

Center for Invasive Plant Management – 2007 Seed Money Grant – Final Report
(awarded 2007)

Title: Evaluating competitive ability of native grasses to exclude Scotch broom

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Proposal: Scotch broom (*Cytisus scoparius*) is a highly competitive, non-native shrub that invades disturbed sites throughout the Pacific Northwest and elsewhere in the United States. Competitive exclusion of one plant species by another is a vegetation management strategy that has the potential to limit the spread of Scotch broom. Such a strategy could be combined with restoration sowings of native species. However, information on competitive ability of a native species is needed to determine if it is capable of excluding Scotch broom.

An additional series of experiment (Study I) was conducted to evaluate the competitive abilities of three native grass species (spike bentgrass (*Agrostis exarata*), blue wild-rye (*Elymus glaucus*), and western fescue (*Festuca occidentalis*)) to exclude Scotch broom. Grass and pre-stratified seed of Scotch broom were sown simultaneously, and seedlings were thinned or transplanted to provide a standardized range of densities for each species. Moderate rates of liquid fertilizer were applied periodically to each pot to prevent deficiencies of soil macro- and micro-nutrients. Aboveground biomass of each species was determined 140 days after sowing. A replacement series experiment (Study II) also was conducted to determine if high or low availabilities of soil water or nutrients influenced the competitive abilities of each grass species to exclude Scotch broom.

Results: In Study I, multiple regression analyses of plant biomass versus density indicated that blue wild-rye and spike bentgrass each competed strongly with Scotch broom, reducing the shrub's biomass by 90% or more when the grasses were grown at densities greater than 164 plants m⁻². Western fescue also was competitive with Scotch broom, but only at densities twice that of the other grass species. In addition, as Scotch broom density increased, the competitive effect of western fescue decreased but the competitive effects of the other two grass species were not affected. With increasing density of Scotch broom, biomass of blue wild-rye and western fescue decreased, but this competitive effect was attenuated by increasing density of grass. Increasing density of Scotch broom did not negatively influence biomass of spike bentgrass except when the grass was grown at high density (437 plants m⁻²), under which conditions vigor of the grass appeared to decline.

In Study II, availability of soil water did not influence biomass development or competitive outcomes for mixtures of Scotch broom and grass; however, availability of soil nutrients did affect these responses. When grown with high availability of soil nutrients, biomass of Scotch broom and grass averaged 38 and 5 times, respectively, those values observed for low availability of soil nutrients. Although Scotch broom biomass was lowest when grown with grass in the absence of nutrient amendments, the percentage reduction in its biomass due to grass

competition was greater in the presence versus absence of nutrient amendments (95% vs. 75% reductions, respectively). Biomass of western fescue was reduced by competition from Scotch broom, independent of nutrient amendments; however, biomass of the other grass species was not influenced by Scotch broom competition.

Discussion: Of the grass species compared in this study, blue wild-rye and spike bentgrass effectively suppressed biomass development of Scotch broom, regardless of broom density. Western fescue also was competitive with Scotch broom, but these effects diminished as density of Scotch broom increased. These results suggest that, when sown into an existing seedbank of Scotch broom, blue wild-rye and spike bentgrass are likely to inhibit development of this aggressive shrub species; however, western fescue will not be as aggressive at inhibiting Scotch broom. Nutrient amendments strongly stimulated biomass development of Scotch broom and grass; however, broom biomass was lowest when it was grown with grass without any nutrient amendments. Because relative competitive effects of the grass increased with nutrient amendments, the potential may exist to combine fertilization and mowing treatments to create an aggressive stand of grass that may effectively eliminate Scotch broom and inhibit further germination of the species.

Publications: A manuscript is being prepared for submission to *Invasive Plant Science and Management Journal*.

Long-Term Goals and Continued Progress of Research: Proposals will be submitted to The Nature Conservancy, Fort Lewis Military Reservation, and USDA Forest Service Region 6 (National Forest System) to initiate new research that tests effectiveness of sowing native grasses for restoration of Puget Sound prairies and former agricultural fields infested with Scotch broom.

Benefits of Seed Money: The seed money supplemented existing funds to enable the conduct of a full-scale greenhouse experiment. One of the goals of applying for this grant was to increase visibility of ongoing invasive plant research at the Olympia Forestry Sciences Laboratory. With greater visibility, the program will be more likely to attract research support from the Forest Service, as well as other government and non-government organizations.

Advancing This Research: In order to advance this research, applicability of the results must be demonstrated in an operational setting with large plots (0.04 ha or larger), mechanized treatments, and replication of the treatments in time and space. Plans are underway to subject the research to such a test environment through ongoing prairie restoration activities by The Nature Conservancy in the Puget Sound region.

Budget: How the grant monies were spent

Budget item	Cost
Labor:	
Technician @ \$789/week for 5 weeks	\$3945
Materials and supplies:	
2-gallon pots, 300 total @ \$0.75 ea.	225
Sunshine #2 potting soil, 15 bags (3.8 ft ³ ea.) @ \$28/bag	420
Perlite, 4 bags (6 ft ³ ea.) @ \$21/bag	84
Grass seed	32
Fertilizer	40
Drip irrigation hardware	200
Paper bags for biomass assessment	30
Total	\$4976