From Forest Nursery Notes, Summer 2013

29. © Taming the beast: managing hydrology to control Carolina willow (*Salix caroliniana*) seedlings and cuttings. Quintana-Ascencio, P. F., Fauth, J. E., Morales, L. M. C., and Ponzio, K. J. Restoration Ecology. 2013.

Restoration Ecology
THE JOURNAL OF THE SOCIETY FOR ECOLOGICAL RESTORATION INTERNATIONAL

RESEARCH ARTICLE

Taming the Beast: Managing Hydrology to Control Carolina Willow (*Salix caroliniana*) Seedlings and Cuttings

Pedro F. Quintana-Ascencio,[1,2] John E. Fauth,[1] Luz M. Castro Morales,[1] Kimberli J. Ponzio,[3] Dianne Hall,[3] and Ken Snyder[3]

Abstract

Historically, wetlands along the St. Johns River, Florida, were dominated by herbaceous marshes. However, in the last 50 years many areas transformed to shrub-dominated wetlands, at the same time a system of levees and canals was constructed to control flooding. We tested the role of water management in controlling Carolina willow (*Salix caroliniana*), a native shrub that accounts for most of this shift. We assessed survival and growth of seedlings and cuttings on four artificial islands. We planted willow seedlings and cuttings at the spring waterline and at three higher levels (+17.5, +35, and +50 cm) and evaluated their responses to natural hydrologic fluctuations. Overall, seedlings had lower survival than cuttings. Highest mortality occurred during summer floods and willows greater than 50 cm above marsh surface had the highest survivorship. Surviving seedlings attained similar height and biomass among elevations, but the cuttings had greater stem diameter, stem height, and biomass at higher elevations. In the second experiment, we planted seedlings and short (25 cm) and tall (50 cm) cuttings at the waterline and at three higher levels (+25, +35, and +50 cm) in artificial ponds with controlled water levels. Before flooding, seedlings at the highest elevation suffered some mortality due to desiccation, but after flooding, they had the highest survival. Elevation did not affect cutting survival, but those at the lowest elevation had the greatest height and biomass. Hydrologic manipulation can be a powerful tool to control willow establishment. However, its success depends on timely and prolonged inundation or water drawdown.

Key words: artificial island, artificial pond, hydrology, river, wetland restoration, woody shrubs.

Introduction

Hydrology is a major factor determining the composition of wetland plant assemblages (Mitsch & Gosselink 1993; Busch et al. 1998). Long-term changes in wetland inundation can dramatically change community structure and composition (Thibodeau 1985; van der Valk et al. 1994; Fisher et al. 1996). Prolonged flooding favors submerged and floating vegetation (Thibodeau 1985; van der Valk et al. 1994), while shorter inundation periods favor woody species (Thibodeau 1985; Fisher et al. 1996; Wheeler et al. 1999; Timoney & Argus 2006). Consequently, shortened inundation can promote the conversion of herbaceous wetlands into shrub-dominated wetlands (shrub swamps). Complete replacement of herbaceous wetlands by shrub communities decreases landscape heterogeneity (Kinser et al. 1997), biodiversity (Miller et al. 1998), and ecological (Southall et al. 2003) and economic values.

Management of streams and other freshwater bodies has had unintentional negative consequences for native ecosystems. In some instances, there is a demise of native species, as in the Mary River, Alberta, Canada, where river impoundment and over-allocation has reduced the abundance of *Populus* spp. (Rood et al. 1995). In other systems, human-induced alterations of the hydrology have increased the distribution of nonnative species, as in the case of Russian olive (*Elaeagnus angustifolia*) in western North America (Katz & Shafroth 2003). In Australia and South Africa, exotic willows (*Salix* spp.) were introduced to stabilize soil around water courses, but their spread has resulted in obstructed streams, displaced native vegetation, and reduced water quality and availability (Hendersona 1991; Cremera 2003; Stokes 2008; Giljohann et al. 2011).

The headwater region of the Upper St. Johns River (USJR) in east-central Florida, U.S.A., contains 120,000 ha of herbaceous wetlands, shrub swamps, and forested wetlands. Beginning in the early 1900s, a network of levees and canals was established to facilitate agricultural production and control flooding (St. Johns River Water Management

[1]Department of Biology, University of Central Florida, 4000 Central Florida Blvd., Orlando, FL 32816-2368, U.S.A.
[2]Address correspondence to P. F. Quintana-Ascencio, email pedro.quintana-ascencio@ucf.edu
[3]Division of Environmental Sciences, St. Johns River Water Management District, PO Box 1429, Palatka, FL 32178-1429, U.S.A.

doi: 10.1111/j.1526-100X.2012.00940.x