Shipley-Skinner Reserve – Riverside County Endowment
2002-2003 Progress Report
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Management and Restoration of California Riparian Ecosystems

Background and Summary:

The proposed research sought to investigate the functional roles of native riparian species mixtures in conferring resistance to invasion by *Arundo donax*. Two experiments were initiated at UCR's agricultural experiment station in March, 2002. The experiments were both randomized complete block design, differing only in plant density (small high density plots [1m^2] and large low density plots [2m^2]) and minirhizotron rooting observations, which occurred only in the high density experiment. *Salix goodingii*, *Baccharis salicifolia,* and *Scirpus americanus* represented three physiognomic groups, tree, shrub, and reed, respectively. The species used represented easily obtained riparian species that could be grown from cuttings.

Each experiment consisted of 42 plots, representing six blocks and seven planting treatments. Treatments were all possible combinations of the three species, with six plants to a plot. Following a four-month establishment period, monthly measurements of plant growth and photosynthetically-active radiation (PAR) under each canopy were taken. Minirhizotron rooting observations have commenced in the high density experiment and will be repeated quarterly.

A. donax rhizome pieces were sown into half of the plots on May 8th, 2003. These are being monitored for emergence and growth on a weekly basis. In addition to native plant growth, PAR, and rooting depth data, soil temperature (approx. 10 cm depth) and volumetric water content (20 cm depth) will be measured on a monthly basis.

Results To Date:

Preliminary results show differences in growth of the native plant species and in PAR measurements under each canopy type. Contrary to expectations, the shrub species *Baccharis salicifolia* was larger in volume ($p < 0.000$) than the tree species *Salix goodingii* across all plot types. *B. salicifolia* was smaller ($p < 0.001$) in the high density experiment when compared with the low density experiment, and was smaller ($p < 0.000$) when growing with itself than in all other planting treatments. *S. goodingii* growth was not affected by planting treatment ($p = 0.131$) or plot density ($p = 0.130$). However, high rates of mortality of this species at the beginning of the study necessitated frequent re-planting events. The resultant variation in age of this species may be responsible for the size difference compared to *B. salicifolia* and for the absence of growth differences between treatments. *Scirpus acutus* height was greater in low density plots than in high density plots ($p < 0.000$), and was greatest when growing with itself than in any other planting combination. Relative tiller number of *S. acutus* was not different between high density and low density plots, but was greatest when *S. acutus* was growing with itself than in any other planting combination.

When values for percent of full sun under each canopy were pooled over time, significant differences were found between density experiments and between planting treatments within each experiment. Light penetration was lower ($p = 0.01$) in the high density experiment than in the low density experiment. In both experiments, single-species *S. acutus* plots had the greatest light values. In the low density experiment, plots containing *B. salicifolia* alone or in any two-species combination had lower light values than three-species plots or plots without *B. salicifolia*. High density plot values were significantly different ($p < 0.000$) across treatments, but post-hoc treatment comparisons did not follow the *B. salicifolia* pattern in the low density experiment.

Implications:

Preliminary results suggest that *B. salicifolia* can become the dominant species in early establishment of simplified riparian communities. The reduction in light to the ground in single-species *B. salicifolia* plots may prevent invasion by some understory species (personal observation). For this reason, *B. salicifolia* may be a good choice for general riparian restoration purposes.

While it is too early to make conclusions about the efficacy of these planting treatments in resisting invasion by *A. donax*, it is possible to make stronger hypotheses. Cautious speculation based on light availability predicts lower *A. donax* growth rates in the high density experiment compared to the low density experiment and in one- or two-species plots with *B. salicifolia*. Though a greenhouse experiment showed no effect of light on initial shoot emergence timing from potted rhizomes (Quinn, unpublished data), the experiment was not representative of natural conditions and ran for only six weeks. This controlled field-level study will isolate the effects of community structure on *A. donax* shoot development, a proxy for invasion potential.

Work To Be Completed:

Further collection and analysis of minirhizotron data will add to the quantification of above-ground spatial occupation by the three species in the various planting treatments. *A. donax* shoot emergence and growth will be continually monitored for one year. After establishment of *A. donax*, comparisons will be made of community structure in invaded plots vs. uninvaded plots.

The work described here represents one section of a larger project designed to understand the environmental effects on the invasion-potential of *A. donax*. Along with this community-level study, the project will also investigate the physiological range of *A. donax* in greenhouse experiments and the many variables that affect the establishment of *A. donax* in the field.

Financial Report

Funds were awarded to hire an Assistant II to help with field research, to purchase minirhizotron tubes for observation of belowground growth in the experiments, for soil nitrogen analysis in the field plots, and for rabbit fencing to surround the experiment. The funds awarded were spent for these activities, with some minor changes. Salary and benefit funds were used to partially support Mike Rauterkus, GSR in the Holt lab, to assist in this project. Mr. Rauterkus is also conducting a field research project on *A. donax* for his M.S. thesis. Funds were used to purchase rabbit fencing for the field plots as well as irrigation supplies, and to pay for weed and insect control by Agricultural Operations personnel. Soil nitrogen analysis has not been conducted yet and will be funded from another source. Funds saved from this activity were used to purchase a telescoping rod with which to measure height of the riparian species in the field plot as well as to pay for a University vehicle for several trips to the field. The remaining funds were used to partially cover the travel expenses of Lauren Quinn to attend the 2003 meeting of the Western Society of Weed Science, where she presented her results of research on *A. donax* in a poster session.