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# Development of integrated management practices for the control of Chinese tallow (*Triadica sebifera*) on Parris Island MCRD

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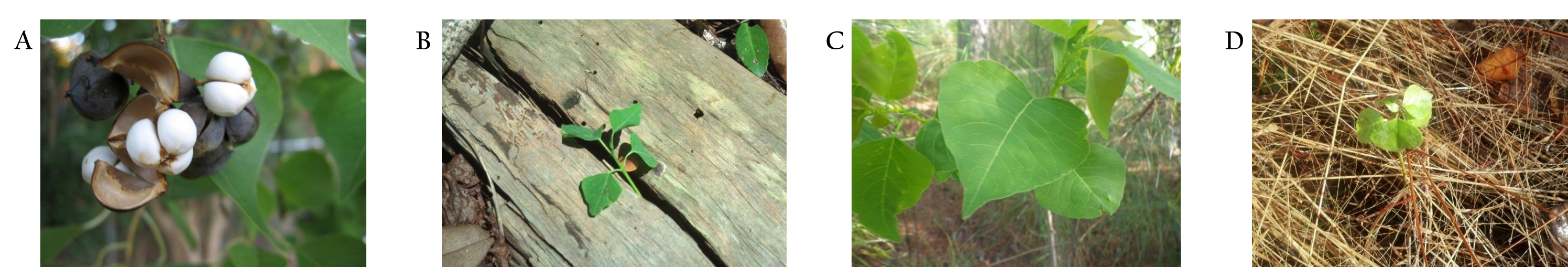


## Introduction

Chinese tallow (*Triadica sebifera*) is the most pervasive, stand replacing non-native tree species in the southern forests. It is an aggressive invader with rapid growth, can reach sexual maturity in three years, and is a heavy seeder with a persistent seed bank. It can invade old fields, coastal tallgrass prairies, and bottomland hardwood forests. It is adapted to a wide range of ecological conditions, with tolerance to shade, flooding, drought and saline soils.

Chinese tallow is a major non-native invasive species (NNIS) at Parris Island Marine Recruit Depot (MCRD) in Beaufort, South Carolina, and it has been subjected to management since 2001, primarily using the hack and squirt application of herbicide (Figure 1A). In May to August of 2010, we surveyed all NNIS at Parris Island MCRD, using a stratified random transect sampling method, in order to review past control effectiveness, and delineate areas of high management priority. The survey recorded a total of 6,526 individual occurrences of Chinese tallow, based on which a management priority map was generated (Figure 1B).

When comparing to the 2001 survey result, it becomes apparent that herbicide alone may not be effective in controlling Chinese tallow. Consequently, a new management approach needs to be developed and implemented at Parris Island MCRD.



Chinese tallow fruit capsules with characteristic popcorn appearance (A), seedling growing out of a downed log (B), rhombic leaf blade (C), and seedling growing under dense competition with grass (D).

