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The impacts of Loblolly Pine (*Pinus taeda*) on native early successional plant communities

Introduction

Invasive and naturalized plant species have been established in North America for many reasons. Agricultural and ornamental purposes are the most common, but plants are also introduced for industrial purposes, wildlife food and habitat, and erosion control. Despite the reasons being, species that are planted outside of their native ecosystems can have very detrimental affects on native plant life.

The loblolly pine, *Pinus taeda*, is one such tree that is used for industrial purposes. This species has been planted in various locations throughout western Kentucky, the midwest, and southeast primarily for harvesting pulp wood and forest reestablishment. This particular pine has also been selected for plantation forestry since it has a relatively fast growth rate. As settlement and agriculture in the U.S. grew, higher quality soils were severely depleted and then abandoned (Warren and Rolfe 1978). As a result, southern pine species, such as loblolly and shortleaf pines, were successfully reestablished in highly disturbed sites where native hardwoods failed to recover because of low nutrient availability and soil runoff.

Pines in general have the tendency to be invasive, and consequently, have the potential ability to naturalize simply because of their life history traits. *Pinus* in particular have small seed masses, short juvenile periods, and short intervals between large seed crops (Richardson and Rejmanek 2004). These factors allow for seed dispersal over long distances, rapid population growth (especially under disturbance regimes) and early and consistent reproduction. Unfortunately, selecting any species for monocultural uses may cause natural ecosystem functions to be relinquished (Hedman et al. 1999).

The purpose of this study was to determine if the local biota that typically occur in early successional plant communities were negatively affected by the homogenization of regenerated loblolly stands in Western Kentucky, Northwestern Tennessee, and Southeastern Illinois. If this species continues to invade, native plant communities could be severely disrupted including threatened species that may inhabit these areas. In addition to the disturbance of landscape, other factors that might increase loblolly naturalization need to be verified as well. Are they more competitive in comparison to deciduous hardwoods? Is the soil in western Kentucky particularly favorable for loblolly growth? Finally, the relationship between mature loblolly stands and native hardwoods and herbaceous plants needs to be examined. Is this the result of too much canopy cover or changes in the soil composition causing native plant species to become intolerant of the invasive loblolly stands that have been established from mature, planted loblolly stands? Extensive field identification capabilities of all plant species are crucial for this study.

Seven locations with regenerated loblolly pines were selected and included two sites in Illinois, Crab Orchard National Wildlife Refuge (CONWR) and Shawnee National Forest, three in Kentucky, Perkins North tract owned by The Nature Conservancy and Land Between the Lakes National Recreation Area (LBL), and two sites in Tennessee, Tennessee National Wildlife Refuge and LBL. Also, seven adjacent locations containing early successional plant communities were also selected. Soil samples were also collected at each transect and will be compared to the neighboring transect as well.

The hypotheses for this study were the following; the diversity and abundance of vegetation would be greater in the control transects compared to the *P. taeda* transects and the soil pH and mineral content would be lower in the loblolly transects compared to the control transects.

