Cottonwood Forest Health Along The Lower Dolores River

An investigation of potential barriers to cottonwood regeneration on the Lower Dolores River, CO

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Introduction

The Dolores River Dialogues (DRD) pursued this research as a result of the observed decline of cottonwood forest along streams of the arid Southwest and the community voiced recognition of the importance of healthy riparian forests*. The goal purpose of this study was to monitor assess both soil salinity and groundwater drawdown rates to determine their suitability to cottonwood regeneration at two sites on the Lower Dolores River. The two study sites were located in the Big Gypsum Study Area (70 miles downstream of McPhee Dam) and Lone Dome Recreational Site Lone Dome State Wildlife Area (X miles downstream of McPhee Dam) in riparian areas.

Soil Salinity

Excessive accumulation of salt in soil can be detrimental to plant growth, especially during germination. Natural salt deposits are present throughout the Colorado Plateau and Lower Dolores River region. The salt-tolerant tamarisk shrub, which is abundant along parts of the river, has the ability to absorb salt water from deep sources and deposit salty leaf litter onto the soil surface.

It was hypothesized that soil salinity would be higher than the threshold for cottonwood establishment in places where tamarisk is abundant on the Lower Dolores River. Soil salinity was monitored in sites ranging in tamarisk abundance in The Big Gypsum Study Area. We found that soil salinity was within a tolerable range in all locations where tamarisk was not abundant. However, in all locations where tamarisk was abundant, soil salinity exceeded the threshold for cottonwood germination (4mmhos/cm) [1].

Groundwater Drawdown Rates

After Following spring runoff, the survival of newly germinated sapling trees is dependentdepends on the rate in at which groundwater drops through the soil. When groundwater moves through the soil faster than sapling seedling roots can grow (2.5 cm/ day) studies have shown that they cannot , saplings can't survive. Groundwater drawdown rates are related to the ramp down rates of spring runoffspills , which is controlled by managementfromout of McPhee Dam.

Groundwater drawdown rates were monitored both at a site near the in dam (at Lone Dome Recreational Area)RecreatioState Wildlife Area nal site, and at a site ina site 70 miles downstream of the dam in the Big Gypsum Valley. In At both study sites, two clusters of soil moisture probes (SMPs) were installed in an attempt to capture the movement of groundwater through the cross section making up the riparian zone. Soil moisture probes detect the pressure tension (in centibars) in at which water is being held in soil pores, which is directly related to soil moisture content. In order to track the movement of soil moisture through the soil profile, a specific water tension was tracked through each cluster SMPs. Since the SMPs are at known depths, an easy calculation allows one to observe the amount of time (in days) it takes a specific water tension to

move through the soil. The water tension that was tracked in this study corresponds closely to the soil's wilting point (the point there where vegetation cannot extract water from the soil). Ground water wells were installed adjacent to all clusters in order to compare soil moisture with the rise and fall of the water table.

Lone Dome Recreational SiteState Wildlife Area

Two clusters of SMPs were installed in the Lone Dome Recreational Site, located 31 feet (cluster #1) and 174 feet (cluster #2) perpendicularly from the river's edge at base flow[2].

Cluster #1 remained sufficiently wet at all depths recorded throughout the summer (groundwater drawdown was not calculated for this cluster).

In cluster #2, groundwater drawdown rates were calculated to be 4.6cm/day between SMPs #1 and #2, and 3.8 cm/day between SMPs #2 and #3. In this cluster, groundwater drawdown rates were found to be higher than the established threshold rate for cottonwood regeneration (2.5 cm/day). No new cottonwood saplings were observed along this transect.

Big Gypsum Study Area

Two clusters of SMPs were installed in Big Gypsum Study Area, located 16 feet (cluster #1) and 70 feet (cluster #2) perpendicularly from the river's edge at base flow[3].

In cluster #1, groundwater drawdown was calculated to be 4.6 cm/day. In cluster #2, groundwater drawdown was calculated to be 2.9 cm/day between SMPs #1 and #2, . In both clusters, groundwater drawdown rates were found to be higher than the established threshold rate for cottonwood regeneration (2.5 cm/day). Soil moisture probes #3 and #4 remained sufficiently wet throughout the season. No new cottonwood saplings were observed along this transect.

Conclusions and Next Steps

In conclusion, sIt was concluded that soil salinity was within an acceptable range in all locations except those where tamarisk is was not abundant. , in which case Ssalinity was higher thanthat the threshold for cottonwood germination at sites where tamarisk was abundant.

It was concluded that At both in Big Gypsum Valley and Lone Dome Recreational site State Wildlife Area, groundwater drawdown rates were higher than the threshold rate for cottonwood establishment.

A long-term goalThe possibility exists for water managersthe DRD is to use groundwater drawdown rates to determine inform the threshold rate at which McPhee Dam can ramps down its spring flow spill, in order to in order toso as which can to improve chances for facilitate the successful establishment of cottonwoods on the Lower Dolores River. A better understanding of the relationship between in-stream flows and groundwater drawdown rates can improve the efficiency of water usage during a season where cottonwood germination is a priority. could improve manager's ability to promote cottonwood seedling survival in certain years.

Based on the pilot study results presented above, the nNext steps to accomplish this goal are to:for developing this relationship opportunity include

1) further analyze and comparinge groundwater drawdown rates with the movement of the standing water table (as recorded by the peizometers);
2) continucontinuinge to monitor, record and analyze data from the existing SMP's and peizometers for the life (~3 years) of the existing equipment;
3) installing several additional clusters of SMP's and peizometers along the Lower Dolores River in order to more accurately identify the better understand the correlationrelationship between the ramp down of the spill out of McPhee reservoir and groundwater drawdown rates.

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* For referenced publications and/or additional details for this abstract, please refer to the full manuscript: "Potential Barriers to Cottonwood Establishment along The Lower Dolores River." Rob Anderson. 2010. In editing.

[1] Soil salinity was measured as electric conductivity in mmhos/cm.

[2] Two SMPs were installed at cluster #1 (23 and 47cm depths) and three SMPs were installed in cluster #2 (23, 46, and 69cm depths).

[3] Two SMPs were installed at cluster #1 at 23 and 46 cm depths, and four probes were installed in cluster #2 at 24, 44, 66, and 94cm depths.