PREDICTING CONDITION OF SMALL ESTUARINE SYSTEMS ALONG THE UNITED STATES' ATLANTIC COAST

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Abstract

Anthropogenic activities are known to degrade the ecological condition of estuaries. Also, numerous studies find links between landscape structure and estuarine condition. From these relationships, it is possible to build reliable, predictive models of estuarine condition. In this study, I examined issues of data quality, scale, and statistical approach to developing predictive models of estuarine sediment metal concentrations in the Mid-Atlantic region of the United States. I assessed the accuracy of the National Land Cover Dataset (NLCD) at multiple scales by comparing it with reference data from Rhode Island and Massachusetts. Area of developed lands, agriculture, forest and water had acceptable accuracy at all but the finest scales (i.e., accurate for sampling units greater than $10 km^2$). Rangeland, wetland, and barren were consistently, poorly classified. Appropriate scales for modeling landscape structure and estuarine sediment metal concentrations are often determined on a per-study basis. I varied the spatial extent used to calculate landscape structure and assessed linear relationships between estuarine sediment metal concentrations and the total area of developed and agricultural lands at each scale. Area of developed lands was consistently related to sediment metals while total agricultural land was not. Developed land had strongest associations with lead and copper; weakest with arsenic and chromium; and moderate with cadmium, mercury, and zinc. All metals showed negative scaling trends, but only lead and zinc were significant. Landscape structure within 15-20 km from a sampling station may be most important for describing the relationship between developed land and estuarine sediment metals. Lastly, with information-theoretic approaches I assessed multiple models containing pollution sources and estuarine characteristics and made predictions with model-averaging techniques. Total developed land and percent silt/clay of estuarine sediment were most important for all metals. Estuary area, hydrology, and total agricultural land varied in their importance. The model-averaged predictions explained 78.4%, 70.5%, 56.4%, and 50.3% of

the variation for copper, lead, mercury, and cadmium respectively. Overall prediction accuracies of the Effect's Range values were 83.9%, 84.8%, 78.6%, 92.0% for copper, lead, mercury, and cadmium respectively. I conclude that combining broad-scale data with information-theoretic approaches is an effective technique for predicting condition of small estuarine systems.