

Diatom communities and metrics as indicators of urbanization effects on streams and potential moderation by landscape green infrastructure

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Diatoms are very useful and important indicators of anthropogenic impacts on streams because they are the foundation of primary production and are responsive to nutrients, conductivity, and habitat conditions. We characterized relationships of diatom assemblages with water chemistry and land cover for 160 sites in New England. Diatom community structure was strongly related to urban land cover in upstream watersheds, conductivity, and concentrations of P and N. Diatom metrics indicative of high or low nutrient concentrations, high conductivity, altered hydrology, and sedimentation were significantly correlated with land cover in upstream watersheds and changes in community structure. Threshold Indicator Taxa Analysis and nonparametric change-point analysis identified impervious cover (IC) thresholds around 3% at which substantial changes in diatom community structure occurred. Boosted regression trees (BRTs) showed that diatom metrics had similar threshold responses from 1-5% IC, at which low nutrient and sensitive taxa decreased in relative abundances and high nutrient, high conductivity, motile, and prostrate taxa increased in relative abundances. Interaction plots of BRTs indicated that maintaining >65-80% green infrastructure in 120 m near-stream buffers could potentially reduce watershed IC effects on diatom assemblages by 20-25%. High conductivity diatoms and motile diatoms greatly increased with less GI in buffers and were less affected by watershed % IC, potentially indicating that disturbed areas with near proximity to streams contributed more salts and sediments than areas farther away. Restoring and maintaining near-stream green infrastructure may effectively benefit stream condition in urban areas and reduce watershed impervious cover effects on diatom communities.