

Changes in water yield after a sequence of perturbations and forest management practices in an *Eucalyptus globulus* Labill. watershed in Northern Spain

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Abstract

An experimental study to assess the effect of the sequence wildfire–clearfelling–coppice sprout selection–foliar damage caused by a defoliating beetle (*Gonipterus scutellatus* Gill.) on seasonal water yield in an *Eucalyptus globulus* Labill. watershed was carried out in Galicia (NW Spain) from 1987 to 2005. The effect on water yield of a sequence as described in this investigation had not been evaluated till now.

A summer wildfire in 1989 caused a mean increase in annual streamflow of 68%, compared with the expected value, during the first three post-fire years. After a clearfelling in 1992 a mean increase of 73% in the annual streamwater was measured for the three following years. A mean increase of 47% in streamflow was observed in the three years after coppice sprout selection in 1995. No effect in streamflow was detected the fourth year after this forestry operation. Finally, a *G. scutellatus* pest attack resulted in a significant average increase in annual streamwater of 22% from 1999–2000 to 2004–2005.

The seasonal deviations (observed minus predicted values) in streamwater during the study period were significantly correlated with precipitation and its seasonality that explained 70% of variation in water yield deviations. Most of significant deviations were measured in autumn and winter. In no case was an increase in water availability observed during summer. No evidence of cumulative effect of those successive perturbations was found.

The results presented here could help to evaluate the hydrological consequences of current intensive forest management and frequent perturbations that are affecting *E. globulus* stands in NW Spain. They might also be used by forest managers to understand the relationship between forest cover and water yield in the context of climate change and reduced rainfall.

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1. Introduction

Eucalyptus globulus Labill. has experienced a rapid expansion in Galicia (NW Spain) over the last decades, reaching about 175,000 ha in monocultures and 160,000 ha (M. Medio Ambiente, 2001) in mixed stands in the area.

As in other countries, in Spain, the potential hydrological effects of *E. globulus* plantations on water availability for different uses have also been a subject of concern. Global climate change has recently increased by that concern (Iglesias et al., 2005). Projections for the current century (De Castro

et al., 2005) predict a 10% decrease in annual precipitation in NW Spain.

Although several studies on this issue have been carried out in Galicia (Díaz-Fierros et al., 1982; Paz, 1982; Calvo de Anta, 1992), available long-term hydrological information, at watershed level, is still scarce (Gras, 1992, 1993; Gras et al., 1993).

The effect of forest cover reduction on water yield has been extensively analysed in studies developed in eucalypt covered watersheds after different perturbations or management activities such as wildfires (e.g., Langford, 1976; Mackay and Cornish, 1982; O'Loughlin et al., 1982; Scott, 1993, 1997), clearcutting (e.g., Langford et al., 1982; Cornish, 1993; David et al., 1994; Cornish and Vertessy, 2001; Watson et al., 2001), thinning (e.g., Lesch and Scott, 1997; Lane and Mackay, 2001),

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