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Changes in Tree Species in Riparian Zones of Urban Streams May Have Effects on Restoration and Storm Water Control Efforts.

Research Value:

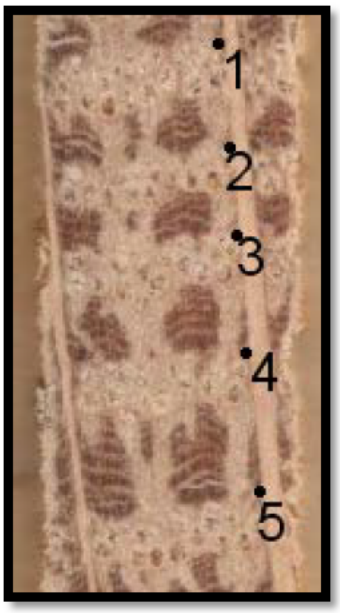
A riparian zone is the land and vegetation within and directly adjacent to surface water ecosystems, such as lakes and streams. The vegetation in riparian zones provides ecosystem services to communities to help them remain sustainable; services such as reducing flooding and bank erosion and reducing levels of pollutants in streams. So, a healthy riparian zone benefits a community economically by reducing property damage, increases the quality of life by providing more recreational opportunities for people and habitat for a diverse community of terrestrial and aquatic animals, and helps protect public health by aiding in pollution control. Riparian zones are considered green infrastructure in similar fashion as things like green roofs and rain gardens because they provide the same kind of ecosystem services.

In cities such as Cincinnati, OH and Baltimore, MD, tree species characteristic of lowland areas have disappeared from urban riparian zones and have been replaced by typical upland tree species [1,2]. This change in tree species could affect the riparian zones by making them less effective at flood control and at providing quality habitat for organisms such as stream fish.

Differences in hydrology and pollution in urban vs. rural areas are prime suspects for this change in tree species near streams in urban areas. By sorting out which stressors are more likely the cause of this change in species, this study can provide useful information to those trying to preserve and restore riparian zones in their communities.

Research Background:

Ozone in smog at ground level in the troposphere (as opposed to the protective ozone layer in the stratosphere), is a pollutant that may be responsible for the disappearance of some ozone-sensitive lowland tree species[3] in urban areas. Though once at high concentrations in smog, ground-level ozone concentrations have been lowered in many cities, likely through EPA-developed regulations in the Clean Air Act, first enacted in 1963.



Magnified image of a tree core from a chestnut oak. Numbers on the image show the annual rings.

If the shift towards upland species is due to decades of high ozone exposure prior to regulation, then restoring lowland species to urban riparian zones may once again be of hydrologic benefit. However, if the same species shift was due to lower water tables and more severe droughts in urban areas, then replanting urban riparian

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zones with lowland species would not be successful.

By analyzing annual growth rings of trees to see if patterns are evident in growth associated with location or years, this study may separate the effects of urban pollution from persistent hydrologic changes such as drought.

The growth and species abundance data from the urban and rural riparian zones in Baltimore and Cincinnati will be used to shed light on the following question:

What are the roles of ground-level tropospheric ozone and urban hydrology in determining riparian tree species composition?

Outcomes and Impacts:

Results of this study, which was begun in 2010, are expected to be available by late 2011. When the study is completed, the results of this investigation have implications beyond these two cities. This research has potential impact on the conservation of riparian zones and storm water management, both of which are critically important to communities in terms of their economies and public health. This information can be useful to a number of community groups which are already working to preserve and restore their riparian zones. Follow-up studies that expand on the knowledge gained in this study are likely as well.

LAND RESEARCH PROGRAM WEB SITES: www.epa.gov/ord/lrp. www.epa.gov/nrmrl/lrpcd

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