LAND TRUST AND UNIVERSITY PROFIT FROM PARTNERSHIP: CASE STUDIES INVOLVING INVASIVE SPECIES AND DENDROCHRONOLOGY

Matthew R. Opdyke[1], Michael Good[2], and Ingrid Reiland[1]

Introduction

Allegheny Land Trust is a nonprofit organization in Pennsylvania whose mission is to serve as the lead trust conserving and stewarding lands that support the scenic, recreational and environmental well-being of communities in Allegheny County and its environs. It was incorporated in 1993 and protects more than 1,600 acres by acquiring property with the assistance of donations and grants. The land trust maintains a diligent effort to protect greenspace and organizes community activities such as native plantings and invasive species removal. It is volunteer driven and leans on the expertise of local universities to inform and guide their work. Additional information about Allegheny Land Trust can be found at *alleghenylandtrust.org*.

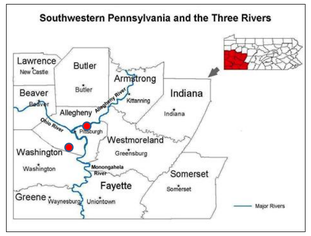
Collaborative Benefits:

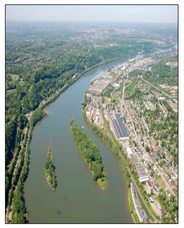
Land trusts benefit by having access to university resources such as faculty experts dedicated to research and education. Faculty are more likely to invest in long-term commitments than private consulting firms and can assist land trusts in obtaining conservation grants.

Universities benefit by accomplishing their missions of serving the community. Shared marketing between land trusts and universities attracts parents and students to a university that provides practical experiences.

Students gain real-life experience working in the environmental field, with opportunities in networking, conference attendance and publishing. Students who participate in faculty research and internships are more likely to obtain jobs right out of college.

Site Descriptions





Wingfield Pines

Wingfield Pines is located in the southwestern corner of Allegheny County. It is an 80-acre parcel of floodplain and wetlands along the banks of Chartiers Creek.

Allegheny Land Trust purchased the property in 2001. Wingfield Pines was strip mined in the 1940s and was operated as a swim club and golf course between 1968 and 1983, after which it was abandoned for 18 years.

In 2009, Allegheny Land Trust installed a passive wetland treatment system at the northern end of the property to treat underground abandoned mine effluent that surfaced on the site. The treatment system displaced 1.25 acres of wetland. Allegheny Land Trust proposed the enhancement of the southern wetland area to compensate for the displaced wetland. Saplings and shrubs were planted in the southern wetland to restore native vegetation, and Point Park University has been monitoring the establishment of wetland vegetation since 2009.

Sycamore Island

Sycamore Island is located in the Allegheny River near Blawnox and is the last remaining privately owned undeveloped island in Allegheny County. The 14-acre island hosts a unique floodplain hardwood forest, with a maximum elevation of 28 feet above the river.

Allegheny Land Trust acquired the property in 2008. Plans for the development of a marina on the island were initiated during the late 1960s but were later abandoned, leaving behind artifacts such as a partially installed swimming pool. During the last century, development and industrialization has contributed to the growth of the island, due in part to dredge spoiling and increased sedimentation.

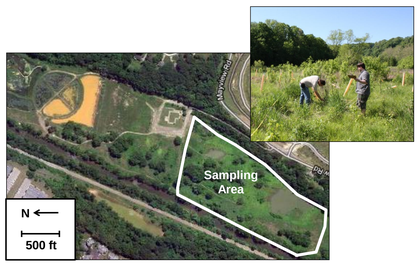
Saplings and shrubs were planted on the island to diversify the floodplain forest in 2013. In an effort to understand the role of hydrologic and climate stressors on tree growth, Point Park University recently began dendrochronology research.

Wingfield Pines: Case Study on Invasive Species

Methods

Herbaceous plant surveys are annually conducted at permanent sampling plots in July, which started in 2009. The surveys satisfy a requirement by the Pennsylvania Department of Environmental Protection to enhance wetland habitat as part of a project to install a passive wetland treatment system at Wingfield Pines.

Ten permanent sampling plots (1 m^2) are randomly established in a wetland enhancement area of 8.3 acres. Herbs are identified and percent cover is estimated at each plot. In addition, timed-meander surveys were conducted in May, July and September 2012 in which all flowering herbs were identified while meandering through the sampling area for one hour.



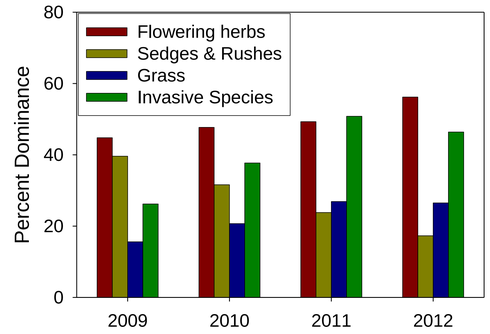
Results

Thirty-four species of herbs were identified during the timed-meander survey in May and September, and 48 species were identified in July.

