Evaluation of Control Options for Eastern Baccharis to Restore Bottomland Hardwood Forests

Project Summary:

Restoration of bottomland hardwood forests is crucial to improving habitat conditions for many of the 149 species with the greatest conservation need in Arkansas' Mississippi Alluvial Plain eco-region. The establishment of hardwood seedlings on former agriculture fields has been hampered by the invasive shrub, eastern baccharis or groundsel tree. We are proposing to evaluate several control options to manage this invasive shrub. Additionally, we will examine germination requirements and seedling flood tolerance to further identify sites/site conditions that predispose areas to invasion by eastern baccharis.

Project Leader:

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Project Partner:

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Total Project Cost: $33,688

Total amount of SWG money requested: $14,361

Total matching funds: $19,3282

Rationale and Justification

More than 85% of the original bottomland hardwood forests in the Mississippi Alluvial Plain (MAP) including those in Arkansas have been lost, largely due to conversion to agricultural crop production. Habitat loss and degradation of water quality in these areas have resulted in the loss/reduction of many species of amphibians, birds, fish, insects and mammals. Restoration of these areas has been listed as the single most important conservation action recommended for the MAP by the Arkansas Wildlife Action Plan. Ecological restoration of bottomland hardwood forests, especially key fragments that act as corridors or ameliorate severely degraded areas will undoubtedly improve habitat conditions for many of the 7 amphibian, 66 bird, 1 crayfish, 21 fish, 11 insect, 7 mammal, 30 mussel and 6 reptilian species listed as species of greatest conservation need in Arkansas' MAP eco-region.

As part of the overall restoration effort, planting of hardwood seedlings is often seen as the first step in the restoration process. To date, 100s of thousands of acres have been planted using hardwood seedlings in the lower MAP. However, surveys of WRP plantings revealed that fewer than 10% of sites achieved the criteria of having at least 100 stems/acre (C.J. Schweitzer, unpublished data). Stanturf and others (2004) attribute these failures, in large part, to the failure of landowners and/or land managers to recognize difficult site conditions and site limitations. Specifically, a recurrent issue is dealing with adverse site conditions created by competing vegetation, both pre- and post-planting.

One of the more notable species affecting restoration efforts in newly established hardwood plantings is eastern baccharis or groundsel tree (*Baccharis halimifolia*). This shrub species is extremely common in CRP and WRP plantings, often completely invading sites (figure 1). This species is highly invasive (but native) and competes with the planted hardwood seedlings for soil moisture, nutrients, and light reducing hardwood seedling survival and growth (Seifert and Woeste 2002).

Figure 1. Eastern baccharis dominating a 7-yr-old hardwood planting.

Eastern baccharis is difficult to manage for several reasons. First, it is rarely noticed until well-established in fields. Once established, control options are limited and/or expensive. Studies in Australia and Texas have effectively used dicamba; glyphosate; 2,4,5-T; 2,4-D acid; and 2,4-D amine to control various species of *Baccharis* (Boldt 1989, Everitt et al. 1978, Westman et al. 1975). However, these treatments occurred in pastures where no crop trees were present. In established hardwood plantings, chemical control options are currently limited to directed sprays since most readily used herbicides will also harm hardwood seedlings if used as broadcast treatments. Mechanical methods have been used to control *Baccharis* species with variable success. These methods include grubbing, cutting, root plowing,

burning, dozing, and shredding (Everitt et al. 1978, Hobbs and Mooney 1985, Hoffman 1968). While effective these types of treatments are extremely inefficient and costly, especially on larger scales.

If the first step to improving habitat for the numerous species of conservation need in the MAP is to restore bottomland hardwood forests through tree planting, then it will become necessary to find ways to manage eastern baccharis. The majority of the published research has been performed in Australia and New Zealand, where the species has been introduced and is aggressively overtaking pastures and timberlands (Westman et al. 1975). Besides being an important competitor to seedlings, eastern baccharis is toxic if ingested to livestock causing staggering, trembling, convulsions, diarrhea, and other gastrointestinal symptoms (Boldt 1989). In Texas, local farmers are concerned about the control of *Baccharis spp.* because they are most commonly found in disturbed habitats (i.e., improved pastures, rangelands, roadsides, and sides of drainage ditches and irrigation canal banks). If ignored, it quickly develops into dense thickets and becomes impenetrable (Everitt et al. 1978).