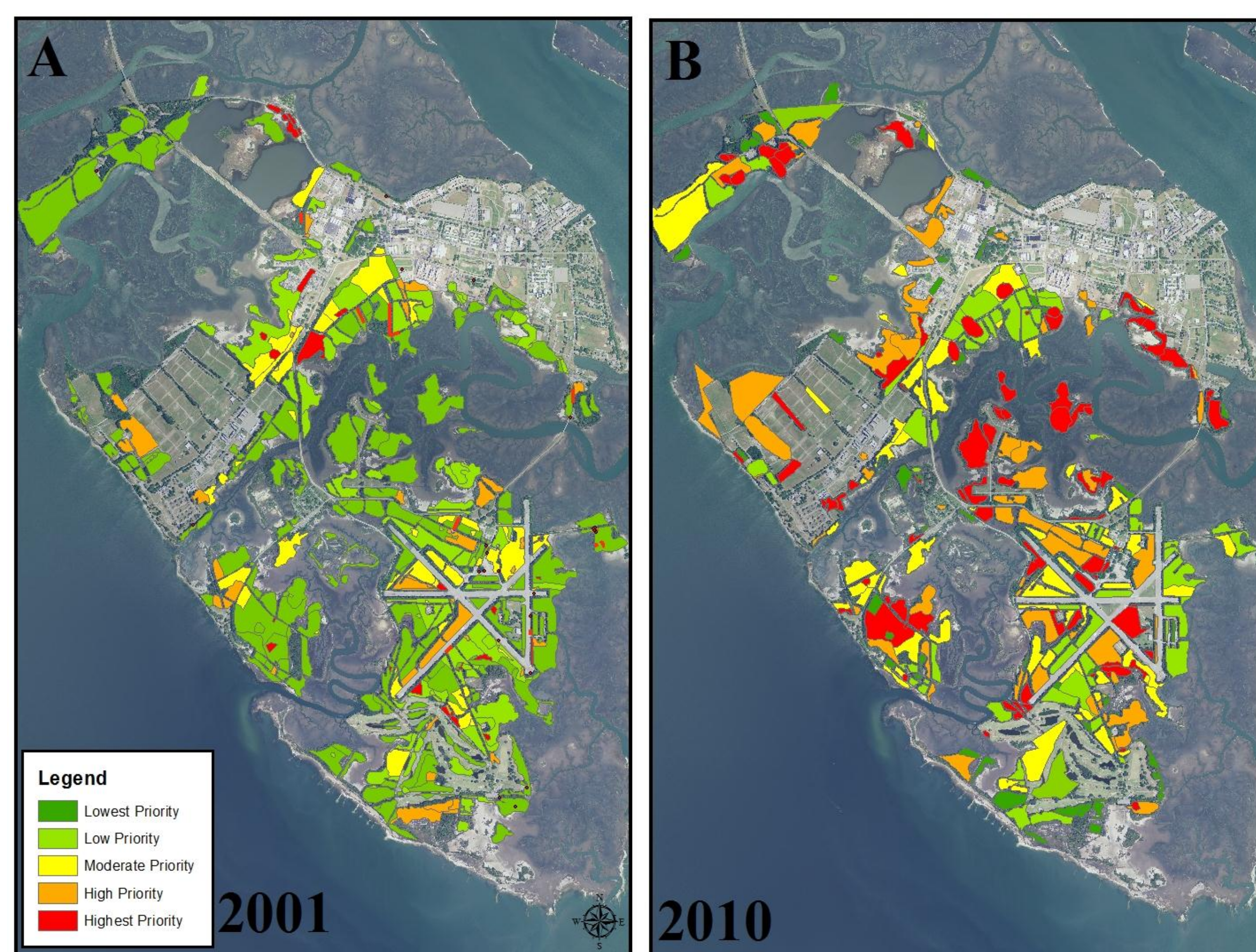


Figure 1. Chinese tallow management priority areas by forest stand level on Parris Island MCRD: A) 2001 management priority areas; B) 2010 management priority areas.

**Objective:** The primary objective of the study is to develop an integrated management approach to reduce the infestation size and distribution of Chinese tallow to enhance military training grounds and promote natural ecosystem processes. Specifically, we will test four integrated treatments in terms of their efficacy and potential adverse effects on native vegetation.

**Hypothesis:** Mechanical, herbicide and fire (MHF) treatment results in the greatest reduction of Chinese tallow presence and abundance while increasing native species diversity and abundance.

## Methods

Four integrated treatments were tested in both pine and maritime hardwood forests at Parris Island MCRD using a randomized complete block design. In each forest type, four forest stands (blocks) were selected. Each block has been divided into four experimental units (approximately 1 acre in size), and each unit was randomly assigned a treatment type (Figure 2). Details of the four prescribed treatments are given in Figure 3.

The treatment effects on Chinese tallow and native plant community were monitored yearly during growing season in 20 by 40 meter measurement plots in each experimental unit (figure 4). In each measurement unit, all tree species greater than 3 cm in DBH were recorded by species and DBH.

In four randomly selected 10 by 10 meter subplots all shrubs and saplings less than 3 cm in DBH but greater than 4.5 feet tall were recorded by species and DBH. All herbaceous cover and regeneration were recorded in a 1 by 1 meter quadrat established in the center of each subplot by species and cover class.