	Percent of Species that were Invasive	Mean Floristic Quality Adjusted Index*
May	71	1.6
July	42	6.5
September	20	4.8

*A site that exhibits little to no disturbance has a value of 46.

In the permanent sampling plots, the percent dominance of invasive species increased from 26% in 2009 to a maximum of 51% in 2011. Because the majority of invasive species are flowering herbs, the increase resulted in an increase in flowering herbs. In response, sedges and rushes have declined from 40% to 17%.



Conclusion

Invasive species are detrimental to the naturalization of wetlands when outcompeting native herbs, resulting in a decrease in species diversity that can affect an entire food web. The establishment of invasive species is a concern at Wingfield Pines. Efforts to manage them include manual removal of purple loosestrife (*Lythrum salicaria*) and chemical treatment of multiflora rose (*Rosa multiflora*) and crownvetch (*Securigera varia*).

Creeping jenny (*Lysimachia nummularia*) is the dominant invasive species, accounting for nearly three-quarters of all invasives. Currently, there is no management plan for creeping jenny.

Sycamore Island: Case Study on Dendrochronology

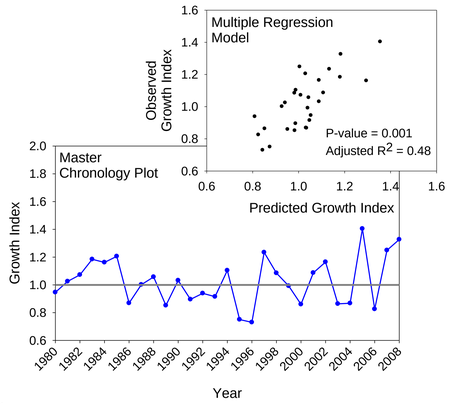
Methods

Two cores (core length = 40 cm) from each of seven American sycamore (*Platanus occidentalis*) trees were collected in March 2013. The trees were strategically chosen to account for variability in elevation and soil type on the island, as well as, having a trunk diameter greater than 30 cm. Ring widths were measured in the laboratory to a precision of 0.01 cm.

Ring widths of paired cores from the same tree were averaged and a best fit biological growth model was applied to calculate growth indices. The biological growth model applies an exponential equation, removing the age-related trend of decreasing trunk diameter with age to better analyze the influence of climate variables.

Cores from different trees were cross-dated against each other to assure that each ring width and climatic value is placed in its proper time sequence. A master chronology plot was made by averaging the cores of all trees. The mean series intercorrelation value in which each core was correlated against the master chronology plot was 0.64 (standard error = 0.05). An intercorrelation value >0.50 suggests accurate cross-dating.

	Mean (standard error)
Tree age (yrs)	39 (2.2)
Trunk diameter (cm)	51 (3.3)
Tree height (m)	30 (1.8)



Results

Stepwise multiple regression using R software was used to determine what model best predicts ring width as a linear function of climatic variables. The climatic variables analyzed in the model were from NOAA National Climatic Data Center, which included seasonal mean temperatures and total precipitation for the current and previous year of any given growth ring.

$$\text{Model} = 2.439 + 7.972e\text{-}5*P_{SP} + 1.212e\text{-}4*P_{SPY\text{-}1} + 1.189e\text{-}4*P_{W} + -7.562e\text{-}3*T_{SUY\text{-}1} + -6.177e\text{-}3*T_{SP}$$

P-value = 0.001; adjusted R^2 = 0.48

where

P_{SP} is total spring precipitation (March-May) for the current year
$P_{SPY\text{-}1}$ is total spring precipitation for the previous year
P_W is total winter precipitation (December-January) for the current year
$T_{SUY\text{-}1}$ is mean summer temperature (June-September) for the previous year
T_{SP} is mean spring temperature for the current year

Conclusion

Ring width was best predicted by spring precipitation of the current and previous year, as well as, winter precipitation. Water is essential for photosynthesis, growth promoters in apical meristem tissues and cell expansion. The greatest amount of precipitation falls during winter and spring in southwestern Pennsylvania, which are also critical periods of growth for trees.

Temperature impacts tree growth due to its influence on respiration and assimilation. The regression model suggests an inverse relationship between spring temperatures and summer temperatures of the previous year and ring width.

[1]Point Park University, 201 Wood St., Pittsburgh, PA 15222
[2]Allegheny Land Trust, 409 Broad St., Suite 206B, Sewickley, PA 15143

For further information contact Matthew Opdyke, Point Park University, 201 Wood St., Pittsburgh, PA 15222, email: mopdyke@pointpark.edu