Goldilocks and the Raster Grid: Scale and the Evaluation of Forest Conservation

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Abstract

Access to high quality spatial data raises fundamental questions about how to select the appropriate scale and unit of analysis. Studies that evaluate the impact of conservation programs have used multiple scales and areal units: from 5x5 km grids; to 30m pixels; to irregular units based on land uses or political boundaries. These choices affect the estimate of program impact. The bias associated with scale and unit selection is a part of a well-known dilemma called the modifiable areal unit problem (MAUP). We introduce this dilemma to the literature on impact evaluation and then explore the tradeoffs made when choosing different areal units. To illustrate the consequences of the MAUP, we begin by examining the effect of scale selection when evaluating a protected area in Mexico using real data. We then develop a Monte Carlo experiment that simulates a conservation intervention. We find that estimates of treatment effects and variable coefficients are only accurate under restrictive circumstances. Under more realistic conditions, we find biased estimates associated with scale choices that are both too large or too small relative to the data generating process or decision unit. In our context, the MAUP may reflect an errors in variables problem, where imprecise measures of the independent variables will bias the coefficient estimates toward zero. This problem may be pronounced at small scales of analysis. Aggregation may reduce this bias for continuous variables, but aggregation exacerbates bias when using a discrete measure of treatment. While we do not find a solution to these issues, even though treatment effects are generally underestimated. We conclude with suggestions on how researchers might navigate their choice of scale and aerial unit when evaluating conservation policies.