From Forest Nursery Notes, Winter 2010

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Restoration Ecology
THE JOURNAL OF THE SOCIETY FOR ECOLOGICAL RESTORATION INTERNATIONAL

TECHNICAL REPORT

Love of Nurse Plants is Not Enough for Restoring Oak Forests in a Seasonally Dry Tropical Environment

Ernesto I. Badano,[1,2,4] Delfina Pérez,[3] and Carlos H. Vergara[1,2]

Abstract

The highest concentration of oak species in the world occurs in Mexico, but human activities have strongly degraded these oak forests. Mexican oaks have high economic, social, and cultural value, and restoring these forests is of paramount importance for the people of Mexico. Here, we propose a method for restoring oak forests using native shrubs that colonize degraded areas as nurse plants for oak seedlings. To test the viability of this proposal, seedling transplant experiments were performed in a degraded area near a protected oak forest relict. Two pioneer shrubs were identified as potential nurse species: *Mimosa luisana* and *Senecio* sp. The target oak species was *Quercus castanea*. Oak seedlings were located beneath the canopies of both shrubs and in the surrounding area without shrub cover. Water is a limiting resource for oak establishment in seasonally dry environments; therefore, we included irrigation systems in our experimental design to determine whether the combination of nurse plants plus watering led to higher rate of survival than the presence of nurse species alone. Seedling survival without watering was less than 20% both beneath nurse species and in the surrounding habitat. When water was supplied, survival rate beneath nurse species increased up to 58% while survival in the surrounding habitat did not differ from that observed in treatments without watering. Our results indicate that survival rate of oak seedlings is increased by the presence of nurse plants only when water is supplied. This suggests that restoration of oak forests in these degraded areas requires both nurse plants and watering.

Key words: oak forest restoration, nurse plants, positive interactions, seasonally dry forests, seedling survival.

Introduction

Forest restoration has become a worldwide goal because of the services that forests provide to humans acting, for instance, as water reservoirs and carbon sinks (Ruis 2001). The most common forest restoration strategy implies massive planting of tree seedlings in degraded areas. This strategy works well in environments where water is not a limiting factor for plant establishment, but its success in seasonally dry environments is low because of heavy plant losses caused by desiccation during the dry season (Castro et al. 2002; Gómez-Aparicio et al. 2004). As an alternative to restoring forests in dry habitats, it has recently been proposed that positive interactions between plants may improve the success of restoration efforts (Maestre et al. 2001; Padilla & Pugnaire 2006). The principle behind this proposal is that, under harsh physical conditions, the pioneer plants that colonize degraded areas can provide more favorable microhabitats than the surrounding zones without vegetation cover for the establishment of late successional species (Castro et al. 2002, 2004; Gasque & García-Fayos 2004; Sánchez-Velásquez et al. 2004; Norisada et al. 2005). Such a positive effect occurs because the shaded environment beneath the canopy of pioneer species may ameliorate extreme temperatures and/or improve soil water retention, thus decreasing vapor pressure deficit, heat loading, or photoinhibition in seedlings of beneficiary species (Callaway & Pugnaire 1999; Shumway 2000; Tewksbury & Lloyd 2001).

Despite the recent emphasis on restoring forests by using positive interactions between plants, it is important to note that most of these restoration strategies have been proposed and tested in temperate environments. Literature evaluating the potential for restoring degraded areas of seasonally dry tropical environments is still scarce (Meli 2003; Norisada et al. 2005). Thus, restoration of seasonally dry tropical forests currently requires more research in order to provide tools to improve the success of restoration practices (Vieira & Scariot 2006).

Oak (*Quercus* spp.; Fagaceae) forests are a conspicuous component of the flora of the Northern Hemisphere (Manos

[1] Departamento de Ciencias Químico Biológicas, Escuela de Ingeniería y Ciencias, Universidad de las Américas Puebla, Ex-Hda. Santa Catarina Mártir, San Andrés Cholula 72820, Puebla, México
[2] Secretaría de Medio Ambiente y Recursos Naturales, Gobierno del Estado de Puebla, Calle 33 Sur, Puebla 72480, México
[3] Comisión Nacional Forestal Región X Golfo-Centro, Calle 26 Norte 1202, Puebla 71379, México
[4] Address correspondence to E.I. Badano, email ernesto.badano@udlap.mx

doi: 10.1111/j.1526-100X.2009.00530.x