

THE EVALUATION OF DEVELOPING SHORELINE COMMUNITIES AND
POTENTIAL FOR NATURAL VEGETATION IN GLEN CANYON NATIONAL
RECREATION AREA, ARIZONA-UTAH

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Objectives

This research was initiated in November, 1988, to evaluate plant communities developing along the shoreline of Glen Canyon National Recreation Area in northern Arizona and southern Utah. One goal of this research is to determine the species composition of these communities and their distribution on representative substrate types throughout the recreation area. Secondly, the interactions of native and exotic plant species present in the recreation area will be evaluated experimentally, to determine the feasibility of establishing populations of native species in these plant communities which, currently, are largely comprised of the exotic riparian tree species tamarisk, Tamarix ramosissima.

Methods

Details of methods are available in the formal proposal submitted to U.W.-N.P.S. Research Center and only general methodology will be discussed in this report.

A census of the plant communities and their distributions along Lake Powell's shoreline will be conducted at the beginning and at the end of this project (November 1988 and 1990). A combination of aerial photographs and aerial and boat surveys will be used to conduct this census. Each of four substrate types (bedrock, gravel-talus, sand and alluvium) will be censused randomly at intervals along the length of Lake Powell, to determine the frequency and composition of plant communities in different substrates and over the distance of the lake.

A series of permanent plots will be established to measure growth and change in plant communities in each of the four substrates along the lake.

Experimental work to study interactions of native species and the exotic tamarisk will entail the following: At plots on the four substrates mentioned previously, rooted cuttings of tamarisk, coyote willow (Salix exigua) and Fremont cottonwood (Populus fremontii) will be grown in various combinations to determine the effects the presence of tamarisk

on the two native species and, conversely, the effects of the native species on tamarisk growth. These plots will be monitored throughout the duration of the study.

A census of reptilian, amphibian, avian, mammalian and invertebrate species associated with these plant communities will be made in the Spring of 1989.

Results

In November, 1988, an assistant and I spent two weeks moving from Wahweep to Hite on Lake Powell, censusing and establishing permanent study plots. Additionally, a number of side canyons feeding into Lake Powell were studied, in the search for populations of native species. We censused the eastern shoreline of the lower lake and both sides of the upper lake. We established 34 of 40 permanent plots and conducted 150 of 200 random censuses. The remaining work will be completed in the winter and spring of 1989 in cooperation with the N.P.S. at Page, Arizona. In light of this, the information presented in this report is incomplete.

Over 80% of all sites encountered in the random census were colonized by annual and/or perennial plants. This high level of colonization is due in part to the fact that bedrock sites were censused only if they had a slope of 45° or less. I want to wait to present data on the proportion of each substrate colonized, because slope in general was found to be a strong determinant of plant colonization, regardless of substrate, and the data have yet to be adjusted for slope, although the information was collected.

Tamarisk was encountered at 68% of the census sites and native perennial shrub or tree species were found at 13% of the sites. Native species included Fremont cottonwood (Populus fremontii), seep willow (Baccharis salisifolia), waterweed (Baccharis emoryi) and arrowweed (Tessaria sericea). Seep willow was the native species most commonly encountered along lake shoreline and occurs in large numbers in some stretches of the lake. However, it was rare or absent in most side canyons.

Preliminary census results and analysis indicate that when tamarisk colonize sites, they tend to be more abundant in soils than in talus or bedrock (Table 1). Based on plant height measurements, soils and talus, rather than bedrock appear to provide better growing conditions for these plants (Table 1B). We collected cores from tamarisk trunks at many of these sites and will be able to corroborate this pattern using growth ring analysis. We encountered native species of trees and shrubs in nearly equal frequency on all of the different substrate types, and tentatively conclude that substrate type is not influencing their distributions. However, there may be differences in densities and growth performance on different substrates. We have data to address this question, but it is not yet analyzed.

A striking finding in this study was the occurrence of extensive plant communities below the 3700' line. We found large stands of tamarisk and native species below the high water line at nearly 30% of the census sites. Seep willow was encountered more commonly below the 3700' line than above it, which may reflect an intolerance to water stress that plants above the 3700' line probably encounter when lake levels are low. We tagged plants and estimated densities in these communities at 5 sites, to determine their fate in subsequent years. We also tagged seep willows above the 3700' line to measure growth and survivorship in the next 3 years.

Native species as well as tamarisk were present in many of the permanent plots we established, which will enable us to study interactions of native and nonnative species in a natural setting. We found evidence native species growing in close proximity to tamarisk, and noted the establishment of seep willow seedlings under tamarisk canopies. Our permanent plot data have not yet been analyzed.

Conclusions

The shoreline along Lake Powell in GCNRA has been colonized extensively in the last 5 years, particularly by the exotic Tamarix ramosissima. We have presented preliminary evidence to indicate that while most available substrates along the lake are colonized, they are colonized to different extents and have varying effects on plant growth. Native plant species are relatively rare in these emerging communities, with the commonest species being seep willow (Baccharis salisifolia). While many native perennial woody species occur in high densities up side canyons, the rate of their dispersal onto lake shoreline has been far slower than that of tamarisk.

The occurrence of native species predominantly below the 3700' water line may indicate that they are intolerant of the fluctuating lake levels that plants above the 3700' line encounter each year. This issue will need to be taken into account in the reintroduction of native species into the Lake Powell shoreline plant communities.

Table 1. (A.) Abundance (abundance of plants where colonization has occurred) and (B.) height of *Tamarix ramisissima* at census sites on different substrates (S.D. = standard deviation) (These do not include census sites in the Chinle formation).

A. ABUNDANCE BY SUBSTRATE:

SUBSTRATE TYPE	N	MEAN # PLANTS/ 50 X 100'	S.D.
1. SILT	3	1,171.7	1,021.7
2. SAND	28	653.6	2,495.9
3. COBBLE	6	389.7	561.6
4. TALUS	33	46.6	85.0
5. BEDROCK	27	13.8	16.8

B. PLANT HEIGHT BY SUBSTRATE:

SUBSTRATE		MEAN HEIGHT (M)	S.D.
1. SILT	3	2.13	0.97
2. SAND	28	1.98	0.63
3. COBBLE	6	1.51	0.48
4. TALUS	33	2.20	0.66
5. BEDROCK	27	1.32	0.56