CHINESE TALLOW CONTROL ON THE PINEYWOODS MITIGATION BANK IN EAST TEXAS: STAND STRUCTURAL EFFECTS ON TALLOW ESTABLISHMENT AND HERBICIDAL CONTROL

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INTRODUCTION

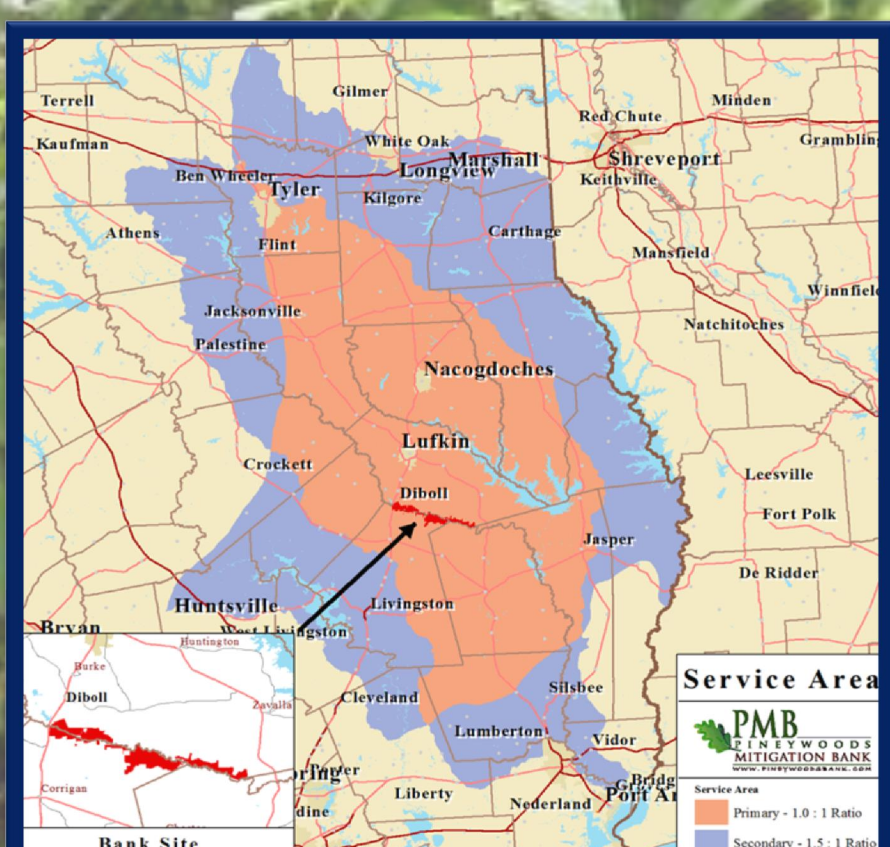
Chinese tallow (*Triadica sebifera*) is one of the most aggressive and invasive woody species in the Southern Coastal Plain. Oak flats in the Western Gulf Region are particularly prone to tallow invasion. Efficient and economical control of tallow represents a substantial challenge, particularly given the comparatively slow growth rates of native species, which are in part attributable to nutrient limitations. Mechanical methods or fire provide ineffective control of tallow due to its prolific ability to sprout, leaving chemical control with forest herbicides as the only viable management option (Whisenant and Crane 2001, Williams and Minogue 2008). Efficacy of control with different forest herbicides applied via different methods, their effects on tallow survival and subsequent establishment on a site, and the ecological effects of tallow and tallow control on bottomland hardwood stands in East Texas have been the subject of little published research to date.

Our primary objective was to compare bottomland hardwood stand structure in areas with both high and low tallow stocking to create a baseline for subsequent work. Results presented are part of a larger project that is also examining edaphic factors between areas with high and low tallow abundance as well as various herbicide treatments. Ultimately, the project will allow for a classification of sites most susceptible to tallow invasion and will develop precision silvicultural recommendations for tallow control.

STUDY AREA

The Pineywoods Mitigation Bank (7,725 ha) is the largest wetland mitigation bank in Texas and one of the largest in the world. The property lies along the Neches River in Angelina, Jasper, and Polk Counties. This unique area includes more than 5,200 hectares of forested wetlands, primarily sweetgum-willow oak and water-laurel-willow oak cover types.


