

Changes in *Eucalyptus globulus* Labill. saplings growth and physiological parameters following fire-induced stem and crown damage in a plantation in north-western Spain

Enrique Jiménez · José A. Vega · Cristina Fernández · Pedro Pérez-Gorostiaga · Pedro Cuiñas · Teresa Fonturbel · Margarita Alonso · María J. Rozados · Salvador Bará

Received: 28 October 2011 / Revised: 29 May 2012 / Accepted: 9 July 2012 / Published online: 29 July 2012
© Springer-Verlag 2012

Abstract Stems and crowns of young *Eucalyptus globulus* Labill. saplings were experimentally damaged by fire to assess the short-term effects on tree growth and selected physiological parameters (stem sap flow density, electrical resistance of stem cambium and leaf stomatal conductance). Four different treatments were considered: partial stem damage (42 % of the stem circumference girdled by the direct application of heat in the cambium zone), crown foliage damage (56 % of crown volume scorched by heating the foliage with a torch), combined stem and crown damage, and no damage (control). Saplings displayed high sensitivity to crown scorching, in terms of basal area growth. The relative growth of the basal area of crown-damaged and stem + crown-damaged trees was, respectively, 3.1 and 6.2 times lower than that of undamaged trees for the 4 months following treatment. In contrast, stem injury alone did not have any negative effect on stem growth. The results suggest that tree growth is scarcely affected by low intensity surface fire and prescribed burning that do not affect the crown. Sap flow density, cambial electrical resistance and leaf stomatal conductance were useful indicators of the loss of physiological activity caused by fire. Although in the case of partial crown damage these parameters reflected a slight compensatory effect, the response was not sufficient to balance the loss of photosynthetic area. The study only

focused on the initial effects of fire-related damage, and further research is clearly needed to determine the long-term effects of such damage.

Keywords *Eucalyptus globulus* · Localised heat injury · Tree growth · Tree physiology

Introduction

Eucalyptus globulus Labill. is a fast growing species widely used in afforestation, mainly for pulp purposes, in temperate and tropical areas throughout the world. In north-western Spain (Galicia), it covers about 25 % of all the woodland area, both in monoculture stands (248,000 ha) and in mixed stands with *Pinus pinaster* Ait., or less frequently, with *Pinus radiata* D. Don., *Acacia melanoxylon* R. Br. and *Quercus robur* L. (160,000 ha) (Ministerio de Medio Ambiente 2011). Wildfires are frequent in Galicia, and approximately 10,000 wildfires occur annually (Ministerio de Medio Ambiente 2007). In 2006, approximately 35,000 ha of *E. globulus* were burned in Galicia (Ministerio de Medio Ambiente 2007). The rainy, mild climate in the region encourages fast tree growth and also a vigorous understory and a well-developed forest litter layer, which is further favoured by the low canopy cover and the high height of the trees. Fuel accumulations of between 15 and 40 tonnes ha⁻¹ are common in such stands (Vega 1985).

Prescribed burning has frequently been proposed in eucalypt stands as a potentially useful management tool for reducing fire hazard by modifying the understory fuel structure (e.g. Keith et al. 2002; Lacy et al. 2006). However, the impact of low intensity fires on trees is not well known. Most eucalypt species have some characteristics

Communicated by A. Weiskittel.

E. Jiménez (✉) · J. A. Vega · C. Fernández · P. Pérez-Gorostiaga · P. Cuiñas · T. Fonturbel · M. Alonso · M. J. Rozados · S. Bará
Centro de Investigación Forestal, Lourizán, Consellería de Medio Rural, Xunta de Galicia, P.O. Box 127, 36080 Pontevedra, Spain
e-mail: enjica@hotmail.com