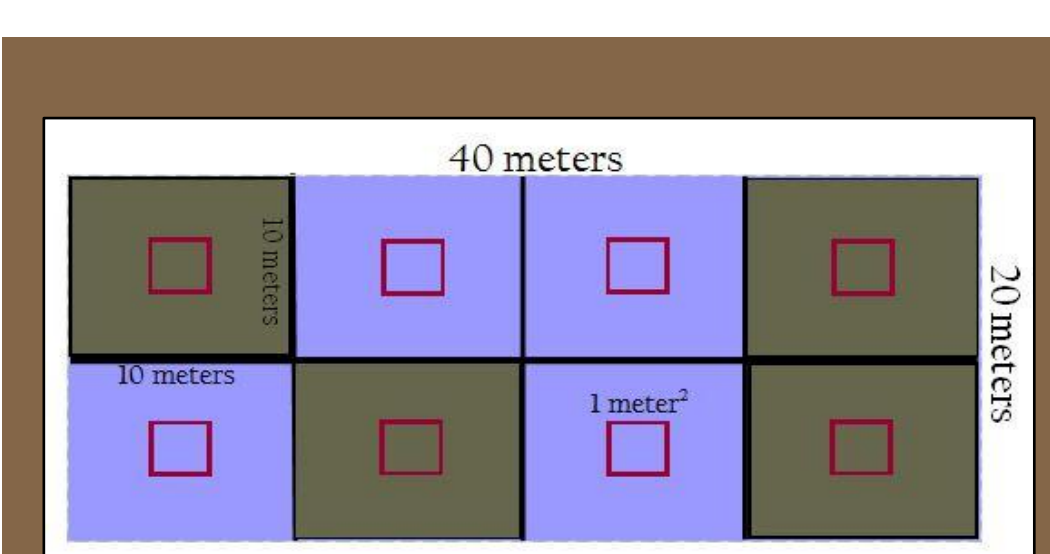
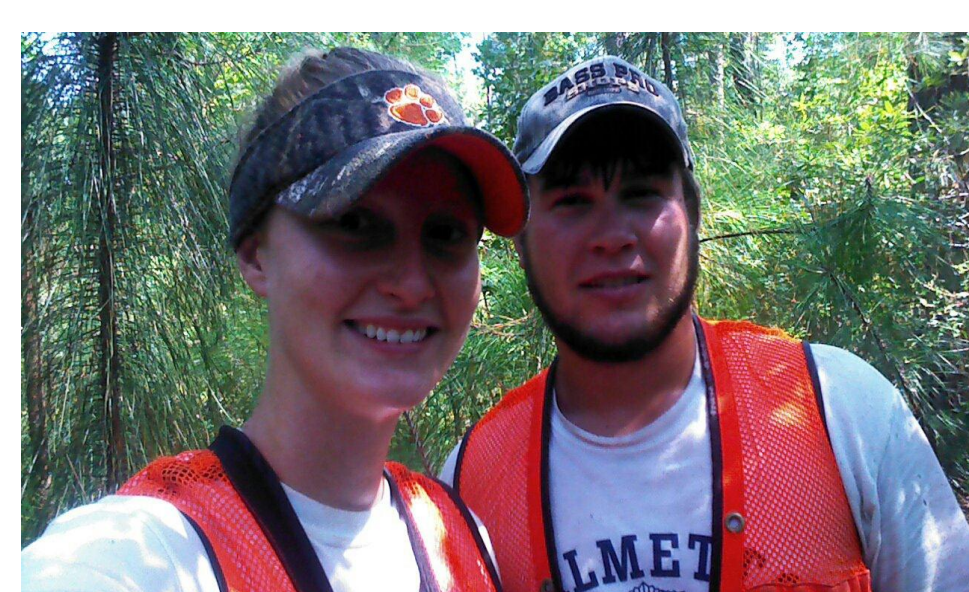


Figure 4. Measurement unit for vegetation analysis.



Figure 2. Study area treatment blocks and experimental units by treatment type.

Data will be analyzed using repeated measure of analysis of variance. Vegetation response at the community level will be analyzed using multivariate statistical analysis.

Treatment	Mechanical	Herbicide	Prescribed Fire
MHF			
MH			
HF			
H			
Season	Spring	Fall	Spring
Year	Year 1	Year 1	Year 3

Figure 3. Four integrated methods of control for Chinese tallow (MHF = Mechanical, herbicide and fire, MH = mechanical and herbicide, MF = mechanical and fire, and H = herbicide only).

## Pre-Treatment Results

Chinese tallow composition is statistically similar across all treatment types (MHF, MH, HF and H) and forest type (maritime and pine).

Of the total of 18,434 individual woody stems recorded across all measurement units, 2,934 stems were of Chinese tallow (TRSE6). It occupies a large range of the diameter class by density, with a large portion occupying the 8 to 11 cm diameter class in comparison to the other tree species (figure 5A). It is also the second most abundant tree species with the fourth largest average DBH (figure 5B) and the second highest overall (tree and shrub combined) basal area per hectare.

Slash pine (PIEL) is the only species with greater overall number, average DBH and basal area per hectare than Chinese tallow. The two abundant species following Chinese tallow are yaupon (ILVO) and wax myrtle (MOCE2) which are dominant multi-stemmed shrub species of the forest understory. Other woody NNIS were also recorded in the measurement units, which included Chinaberry, tree-of-heaven and lantana.