Pineywoods Mitigation Bank



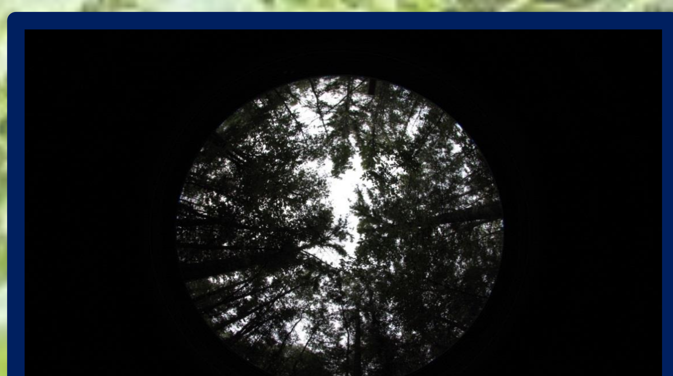


Figure 2. Control plot hemispherical photograph


Figure 3. Tallow plot hemispherical photograph

METHODS

A paired-plot experimental design was installed throughout the study area (N=28). Plots were replicated across stands, but not within each stand. Pairs were separated from other pairs by a minimum distance of 305 meters. Plots were randomly located and stratified, with one plot established in an area with minimal tallow stocking (control plots), while another was established in an area with substantial tallow stocking (tallow plots). A random distance (32-96 m) was placed between each set of pair plots. Stand data were collected using separate overstory and sapling plots (Table 1). Data collected in winter 2011-12 from both plots sizes were combined (Table 2).

Table 1. Sampling protocol for overstory and sapling and plots.

Plot	Trees Measured	Plot Size	Plot Dimensions
Overstory	All species >10.2 cm DBH	200 m²	8 m radius
Sapling	All species 2.5-10.2 DBH	50 m²	4 m radius

Table 2. Stand structure for control and tallow plots. Means are shown, with standard errors in parentheses.

	Control Plots		Tallow Plots	
	Tallow	All Species	Tallow	All Species
Density (ha^{-1})	31.0 (17.8)	1724.1 (281.2)	2255.2 (340.0)	3025.9 (321.6)
Basal Area (m^2 ha^{-1})	0.1 (0.1)	28.5 (1.9)	8.7 (1.0)	18.2 (1.8)
QMD (cm)	1.2 (0.7)	18.8 (1.9)	8.9(1.1)	9.3 (0.8)

