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Direct seeding for riparian tree re-vegetation: Small-scale field study of seeding methods and irrigation techniques

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ABSTRACT

Restoration of wetland and associated ecosystems is a major goal of land management agencies throughout the world. On the lower Colorado River, creation of riparian forests is planned to mitigate riparian habitat degradation by historic land-use conversions and river management. Current restoration practices use propagated plant stock. If direct seeding can be implemented, genetic and structural diversity could be enhanced at restoration sites even while reducing costs compared to vegetative propagation methods. A small-scale field study was implemented in Cibola, Arizona, to determine the effectiveness of direct seeding of Fremont cottonwood (*Populus fremontii*), Goodding's willow (*Salix gooddingii*), and coyote willow (*S. exigua*). For the first growing season, establishment of Fremont cottonwood averaged 7% of pure live seed rates for all treatments combined, whereas establishment of willows was less than 1%. Volunteer species were abundant, with grasses dominating cover and biomass after one growing season. Saltcedar (*Tamarix ramosissima*) established in abundance, but showed lower growth rates than Fremont cottonwood during the first growing season. Monitoring for three growing seasons indicated higher growth rates and survival of Fremont cottonwood compared to all volunteer species. Study results indicated that direct seeding of Fremont cottonwood is likely to be an efficient method for tree re-vegetation. Additional studies are required for willow species to determine if establishment from seed can be increased through enhanced weed control and elimination of Fremont cottonwood from the seed mix.

1. Introduction

1.1. Background

To mitigate historic destruction of wetlands, momentum is growing to restore or re-vegetate associated ecosystems to provide flood control and habitat for native fauna (Mitsch and Gosselink, 2000). Western U.S. land managers are tasked with restoring thousands of hectares of vegetation along streams, where flow regulation, clearing of native vegetation, grazing, and establishment of non-native species have resulted in soil salinization (Glenn et al., 1998), channel narrowing and incision (Shafroth et al., 2002), and increased frequency and intensity of wildfires (Busch, 1995). Along the lower Colorado River (LCR[1]), areas of riparian vegetation were historically cleared for agriculture. Additionally, dams and levees constructed between Lake Powell and the international border with Mexico reduced flooding and allowed for diversions of water for agricultural and urban use. However, land clearing and flow regulation have resulted in extensive degradation of riparian ecosystems within the historic floodplain.

To mitigate anthropogenic changes in river management and land use, the U.S. Bureau of Reclamation plans to re-vegetate 2400 ha of land on the LCR currently under agricultural use or dominated by saltcedar (*Tamarix ramosissima*), an introduced invasive species, with the native Salicaceae species Fremont cottonwood (*Populus fremontii*, FC), Goodding's willow (*Salix gooddingii*, GW), and coyote willow (*S. exigua*, CW) to provide habitat for native fauna

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[1] *Abbreviations*: FC, Fremont cottonwood; GW, Goodding's willow; CW, coyote willow; LCR, lower Colorado River; bgs, below ground surface; ANOVA, analysis of variance.

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