From Forest Nursery Notes, Winter 2012

**150. © Abrupt drops in water table level influence the development of *Populus nigra* and *Salix alba* seedlings of different ages.** Guilloy, H., Gonzalez, E., Muller, E., Hughes, F. M. R., and Barsoum, N. Wetlands 31:1249-1261. 2011.

Wetlands (2011) 31:1249–1261
DOI 10.1007/s13157-011-0238-8

ARTICLE

# Abrupt Drops in Water Table Level Influence the Development of *Populus nigra* and *Salix alba* Seedlings of Different Ages

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Received: 5 April 2011 / Accepted: 16 September 2011 / Published online: 7 October 2011


**Abstract** Early seedling establishment is a demographic bottleneck for the sexual regeneration of many riparian tree species such as *Populus nigra* and *Salix alba*, two dominant species of European floodplains. Immediately after spring germination, seedling roots must track receding water tables to avoid desiccation. This may be especially difficult if the groundwater recession is too abrupt. In this study, seedling survival and growth under different abrupt drops in water table levels were examined using an experimental facility that allowed continuous and non-destructive measurements of above- and below-ground seedling development. A Cox proportional hazards regression model showed that the risk of mortality for a seedling was significantly lower in *P. nigra* than in *S. alba*, was lower for older than for younger seedlings, and increased with greater drops in water table level. In fact, almost no seedlings survived abrupt water level drops ≥40 cm. However, no substantial differences in any of the growth parameters were observed between species, age, and water table treatments, as shown by R-ANOVA and paired tests. This suggests that abrupt drops in water table level did not stimulate plant growth but only favoured the survival of the most resistant individuals. These findings should be considered when designing improved water flow prescriptions along managed river courses in Europe.

**Keywords** Floodplain forest restoration · Minirhizotron · Poplar · Recruitment · River flow management · Salicaceae · Willow

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## Introduction

*Populus nigra* L. and *Salix alba* L. are two major Salicaceae species of western European floodplain forests with a broad distribution from the Mediterranean region in the south to the northern ~60° latitudes (Lèfevre et al. 1998; Girel et al. 2003). They are pioneer tree species whose life-cycle greatly depends upon natural hydro-geomorphic disturbances (Karrenberg et al. 2002; Rood et al. 2003). Over the past century, an intensification in river management activities (e.g., groundwater exploitation, channelization, impoundments, gravel extraction) has resulted in significant alterations to natural patterns of sediment deposition, river flow, the frequency, timing and intensity