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Roadfill Revegetation in Semiarid Mediterranean Environments. Part II: Topsoiling, Species Selection, and Hydroseeding

Jaume Tormo,[1,2] Esther Bochet,[1] and Patricio García-Fayos[1]

Abstract

Erosion is one of the main problems in roadfill restoration. Revegetation is widely used as a method to reduce erosion rates, and it is often carried out through hydroseeding. In semiarid Mediterranean conditions, this approach to revegetation often produces poor results due to climatic limitations. We evaluated whether (1) spreading topsoil and (2) hydroseeding with local rather than commercial species mixtures could improve the vegetative cover of roadfills. The study was carried out in 24 plots over a 20-month period. At the end of the study, vegetation cover was higher in topsoiled plots (38.8%) than in nontopsoiled plots (21.5%). Locally selected species produced higher vegetative cover (61.1%) than did standard commercial species (52.2%). After 20 months, the erosion index was not different among any treatment probably due to the low sensitivity of this variable. These results suggest that amendment of soils through the addition of topsoil is an important technique in roadfill revegetation in Mediterranean environments. Additionally, hydroseeding with local species will produce better vegetative cover on roadfills than does hydroseeding with available commercial species.

Key words: embankment, local species, public works, restoration, roadfill, seed bank, soil amendment.

Introduction

Road and railway construction significantly impacts soil and vegetation by moving large amounts of soil and underlying materials. Resulting roadfills that are built by accumulating and compacting materials from an adjacent area often present steep slopes and poorly consolidated soils that are very vulnerable to erosion (Arnáez & Larrea 1994; Navarro & Jonte 1996; Nicolau 2002). Erosion not only negatively affects roadfills but also has important consequences for associated infrastructure, including loss of structural support, sedimentation of adjacent areas, filling of roadbeds and dams, and initiation of landslides (Andrés & Jorba 2000; Navarro 2002).

Some authors have promoted passive restoration on the basis that spontaneous plant colonization through seed dispersal from nearby areas might produce high vegetation cover and good soil protection (Prach & Pysek 2001). However, under semiarid climate conditions, roadfills become less hospitable for plant colonization (Bochet & García-Fayos 2004). In these situations, spontaneous colonization is too slow to provide an effective vegetation cover to control soil erosion (Nicolau 1996), even though seed arrival to the slopes is not limited (Bochet et al. 2006).

The success of spontaneous plant colonization in semiarid regions could potentially be improved through soil amendment techniques. The addition of topsoil, which has been previously stockpiled, facilitates vegetation establishment by improving physical or chemical soil properties (Cotts et al. 1991; Harwood et al. 1999; Balaguer 2002). At the same time, it provides a seed bank that can enhance spontaneous revegetation (Ward et al. 1996; Rokich et al. 2000; Holmes 2001).

Many more active restoration techniques, such as the use of geotextiles, blankets, and plants, have also been proposed for use in revegetation (Benik et al. 2003), but these techniques are too expensive to be used extensively in roadfills (Muzzi et al. 1997). More often, the revegetation of large and steep areas of soil is carried out by means of hydroseeding (Enríquez et al. 2004), which consists of projecting a seed mixture together with water, fertilizers, and other substances that improve soil properties to enhance the establishment of vegetation.

Hydroseeding has been widely used for the revegetation of roadfills in Spain for the past few decades. However, in semiarid Mediterranean conditions, this technique does not produce sufficiently dense vegetation cover (Muzzi et al 1997; Bochet & García-Fayos 2004). The species used in these sowings are generally not selected for local climatic conditions and are rarely adapted to Mediterranean semiarid environments with long periods of drought and erosive rains (Bochet & García-Fayos 2004). These environmental conditions become more pronounced in roadfills where soils have low fertility,

[1]Centro de Investigaciones sobre Desertificación-CIDE (CSIC, UV, GV), Camí de la Marjal s/n, Apdo Oficial 46 470 Albal, Valencia, Spain.
[2] Address correspondence to J. Tormo, email jaume.tormo@uv.es