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Poster Abstracts

The Hunnicutt Creek Restoration Project

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Abstract:

The Hunnicutt Creek Restoration Project is an ongoing effort started in 2013 with the goal of re-establishing the natural functions and conditions of a degraded watershed located on Clemson University's campus. Monitoring and removal of invasive species, primarily chinese privet, silverthorn, and nandina, within the upper reaches of the watershed is one of the primary goals and the first step towards restoring a natural and more aesthetically pleasing system. We established thirty 5x5 meter plots, using the Carolina Vegetative Survey protocol, to measure the effectiveness of various removal techniques. We used four treatment methods to remove invasive species: chemical, mechanical, mechanical and chemical, and prescribed grazing. A variety of herbicides were used based on plant size for the chemical treatments. Mechanical removal techniques varied based on stem size. Mechanical and chemical treatments combined both techniques by removing plants and then applying herbicides to cut stems. Prescribed grazing consisted of 40 goats contained in an area for 40 days. Five plots were randomly assigned to each of these treatments in addition to five control plots. Additionally, five plots were selected as reference sites to establish a target long-term restoration goal and for comparison with treatment plots. Preliminary results indicate that the chemical and mechanical treatment is the most effective at reducing cover and stem count of invasive species. The goats were effective in opening up the landscape but were not selective in their grazing. In addition to continued monitoring, we are increasing our removal efforts with a volunteer force using the

mechanical and chemical treatment. Further restoration efforts are being made with the propagation of desired native species for eventual introduction into watershed.

Non-Target Impacts: Non-native weevil biocontrols and Pitcher's thistle (*Cirsium pitcheri*) a rare, Great Lakes native

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Abstract:

Easy and effective control of invasive plants is a pressing need worldwide. The introduction of animal biocontrol agents is used to target and control invasive plant populations. Standards guiding the release of biocontrols have improved in recent decades; however, the negative effects of biocontrol agents on non-target species, particularly rare taxa, are often unknown and/or understudied.

Pitcher's thistle (*Cirsium pitcheri*) is a native of the sand dunes and cobble shorelines of the Great Lakes and is federally listed as threatened. Threats include human disturbance, habitat loss, and competition from non-native plant invasives. Long-term demographic work on several populations show most are already in a slow decline. In the United States, non-native weevil biocontrols, *Rhinocyllus conicus* and *Larinus planus*, were used to control invasive Eurasian thistles, musk thistle (*Carduus nutans*) and Canada thistle (*Cirsium arvense*). Adults oviposit into flowering heads and larvae feed on seed and floral tissues. *R. conicus* was found on *C. pitcheri* heads at the Chicago Botanic Garden in 2007. *L. planus* was found on *C. pitcheri* heads at Whitefish Dunes State Park (Door County, WI) in 2011. Estimated reduction of seed set due to weevil larval herbivory is 50-95%.

Using existing demographic data for two populations of *Cirsium pitcheri* we modeled the effects of a 50% reduction in seed set due to weevil herbivory. Weevil herbivory reduced long-term growth rates by 11-12%. Population viability estimates show a reduction in viability for both populations with the 5% risk of extinction threshold for the two populations exceeded in 5 and 13 years with weevil herbivory versus 8 and 24 years without herbivory.

Invasibility of a longleaf pine fire-managed landscape by non-native, woody plant species

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Abstract:

Periodic disturbance is a phenomenon that provides opportunities (e.g. resources, niche space) in the landscape for plant recruitment. In pyrogenic ecosystems seedling establishment and survival is both directly and indirectly influenced by periodic fire disturbance. However, these opportunities can be exploited by native and non-native species alike. Although fire disturbance may benefit plant recruitment by reducing tree cover, removing litter, and releasing nutrients, fire may also kill seedlings. Our objective was to quantify the impact of fire and microsite conditions on the germination, survival, and growth of six non-native, woody species (*Elaeagnus umbellata*, *Ligustrum sinense*, *Melia azedarach*, *Nandina domestica*, *Pyrus calleryana*, and *Triadica sebifera*) in a longleaf pine ecosystem. These species are considered invasive in the southeastern USA, and are present adjacent to our study landscape. We established 18 study sites along longleaf pine savanna – wetland ecotonal gradients in the NC Sandhills at Ft. Bragg Military Reservation. Each site had paired savanna – ecotone plots, and each plot contained 18 subplots (six species x three treatments [no treatment, litter removed, litter removed and seed buried]). Prescribed burns were applied to our sites one, two, or three years after seed arrival. We measured germination, survival, and growth for all individuals for three growing seasons. For each plot we measured soil moisture and nutrients, canopy cover, and fire history. Four of six species germinated, and recruitment was lowest in the most natural, untreated subplots. Three species survived into the second growing season, but only *P. calleryana* was able to survive fire as seedlings. Survival of *P. calleryana* in unburned plots between the beginning of growing season 2 and 3 was 100%, whereas survival in burned plots was

approximately 39%. Current prescribed fire practices at Ft. Bragg largely appear to filter these species from the landscape due to their incongruence with the disturbance regime.

Assessing the Geographic Potential of Invasive Plants

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Abstract:

Assessing geographic potential is an important component of any weed risk assessment, because climatological factors affect a species' ability to establish in any given area. USDA Plant Protection and Quarantine has developed a simple raster-based overlay model in ArcGIS to predict the potential distribution of weeds and invasive plants. Our weed risk assessment group uses three global datasets representing plant hardiness zones, mean annual precipitation, and Köppen-Geiger climate classes to identify the areas of the United States that have a suitable climate for a species. In the PPQ WRA process, we first map the global distribution of the species and then relate it to the particular levels of each of the three climate variables. These maps are then overlaid to determine the range of combinations of climate variables that are suitable for the species in the United States. We validated our model (Proto3) and also compared it with two other predictive models (MaxEnt and CLIMEX [match climate]). Ten species were analyzed under both non-blind conditions (the user was aware of the species) and blind conditions (the user was unaware of the species). Across all species, our Proto3 model predicted larger proportions of the U.S. as suitable, whereas MaxEnt predicted smaller portions as suitable. It is impossible to determine whether Proto3 is overpredicting, because some of the species may not have reached their final distribution. Overall, under both test types, we found much more variation in model performance among the weed species than among the model themselves.

Differences in sprouting rates and frequencies between monoecious hydrilla turions and tubers at six different temperatures

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Abstract:

Hydrilla (*Hydrilla verticillata*) is a submersed macrophyte often called “the perfect aquatic weed” (Langeland, 1996) and is one of the most expensive and difficult to control aquatic weeds in the US. Monoecious hydrilla, the prominent biotype of North Carolina, is an herbaceous perennial (Nawrocki, 2011). Regrowth is dependent upon sprouting of subterranean and axillary turions (Harlan et al., 1985). This study aims to determine differences in sprouting rates and frequencies between monoecious hydrilla turions and tubers at six different temperatures. Studies were conducted on a temperature gradient table at NCSU. Turions and tubers were floated in jars held at six different temperatures (T1 = 41.0°C, T2 = 34.9°C, T3 = 29.3°C, T4 = 24.0°C, T5 = 17.6°C, and T6 = 12.3°C). Sprouting frequency and shoot length were measured every other day for twelve days. Neither turions nor tubers sprouted at the most extreme temperatures, and turions generally sprouted faster than tubers. Both turion and tuber sprouting differed by temperature with optimum turion sprouting at 29.3 and 34.9°C and optimum tuber sprouting at 29.3 and 24.0°C. Results from this study will be useful when considering management programs across latitudes or elevations.