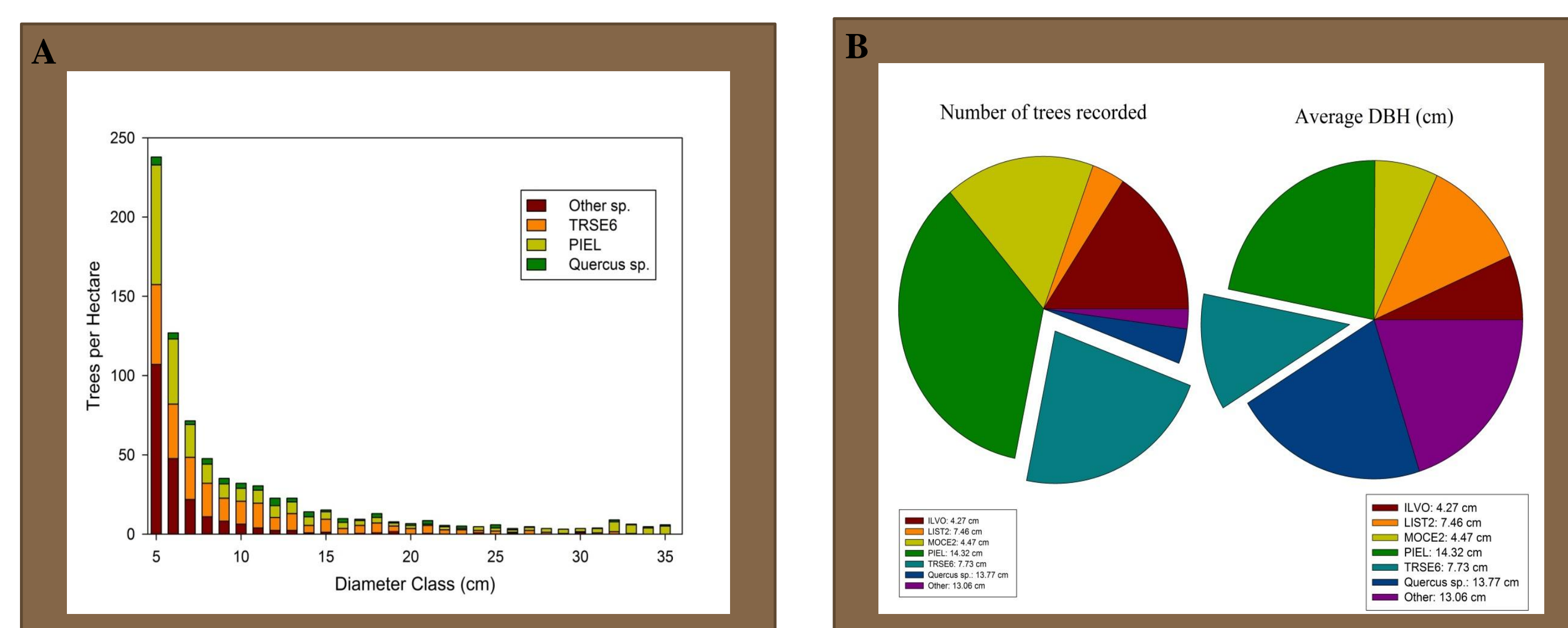


Figure 5. Summary statistics for pre-treatment vegetation data A) Trees (all stems) per hectare greater than 5 cm by diameter class (cm) for Chinese tallow (TRSE6), slash pine (PIEL), *Quercus* sp. and all other (Other sp.) recorded species. B) Summary data of tree species (>3 cm DBH) recorded including total number (left) and average DBH in cm (right).

## Conclusion: Expected Outcomes

**Mechanical treatment (mulching)**-The application of the mechanical mulching treatment in the spring will occur when total non-structural carbohydrates are at their lowest levels in roots as they are being actively transported to above ground metabolic costs associated with break in dormancy, bud break, and leaf development (Conway et al. 1999). The effect of mulching may also provide a damping effect on diurnal soil temperature fluctuation and amplitude, which may result in reduced seed germination, even though the large size of Chinese tallow seeds may provide the nutritional resources for germination and emergence through deep mulch depths (Donahue et al. 2004).

**Herbicide treatment**- The application of herbicide during the fall occurs when total non-structural carbohydrates are highest, which will be more effective for herbicide assimilation into buds and organs (Conway et al. 1999).

**Prescribed fire treatment**- Chinese tallow is a thin barked species when young, which may result in mortality due to fire effects. Rapid leaf litter decomposition by this species may suppress the ability to carry a surface fire without a previous treatment such as mulching. Prescribed burning may also reduce germination probability (Burns et al. 2004).

**MHF Treatment**- Mechanical treatment in the spring will reduce carbohydrate stock in the roots, followed by foliar herbicide treatment in the fall of the same year to target advanced regeneration and newly established seedlings. Prescribed fire treatment will be carried by the fuels provided by the mulching treatment in two years prior, which will also help to reduce vigor of any additional regeneration. This is intended to re-establish the natural fire return interval by the reduction in Chinese tallow which will also promote herbaceous plant diversity.

Future research should address fire effects and fire return intervals on Chinese tallow in forest systems.

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