

DO ABRUPT CHANGES IN STREAM DIATOMS REFLECT ECOLOGICAL THRESHOLDS?

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Variation in watershed land use is known to influence the physical and chemical conditions in streams that reside within their boundaries. However, few studies have evaluated variation in ecosystem structure and function as it may relate to specific thresholds in land use and nutrient concentrations. We test two hypotheses here. First, benthic chlorophyll exhibits an inverse relationship with watershed forest cover among streams, such that abrupt changes are evident. Second, abrupt changes in diatoms species composition occurs as a function of forest cover, whereby guilds of nutrient sensitive species are replaced by tolerant species. To test these hypotheses, we conducted seasonal sampling (spring, summer, and fall of 2005-2006) in 43 third order streams across the state of Pennsylvania. Stream physical, biological, and chemical conditions were measured through 28 variables, in addition to benthic chlorophyll concentrations and the relative abundance of diatom species collected from each stream ecosystem. Watershed forest cover explained significant variation in stream benthic chlorophyll (stepwise linear regression, $r^2= 39.2\%$) as selected from a set of relevant variables (TN, TP, % Forest cover, % Agriculture, and stream temperature). Benthic chlorophyll and nutrient tolerant diatom guilds had a negative correlation with forest cover, while nutrient sensitive diatom species had a positive correlation. Regression tree analysis indicated abrupt changes in benthic chlorophyll and diatom guild relative abundance at average thresholds of 60% and 82% forest cover. Despite the correlative nature of this study, the findings here suggest individual ecosystems may exhibit abrupt changes in ecosystem function following declines in forest cover, particularly at the thresholds identified herein.

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