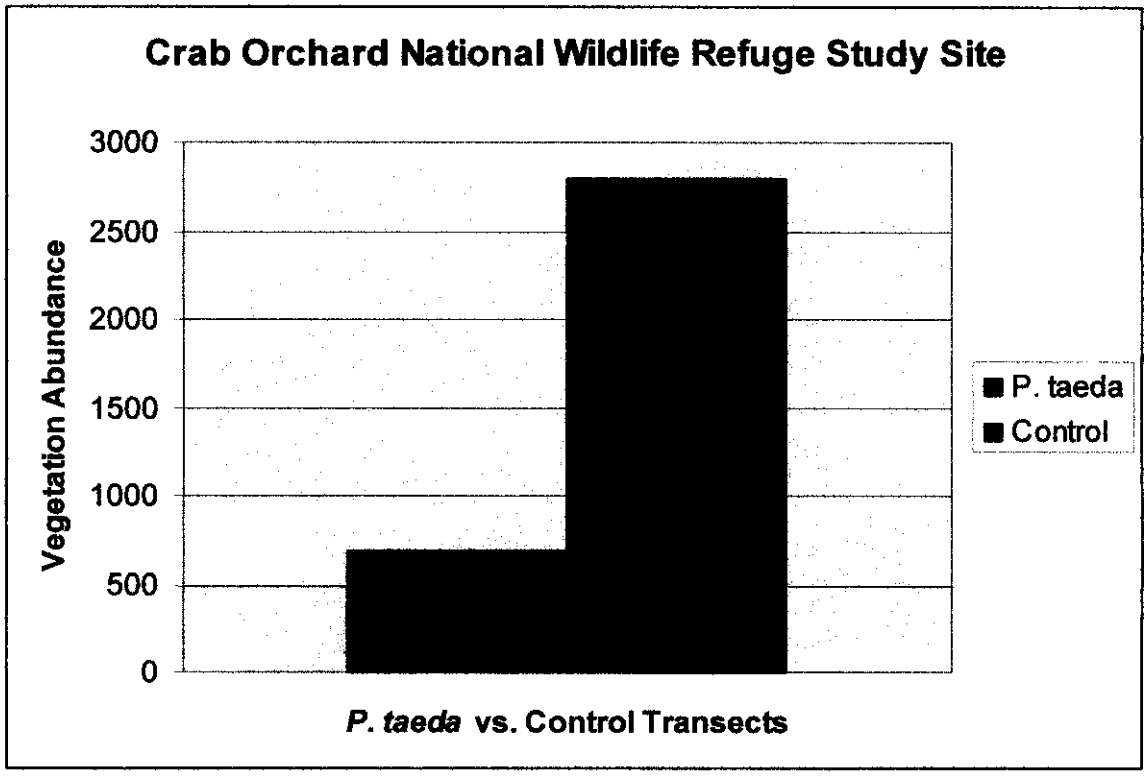
Methods

Every plant species and number of times it occurred were recorded within four separate 1x1 meter squares within each 10x10 meter square. Each 10x50 meter transect consisted of five of the 10x10 meter squares. As a result, 20 1x1 meter vegetation samples were taken per transect. Plant species diversity and abundance of each loblolly pine transect was then compared to the nearby control transect that contained early successional plants. A two-tailed t-test was conducted in order to determine if plant abundance was greater in the control transect.

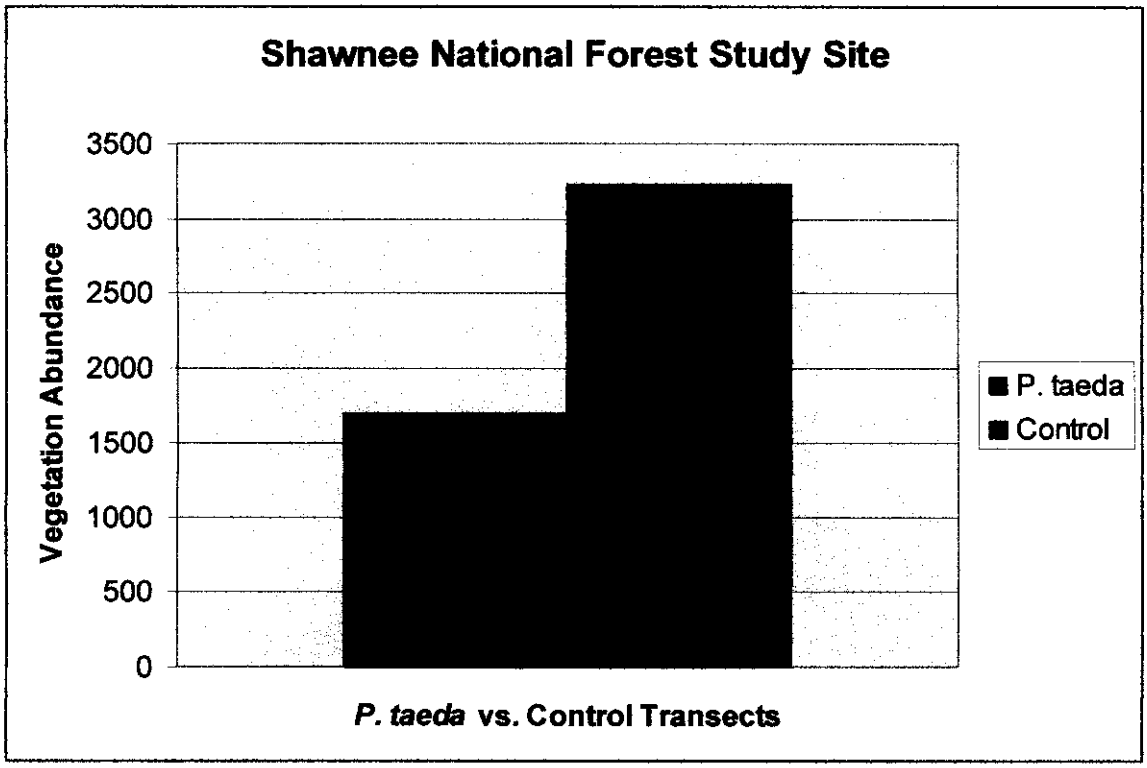
Two, 0-5 cm and two, 5-15 cm soil samples were collected per 1x1 m square. All of the samples of the same depth were pooled per 10x10 m square resulting in a total of five, 0-5 cm samples and five, 5-15 cm samples per transect. Soil samples were taken to the University of Kentucky Agricultural Lab in Princeton, KY to determine soil pH, and mineral contents and percentages.

