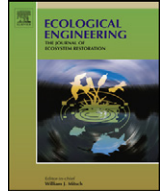


We are unable to supply this entire article because the publisher requires payment of a copyright fee. You may be able to obtain a copy from your local library, or from various commercial document delivery services.

From Forest Nursery Notes, Winter 2012

**175. © Nurse-plant and mulching effects on three conifer species in a Mexican temperate forest.** Blanco-Garcia, A., Saenz-Romero, C., Martorell, C., and Alvarado-Sosa, P. Ecological Engineering 37:994-998. 2011.



## Short communication

## Nurse-plant and mulching effects on three conifer species in a Mexican temperate forest

Arnulfo Blanco-García<sup>a</sup>, Cuauhtémoc Sáenz-Romero<sup>b</sup>, Carlos Martorell<sup>c</sup>, Pedro Alvarado-Sosa<sup>b</sup>, Roberto Lindig-Cisneros<sup>a,\*</sup>

<sup>a</sup> Laboratorio de Ecología de Restauración, Centro de Investigaciones en Ecosistemas, Universidad Nacional Autónoma de México, Morelia, Michoacán, Mexico

<sup>b</sup> Instituto de Investigaciones Agropecuarias y Forestales, Universidad Michoacana de San Nicolás de Hidalgo, Morelia, Michoacán, Mexico

<sup>c</sup> Departamento de Ecología y Recursos Naturales, Facultad de Ciencias, Universidad Nacional Autónoma de México, Distrito Federal, Mexico

## ARTICLE INFO

## Article history:

Received 1 September 2010

Received in revised form 12 January 2011

Accepted 23 January 2011

Available online 18 February 2011

## Keywords:

Ecological restoration

Fir

Pine

Nurse plants

Old fields

Facilitation

Positive interactions

## ABSTRACT

Nurse-plant effects have been used as an effective reforestation and restoration strategy, and mulching has also effectively ameliorated soil-adverse conditions. However, use of nurse plants is limited by the presence of suitable nurse species before trees are planted, and use of mulching depends on availability of appropriate materials. The effects of *Lupinus elegans* as a nurse plant and pine-bark mulch were tested on three conifer species: *Pinus montezumae*, *Pinus pseudostrabus*, and *Abies religiosa*. We tested if nurse-plant type effects occurred if the lupines and the conifers were planted simultaneously. Overall survival was 53%, and significant differences among species were found. Survival regardless of cover type was significantly higher ( $P < 0.01$ ) for *P. pseudostrabus* 17-month-old seedlings at planting (81%), followed by *P. montezumae* 7-month-old seedlings at planting (71%), *P. pseudostrabus* 7-month-old seedlings at planting (42%) and finally *A. religiosa* 7-month-old seedlings at planting (17%) the differences among the treatments were significant ( $P < 0.01$ ). As a soil shading agent, lupines had a significant effect ( $P = 0.02$ ), because they increased survival of *P. pseudostrabus* and *A. religiosa*, the effect of mulching with pine bark was not significant. The effects of a shading agent on growth differed among species. In particular lupines reduced height and stem diameter for *P. montezumae* and *P. pseudostrabus*, between 22% and 33%, and had no effect on growth of *A. religiosa*. The positive effects of the simultaneous planting of *L. elegans* on the survival of the trees suggests that nurse-plant facilitation can be used in areas where no suitable nurse plants are already present.

© 2011 Elsevier B.V. All rights reserved.

## 1. Introduction

Facilitation, the phenomenon by which one plant's presence positively affects the survival and growth of other plants, has been found to be more frequent than previously thought (Padilla and Pugnaire, 2006). Brooker et al. (2008) recently called for testing facilitation as a restoration and reforestation tool for degraded areas. Nurse-plant effects (the most common facilitation process) have been tested in different ecosystems (Gomez-Aparicio et al., 2004; Walker and Powell, 1999; Aerts et al., 2007; Zhao et al., 2007; Yoshihara et al., 2010) and also in severely degraded environments (Densmore, 2005; Frérot et al., 2006; Padilla and Pugnaire, 2006). Most nurse plants are shrubs (McAuliffe, 1988; Padilla and Pugnaire, 2006; Callaway, 1995), but use of shrubs as nurse plants depends on their already being present on site (Gomez-Aparicio

et al., 2004). Establishing nurse plants can be time consuming because they have to grow to sufficient size before the plants they are intended to protect can be introduced (Castro et al., 2002). Therefore, reforestation practices in stressful environments, in most cases lacking appropriate shrubs to act as nurse plants, can be considerably improved if the shrub intended to act as a nurse plant and the species being protected could be seeded or planted simultaneously.

*Lupinus elegans* Kunth (elegant lupine) is an abundant perennial species in the Western Mexico (McVaugh, 1987; Medina et al., 2000). In this region, individuals can be more than 2 m high; the stem at its base can reach 15 cm in diameter and all branching occurs from this stem. The species grows rapidly and reaches its final height only two years after planting. Because the propagation requirements of this species are known (Alvarado-Sosa et al., 2007; Medina-Sánchez and Lindig-Cisneros, 2005) it is an excellent candidate to be tested as a nurse plant to be established simultaneously with trees it will protect. The facilitative role of several lupine species has been studied with mixed results; some species

\* Corresponding author.

E-mail address: [rlindig@oikos.unam.mx](mailto:rlindig@oikos.unam.mx) (R. Lindig-Cisneros).