We are requesting funding to expand our current, on-going research in managing eastern baccharis. Currently, a graduate student at Univ. of Arkansas at Monticello is experimenting with various options to manage this invasive shrub. Since eastern baccharis is a semi-evergreen shrub, we are exploring various winter herbicide applications to control this species, while hardwood seedlings are dormant. The second approach relies on non-chemical means (brush saws) to control the stature of baccharis. We are examining whether dormant or growing season harvested stems will resprout differently. In this proposal we are seeking funding to support a 1-yr graduate stipend and research expenses to perform research in the following three topics areas:

1. Seed germination
2. Seedling flood tolerance
3. Growing season control options

<u>Research Area 1</u>

Managing baccharis has been a major challenge principally because it is trying to be controlled after it is a problem. In most cases baccharis is not initially recognized as contributing to adverse site conditions. This is likely because its early growth is very slow following seedling emergence. However, several months following emergence growth becomes rapid. The goal of this first area of research is to identify site conditions that favor germination and early growth—for bottomland hardwood sites this is generally a function of soil texture and drainage. From a management standpoint, having information concerning soil texture and soil wetness can be used to identify sites/site conditions that would favor eastern baccharis. For example, seed on sand vs clay, flooded vs moist, surface sowing vs buried 0.5 inches may germinate differently. Implications may translate into management guidelines such as—flooded clayey soils or moist clayey soils that are disked (burying seed) are not likely to have eastern baccharis problems, whereas sandy soils are high risk.

<u>Research Area 2</u>

Information concerning flood tolerance is important to managing plant species in bottomland floodplains. Little is known about the flood tolerance of eastern baccharis. We have seed stored that can be germinated and propagated into seedlings. Seedlings will be subjected to various flooding regimes in our greenhouse facilities. Apart from developing a better understanding of its biology, this research component will provide additional information that can be used to aid management decisions.

Flood tolerance will govern to a great extent the locations baccharis can persist and provide long-term competition.

Research Area 3

This research area seeks to further the initial herbicide screening work already underway at UAM. We will expand upon the previous dormant season herbicide applications and include growing season applications. As previously mentioned, very few herbicides are available for these types of "release" treatments. While many herbicides are broad-spectrum, some species do show resistance to certain chemicals. For example, red oak species are resistant to growing season applications of the herbicide Oust, while other species (e.g., elms and black cherry) show sensitivity (Schuler and Stephens 2009). If the same relationships hold, some herbicides maybe highly selective for baccharis but minimally damaging to planted hardwood seedlings.

Budget for 2009-2010

Category	SWG	U of A	Total
Salary/benefits	8,055	15,150	23,205
Operating expenses	5,000	0	5,000
Capital expenses	0	0	0
Subtotal	13,055	15,150	28,205
Indirect	1,306	4,178	5,483
Total	14,361	19,328	33,688
% of total cost	43	57	

Literature Cited

Boldt, P. E. 1989. *Baccharis* (Asteraceae), a review of its taxonomy, phytochemistry, ecology, economic status, natural enemies and the potential for its biological control in the United States. U.S.D.A. Agric. Res. Serv. Grassland, Soil, and Water Research Laboratory. Temple, TX. p. 1-31.

Everitt, J. H., A. H. Gerbermann, and D. G. Akers. 1978. Chemical control of dryland willow in the Lower Rio Grande Valley of Texas. Journal of Rio Grande Valley Horticulture Society 32:89-93.

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Westman, W., F. Panetta, and T. Stanley. 1975. Ecological studies on reproduction and establishment of the woody weed, groundsel bush (*Baccharis halimifolia* L.: Asteraceae). Australian Journal of Agricultural Research 26:855-870.

Qualifications of Project Leaders

Jamie Schuler, Ph.D., Assistant Professor of Silviculture, School of Forest Resources, University of Arkansas at Monticello.

Jamie Schuler has 10 years experience working with hardwood plantation establishment and herbicide application research. He has also performed research on seedling propagation and seed germination. Jamie currently oversees a graduate student that is conducting research focused on eastern baccharis.

Lynne Thompson, Professor of Forest Protection, Arkansas Forest Resources Center, School of Forest Resources, University of Arkansas–Monticello.

Lynne Thompson has conducted research on forest pests for almost 30 years in southeastern Arkansas, including pesticide tests on insects and weeds. In addition, he teaches the forest herbicide class at UAM. Lynne has been interested in Baccharis management for some time, including the use of pesticide and cultural controls.