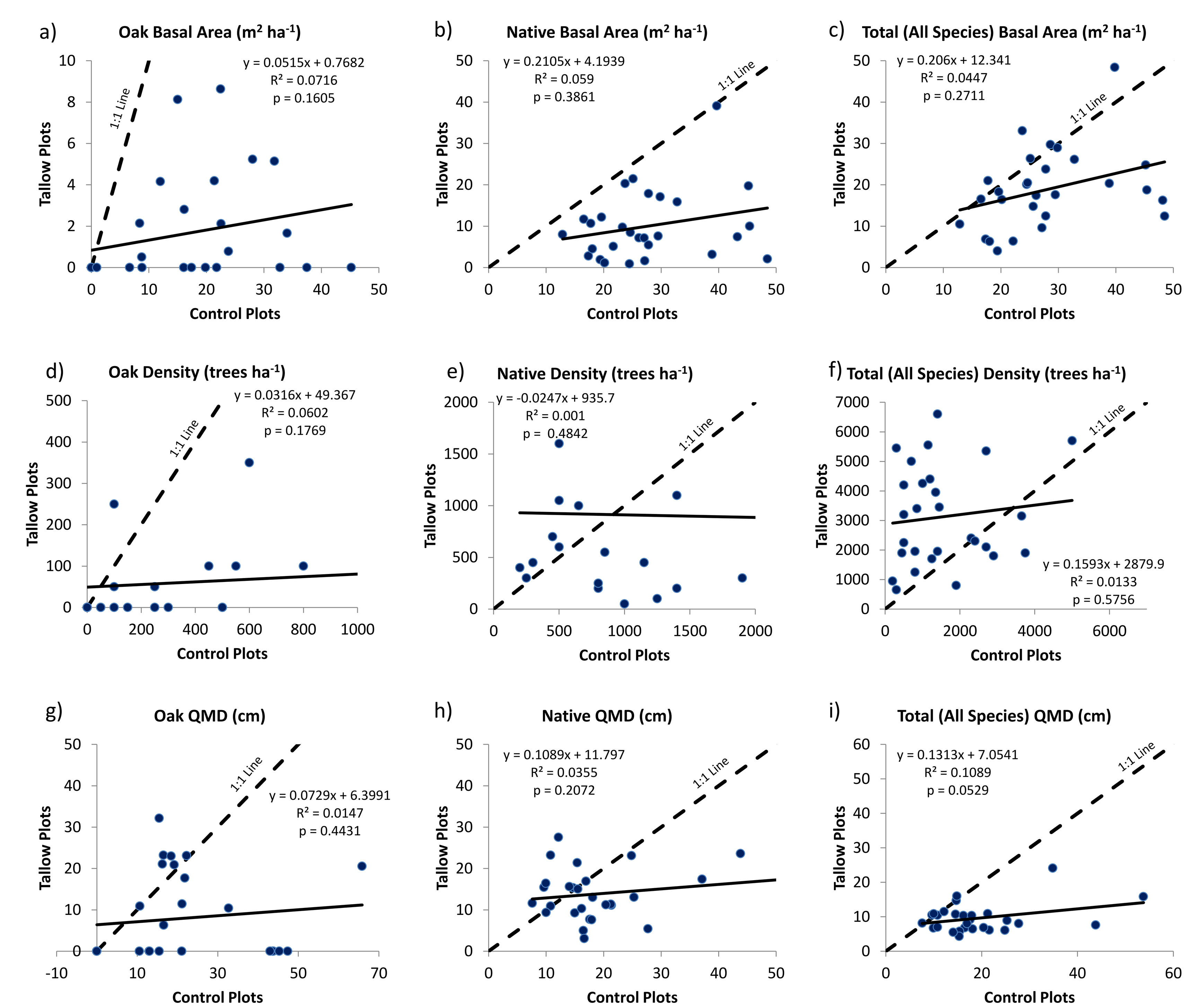


Figure 1. Regressions (solid line) between control plots and tallow plots in the paired plot design for basal area, density, and QMD for oak species, native species, and total species. A dotted 1:1 line (slope = 1) is included on each graph for reference. Points below the 1:1 line have a greater value of the variable in control plots, while points above the 1:1 line have a greater value in the tallow plots.

RESULTS AND DISCUSSION

Results in Figure 1 generally show lower densities, lower basal areas, and smaller quadratic mean diameters (QMDs) in tallow plots relative to control plots. Although these trends hold for all oak species combined, there are some significant exceptions when all species or all native species were examined. For all species, density was higher in the tallow plots, while basal area and QMD were lower. These results are consistent with tallow generally establishing at high densities in gaps formed primarily by wind disturbance, although we have not yet quantitatively assessed ages or disturbance histories. The representative hemispherical canopy photographs in Figures 2 and 3 contrast gaps where tallow was typically found to the closed canopy in the surrounding stand. The same trend was observed for all native species, although there was significantly more variability for density. Some tallow plots actually had higher densities of native species compared to control plots. Tallow appears to be outcompeting the oaks, although in some gaps other native species such as sweetgum and elms are able to compete with tallow.

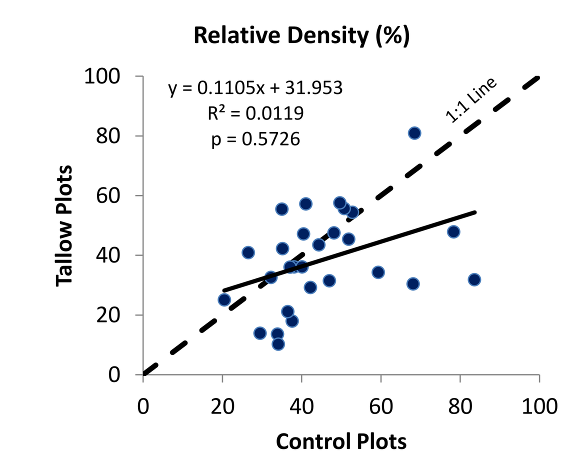


Figure 4. Regression (solid line) between control plots and tallow plots in the paired plot design for relative density for all species. A dotted 1:1 line (slope = 1) is included for reference. Points below the 1:1 line have a greater value of the variable in control plots, while points above the 1:1 line have a greater value in the tallow plots. Maximum SDI for bottomland hardwoods is 570 trees ha^{-1}.

Despite the observed differences in stand structure, there appears to be no consistent relationship between tallow and control plot stocking based on relative density (Figure 4). Stocking is not fundamentally changing due to tallow establishment despite the shift in composition. Some stands had higher stocking in tallow plots relative to control plots, while in other stands the trend was reversed. Additionally, it does not appear possible to predict the stand structure (basal area, density, QMD, or relative density) of tallow plots from control plot stand structure ($R^2 < 0.11$, $p > 0.05$ for all), despite both plots being located within the same stand.

LITERATURE CITED

Whisenant, S., and A. Crane. 2001. "Chinese tallow control research and habitat enhancement". Texas Agricultural Experiment Station, Texas A&M University System. Project Summary Report 4928-S, College Station, TX.

Williams, R., and P. Minogue. 2008. "Biology and management of Chinese tallow tree". University of Florida IFAS Extension. Publication FOR190, Quincy, FL.

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