Suppressing Exotic Weeds on Riparian Restoration Projects Using an Aggressive Herbaceous Understory

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Introduction: Riparian, or streamside, vegetation supports the richest array of wildlife species in California. Historically, riparian vegetation lined the major rivers of the Central Valley covering approximately one million acres when Europeans arrived in the mid 1800s. The rich, productive soils found along the Central Valley's rivers have been developed to agriculture, resulting in the nearly complete conversion of riparian forests. Today, less than five percent of this original acreage remains. As a result, the restoration of riparian vegetation is a priority as a tool for restoring local wildlife populations by most land management agencies and an increasing number of private landowners.

Over the past 15 years riparian restoration has focused on establishing native riparian trees and shrubs on flood-prone land adjacent to Central Valley rivers. This has been largely successful. However, non-native invasive weeds typically remain in the understory after active implementation management has ceased. Significantly, an herbaceous understory composed of native species is an essential for the habitat of many wildlife species.

This report describes an adaptive management exercise that has resulted in the near complete coverage by native plants on a restoration project after three years. The location of the project is on the San Joaquin River National Wildlife Refuge (Refuge), approximately 12 miles west of Modesto. An 800-acres riparian restoration project (funded by CALFED) was initiated in 2002 on the Refuge to restore woody vegetation for wildlife habitat on flood-prone former farmland.

At several locations on the Refuge we observed patches of native herbaceous plants that excluded non-native weeds over relatively large areas of several hundred square feet. These included mugwort, (*Artemisia douglasiana*), gum-plant (*Grindelia camphorum var camphorum*), and creeping rye grass (*Leymus triticoides*). We decided to try to develop a method to install these species into the restoration planting in an effort to competitively exclude the non-native species.

Methods: An adaptive management approach requires that field experiments be conducted of possible methods to achieve desired results. The results of the experiments will guide implementation on the larger scale. Seed was collected of mugwort, gum-plant, and creeping rye grass from plants growing on the Refuge. These were planted in test-plots within the one-year old restoration planting to determine seed germination and seedling establishment success under the on-going implementation activities of irrigation

and mowing. Test-plot results were encouraging because they showed that the three species withstood and prospered under the usual mowing and irrigation regime. Plots were mowed and irrigated six times between March and October 2003. With these results, we then decided that we could try to plant the three species over the entire 800 acre project.

Seed of mugwort and gum-plant are very small. In January 2004 seed of both species were mixed independently with rice-hulls and broadcast in separate aisles between the tree-planted rows at rates of approximately one-half pound of live seed per acre. Site preparation involved disking through the summer to provide a weed-free, bare-soil seedbed. Following broadcasting, the seed was not rolled into the soil. Both mugwort and gum-plant are short-lived perennials. First year growth of each species commences with rain that moistens the soil sufficient to keep the surface moist, typically by January. Growth is rapid through the winter and spring, and the summer with irrigation. A large first-year mugwort can be one foot tall, while a one-year old Gumplant reaches three feet tall. Both species commence growth with the first fall rains of the second growing season and quickly grow taller than winter weeds. They reach maximum growth in April- June completely shading the soil surface and suppressing summer weeds.

Results: Sampling of both density and cover occurred within permanently marked monitoring-plots established the previous year in each field. Sampling of density was performed using a 0.25 square meter frame placed ten times along a permanently marked transect every two months during 2004. Cover was sampled along the same transect and is based upon a belt one meter wide by ten meters long.

Density: First year seedling density of both species ranged from 40 to 150 individuals per square meter at the end of the first growing season.

Cover: *Gumplant*: By the end of 2004 gumplant grew to cover 40 percent of the average plot by the end of the first growing season, accompanied by a 45 to 65 percent cover of weeds. One year later in August 2005 gumplant covered virtually 100 percent of plots, with weeds covering less than 200 percent.

Mugwort: In August 2004 mugwort covered 15 to 40 percent of sample plots, with weeds covering 60 to 80 percent of the same plots. By August 2005 mugwort covered 98 percent of the plots, with weeds a less than two percent cover.

Conclusions:

Aggressive native herbaceous species can compete with non-native weeds to exclude them from actively managed restoration plantings. Critical to success is the preparation of a weed-free seedbed for broadcasting the seeds of the natives. This was accomplished by several diskings during the spring, summer, and fall prior to broadcasting the seeds.

Based on the densities of mugwort and gum-plant during the first year, a reduction in the seeding rate may be called for.

Future monitoring will determine the long-term effectiveness of this approach to weed control.