

DEVELOPMENT OF INTEGRATED MANAGEMENT PRACTICES FOR THE CONTROL OF CHINESE TALLOW ON PARRIS ISLAND MARINE CORPS RECRUIT DEPOT

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Chinese tallow [*Triadica sebifera* (L.) Small] is an aggressive, fast-growing, highly adaptable invasive tree of the southeastern United States coastal region. Since its introduction in the early 1800s, Chinese tallow has become a serious threat to native grassland and forest communities from mid-coastal North Carolina to northern Florida and west to central Texas. Our study is located on Parris Island Marine Corps Recruit Depot (MCRD) in Beaufort County, SC. Parris Island MCRD consists of 3257 ha, with vegetation dominated by mixed maritime forest, pine forest (natural and plantation), and saltwater marsh.

Chinese tallow has been managed on Parris Island MCRD since 2001 through the use of herbicides, primarily with 'hack and squirt' methodology. In 2010, we surveyed for invasive species presence and abundance on Parris Island MCRD in order to monitor the Chinese tallow population and to assess the effectiveness of previous control efforts. Results from this survey suggested that there is the need for a more effective management approach because the Chinese tallow population in some areas had increased despite herbicide applications. Our study was designed to develop an effective approach for managing Chinese tallow while restoring the native forest ecosystem impacted by the invasion of Chinese tallow. Specifically, we tested four integrated treatments series including mechanical, herbicide and fire (MHF), mechanical and herbicide (MH), herbicide and fire (HF), and herbicide (H) only to determine their efficacy on Chinese tallow control as well as their potential adverse effects on native vegetation.

We implemented a randomized complete block design with four treatments and eight replicates. Treatment areas were ≥ 0.4 ha, with a sample

area of 0.08 ha randomly nested within each treatment area to monitor treatment response of Chinese tallow as well as the resident plant community. In 2012, we quantified woody plant abundance by measuring the diameter at breast height (d.b.h.) for each individual in the sampling plots of each experimental unit, and we used analysis of variance to determine any pre-treatment differences in mean basal area, d.b.h., and stems/ha by species. Pre-treatment results indicate that Chinese tallow is the second-most dominant tree species by basal area and has the second highest density across the 32 experimental units at (table 1). There were no significant differences in tree and shrub species composition among treatments (significance level of $p = 0.05$).

The application of the mechanical mulching treatment (MHF and MH) will occur in the spring of 2013 when total non-structural carbohydrates are at their lowest levels in roots and are being actively transported to aboveground tissues that are associated with the metabolic costs of break in dormancy, bud break, and leaf development (Conway and others 1999). Mulching may also provide a dampening effect on diurnal soil temperature fluctuation and amplitude, resulting in reduced seed germination, even though the large size of Chinese tallow seeds may provide the nutritional resources for germination and emergence in deep mulch (Donahue and others 2004). The application of herbicide (all treatments) during fall 2013 will occur when total non-structural carbohydrates actively translocate downwards to the roots, which will be more effective for herbicide assimilation into perennating buds and organs (Conway and others 1999). The addition of a fire treatment (MHF and HF) may also negatively impact Chinese tallow forest dominance and stimulate native species abundance and diversity.

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Table 1--Summary of basal area (m²/ha), diameter at breast height (cm) and density (stems/ha) for all tree and shrub species measured in the 32 (0.08 ha) plots

Scientific Name	Common name ^a	Basal area	DBH	Density
		m ² /ha	cm	stems/ha
<i>Pinus elliotii</i>	slash pine*	18.93950	7.87	3891.02
<i>Triadica sebifera</i>	Chinese tallow*	3.04471	4.54	1883.98
<i>Morella cerifera</i>	wax myrtle	2.01761	2.97	2906.25
<i>Ilex vomitoria</i>	yaupon	1.87733	2.78	3086.33
<i>Liquidambar styraciflua</i>	sweetgum*	0.51409	4.53	319.53
<i>Sabal palmetto</i>	cabbage palmetto	0.46441	31.77	5.86
<i>Fraxinus pennsylvanica</i>	green ash*	0.28090	28.85	4.30
<i>Quercus virginiana</i>	live oak*	0.28029	10.89	30.08
<i>Quercus nigra</i>	water oak*	0.19744	7.20	48.44
<i>Quercus hemisphaerica</i>	Darlington oak*	0.11749	7.74	25.00
<i>Nyssa sylvatica</i>	blackgum*	0.04760	27.85	0.78
<i>Acer rubrum</i>	red maple*	0.03492	15.09	1.95
<i>Juniperus virginiana</i> var. <i>silicicola</i>	southern redcedar*	0.03423	6.20	11.33
<i>Prunus serotina</i>	black cherry*	0.03320	5.27	15.23
<i>Celtis laevigata</i>	sugarberry*	0.03234	16.23	1.56
<i>Quercus pagoda</i>	cherrybark oak*	0.02996	4.10	22.66
<i>Carya ovalis</i>	red hickory*	0.02689	29.60	0.39
<i>Baccharis halimifolia</i>	eastern baccharis	0.02674	2.52	53.52
<i>Callicarpa americana</i>	American beautyberry	0.02623	1.19	235.16
<i>Melia azedarach</i>	chinaberry*	0.01428	8.81	2.34
<i>Rhus copallinum</i>	winged sumac	0.00317	1.61	15.63
<i>Ailanthus altissima</i>	tree-of-heaven*	0.00291	5.62	1.17
<i>Morus rubra</i>	red mulberry*	0.00070	4.77	0.39
<i>Diospyros virginiana</i>	common persimmon*	0.00053	4.14	0.39
<i>Lantana camara</i>	lantana	0.00024	0.89	3.91

^aAn asterisk denotes tree life form.

Chinese tallow is a thin-barked species when young, which may result in increased mortality from fire. Prescribed burning has also been shown to reduce germination probability of Chinese tallow (Burns and others 2004). However, rapid leaf litter decomposition by this species may suppress the ability to carry a surface fire without a previous treatment such as mulching.

We expect that the MHF treatment will have the greatest overall effect on the Chinese tallow population within the treatment areas. The application of the mechanical treatment in the spring will reduce carbohydrate stocks in the roots and will be followed by foliar herbicide treatment in the fall of the same year to target advanced regeneration and newly established seedlings. The prescribed fire treatment will be

carried by the fuels provided by the mulching treatment 2 years prior, which will also help to reduce vigor of any additional regeneration. The use of fire is also intended to re-establish the historical fire regime, to prevent the future invasion of Chinese tallow and to promote native plant diversity in herbaceous layer.

LITERATURE CITED

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