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Shrub resprouting response after fuel reduction treatments: Comparison of prescribed burning, clearing and mastication

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ABSTRACT

Fuel reduction treatments are commonly used to reduce the risk of severe wildfire. However, more information about the effects on plant resprouting is needed to help land managers select the most appropriate treatment. To address this question, we evaluated the resprouting ability of five shrub species after the application of different types of fuel reduction methods (prescribed burning, clearing and mastication) in two contrasting shrubland areas in northern Spain. The shrub species were *Erica australis*, *Pterospartum tridentatum* and *Halimium lasianthum* spp. *alyssoides*, *Ulex gallii* and *Erica cinerea*.

For most of the species under study (*E. australis*, *P. tridentatum*, *H. lasianthum* spp. *alyssoides* and *U. gallii*), neither plant mortality nor the number nor length of sprouted shoots per plant differed between treatments, although in *E. cinerea* the number of shoots was more negatively affected by prescribed burning than by clearing or mastication.

The pre-treatment plant size did not affect plant mortality or plant resprouting response, suggesting that this parameter alone is not a good indicator of plant resprouting after fuel reduction treatments. Stem minimum diameter after treatments, a proxy of treatment severity, was not related to plant mortality, number or length of resprouted shoots. The duration of temperatures higher than 300 °C during burning in plant crown had a negative effect on the length of resprouted shoots, only in *E. cinerea*.

The results show that fuel reduction treatments did not prevent shrub response in any case. Some reflections on the applicability of treatments are discussed.

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1. Introduction

Large areas covered by shrublands around the world are frequently affected by wildfire (e.g. Whelan, 1995; Bond and van Wilgen, 1996; Bradstock et al., 2002). Shrubland communities in Spain are also frequently affected by wildfire. In the past decade, more than 35% of the wildland burned in Spain was shrubland (Ministerio de Medio Ambiente, 2006) and a high proportion of the fires occurred in northern Spain. Moreover, under climate change scenarios, wildfire frequency and the extent of the area burned are expected to increase in northern Spain (Vega et al., 2009).

In such fire-prone ecosystems, shrubs are characterized in terms of two main fire response features as non-resprouters, which are killed by fire and depend on recruitment from seeds for persistence, or as resprouters, which regrow vegetatively from buds after fire, although these are extremes on a continuum of responses (Vesk and Westoby, 2004). *Erica australis* L., *Pterospartum tridentatum* (L.) Willk., *Halimium lasianthum* spp. *alyssoides* (Lam.) Greuter, *Ulex*

gallii Planch. and *Erica cinerea* L. are common components of shrubland areas in northern Spain and although the seed germination in some of them (i.e. *P. tridentatum*, *U. gallii* and *H. lasianthum*) is heat-stimulated (Rivas et al., 2006) the contribution of the seedlings to post-perturbation recovery, in terms of biomass and cover, is negligible (Valbuena et al., 2000; Reyes and Casal, 2008). In fact, the persistence of those species mainly depends on their resprouting capability after perturbation (e.g. Mallik and Gimingham, 1985; Vera et al., 1995; Cruz et al., 2002, 2003; Reyes and Casal, 2008; Reyes et al., 2009; Paula and Ojeda, 2011). In particular, *E. australis* has a large lignotuber that enables accumulation of huge carbohydrate reserves (Cruz et al., 2003).

Fuel reduction treatments are commonly used to reduce the risk of severe wildfire and for ecological objectives (Covington et al., 1997; Stone et al., 1999; Vega et al., 2000). Moreover, fuel management has become a priority at the wildland–urban interface. The Spanish Environmental Ministry (Ministerio de Agricultura, Alimentación y Medio Ambiente) is carrying out a Forest Fire Prevention Program aimed at implementing fuel reduction treatments in shrubland areas to recover the traditional use of fire in many Spanish rural communities (Vélez, 2010). The present research was

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