Results

The results of the study for plant abundance were significant for the Crab Orchard National Wildlife Refuge site with a p-value of 0.000875. However, the results for the site at Shawnee National Forest were insignificant with a p-value of 0.377217.



Graph 1. This graph depicts the comparison of vegetation abundance between the *P. taeda* and the control transects in the Crab Orchard National Wildlife Refuge study site.



Graph 2. This graph depicts the comparison of vegetation abundance between the *P. taeda* and the control transects in the Shawnee National Forest study site.

Discussion

The control transect at CONWR had a significantly higher plant abundance in comparison to the loblolly pine transect most likely due to the fact that native plants were abundant in an unaltered location. Also, the pines in the experimental transect had been present long enough to establish needle cover on the surface and shade, which both discourage plant growth.

There was no significant difference between the control and experimental transects in the Shawnee National Forest site due to a high number of exotic species recorded in the loblolly pine transect; namely *Lespedeza cuneata*. This caused an increase in plant abundance in the experimental transect. However, if the number of

exotic species were lower, the control transect would most likely have a significantly higher level of plant species abundance. The experimental transect may have also had a higher plant abundance rate as a result of younger pines, and therefore, less shade and needle cover.

Despite the insignificant results of the Shawnee site, the invasive nature of *P. taeda* may continue to be problematic for early successional plant communities in southern IL, western KY, and northwestern TN. These communities are present in prairies, barrens, and glades, which are threatened ecosystems. Keeping loblolly pine regeneration out of these rare places could be vital to their health and continuation.

Literature Cited

Hedman, C.W., S.L. Grace, and S.E. King. 1999. Vegetation composition and structure of southern coastal plain pine forests: an ecological comparison. Forest Ecology and Management. 134:233-247.

Warren, S.L., and G.L. Rolfe. 1978. Microenvironmental conditions under old field and pine cover in southern Illinois: air and soil temperatures. For. Res. Rpt. 78-10, Illinois Agricultural Experiment Station. University of Illinois at Urbana-Champaign.

Richardson, D.M., and M. Rejmanek. 2004. Conifers as invasive aliens: a global survey and predictive framework. Diversity and Distributions. 10:321-331.

Project Information

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Time frame of the report: 1.5 years

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Project objectives: to determine if loblolly pine regeneration has negatively affected native, early successional plant communities where it most commonly invades; to determine whether plant abundance and diversity and soil characteristics decline as a result of loblolly pine invasion.

Digital Images: Crab Orchard NWR & Shawnee National Forest

P. taeda in the experimental transect of CONWR

Vegetation grid (1x1m) at CONWR

Vernonia gigantea in the control transect at CONWR

Collecting soil samples at CONWR control transect

Vegetation survey using the grid at Shawnee National Forest

Control transect at Shawnee National Forest

Experimental transect including the young, regenerated pines at Shawnee National Forest

Separating 0-5cm and 5-15cm soil samples and bagging them

Total project expenditures: $952.36 for supplies from **Forestry Suppliers, Inc**. (item order forms include item description, quantity purchased, and date of items purchased. Name and Address of vendor: 205 West Rankin St. P.O. Box 8397 Jackson, MS 39284-8397

Vendor telephone number: 1-601-354-3565

Website: www.forestry-suppliers.com