster set is classified highlighting the elements of the urban forest for the specified areas. To determine the accuracy of the classification, an extensive groundtruthing campaign was conducted. Subsequent analysis of commission errors indicated a user’s accuracy of woody vegetation of 0.96, indicating that 96% of the objects identified as woody vegetation were, indeed, trees or shrubs.

Simple regression comparing the relationship between vegetation coverage and bird abundance was performed on a multiple series of scales at a variety of radii from the bird count point (i.e. 0.5, 1.0, 1.5,…,10.0 km). From the twenty simple regressions conducted the above figures represent two examples. Note: all regressions were significant α=0.01.

Acknowledgments: We thank Dr. Margaret Nelson and the Community of Undergraduate Research Scholars (COURS) program in conjunction with the IGERT in Urban Ecology for providing support for this project. We also thank all those who have identified the countless numbers of birds: Mike Baker, Adam Burdick, Katherine Clemens, Kathy Groschupf, Bill Higgins, Tom Hulen, Jill Jones, Roy Jones, Jodi Lemmer, Susannah Lerman, Christopher Putnam, Beverly Rambo, Diana Stuart, and Suzanne Winckler.