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Infiltration and Sediment Rates Following Creosotebush Control With Tebuthiuron

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Abstract

The effects of chemical creosotebush (*Larrea tridentata* [D.C.] Cov.) control on infiltration rates, wetting-front depth, and sediment production were examined in the Chihuahuan Desert of southern New Mexico. Study sites were treated with aerial applications of tebuthiuron (N-[5-(1,1-dimethylethyl)-1,3,4-thiadiazol-2-yl]-N,N′-dimethylurea) as part of a brush control program administered by the US Bureau of Land Management. Study sites were equally distributed among 3 geographic regions and included 6 sites treated 5–9 years ago, 6 sites treated 15–18 years ago, and 12 contiguous nontreated sites. Paired 1-m^2 rainfall simulation plots encompassed the creosotebush canopy zone and adjacent interspace area with runs made using simulated rainfall at 9.1 $cm \cdot hr^{-1}$ for 30 minutes. Runoff and sediment were collected every 5 minutes, and wetting-front depths were measured at the end of rainfall simulations. Infiltration rates were significantly higher in the canopy zone than in interspace areas and were highest in 5–9-year-old sites, intermediate in nontreated sites, and lowest in 15–18-year-old sites. Regression equations showed that infiltration rates within the canopy zone were positively correlated with litter mass, and cover of litter, shrubs, and grasses. Within interspace areas, infiltration rates were most correlated with aggregate stability and cover of litter, rocks, and grasses. Wetting-front depths were significantly deeper in the canopy zone than in interspace areas for all treatments. Sediment concentration ($kg \cdot L^{-1}$) was higher in the canopy zone than interspace, but total sediment yield was not significantly different between these areas or affected by any treatments.

Resumen

Se examinaron los efectos del control químico del "Creosotebush" (*Larrea tridentata* (D.C.) Cov.) sobre las tasas de infiltración, profundidad del frente húmedo y producción de sedimentos en el Desierto Chihuahuense del Sur de Nuevo Mexico. Los sitios de estudio se trataron con aplicaciones aéreas de tebuthiuron (N-[5-(1,1-dimetiletil)-1,3,4-tiadiazol-2-yl]-N,N′-dimetilurea) como parte de un programa de control de arbustos administrado pro el Buró de Manejo de Tierras de EE.UU. Los sitios de estudio fuero distribuidos equitativamente entre 3 regiones geográficas e incluyeron 6 sitios tratados 5–9 años antes, 6 sitios tratados 15–18 años antes y 12 sitios contiguos no tratados. Se Usaron parcelas apareadas de 1 m^2 para simulación de lluvia que abarcaron la zona de la copa del "Creosotebush" y el área del espacio entre plantas adyacente y se hicieron corridas usando lluvia simulada a razón de 9.1 $cm \cdot hr^{-1}$ por 30 minutes. El escurrimiento y los sedimentos fueron colectados cada 5 minutos y las profundidades del frente húmedo fueron medidas al final de las simulaciones de lluvia. Las tasas de infiltración fueron significativamente mayores en la zona de la copa que en el área del espacio entre plantas y las mayores tasas fueron en los sitios con 5–9 años de haber sido tratados y las menores en los sitios con 15–18 años de antigüedad. Las ecuaciones de regresión mostraron que las tasas de infiltración dentro de la zona de la copa estuvieron positivamente correlacionadas con la masa de mantillo, arbustos y zacates. En las áreas entre plantas las tasas de infiltración estuvieron más correlacionadas con la estabilidad de los agregados y cobertura de mantillo, rocas y zacates. Las profundidades del frente húmedo fueron significativamente más profundas en la zona de la copa que en las áreas entre plantas, esto fue igual en todos los tratamientos. La concentración de sedimentos ($kg \cdot L^{-1}$) fue mayor en la zona de la copa que en el área entre plantas, pero el rendimiento total de sedimentos no fue significativamente diferente entre estas áreas o las afectadas por cualquiera de los tratamientos.

Key Words: brush control, erosion, *Larrea tridentata*, rainfall simulator, wetting front

INTRODUCTION

Creosotebush (*Larrea tridentata* [D.C.] Cov.) has increased over the last century in many areas that were once predominantly grasslands in the Chihuahuan Desert of southern New Mexico (Buffington and Herbel 1965; Grover and Musick 1990; Van Auken 2000). This shift from a grass-dominated to a woody-dominated community has likely changed the spatial and temporal distribution of soil resources (Schlesinger et al. 1990) and altered hydrologic processes (Abrahams et al. 1994; Quinton et al. 1997; Dunkerley and Booth 1999; Parizek et al. 2002). In shrub-dominated communities, organic resources

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