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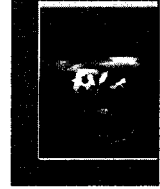
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Comparing survival and size of resprouts and planted trees for post-fire forest restoration in central Portugal

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ABSTRACT

The post-fire restoration of burned forests in the Mediterranean basin usually involves planting or direct seeding, often neglecting the use of natural regeneration through basal resprouting. This study compared the survival and size of planted and resprouted *Fraxinus angustifolia* (narrowleaf ash) and *Quercus faginea* (Portuguese oak) in a burned area in central Portugal, after a 20–22-month growing period. Adult ash and oak trees were burned in a wildfire in September 2003. The survival and height of resprouting suckers were assessed 21 months after fire. Seedlings coming from nurseries were planted in the same area during January to March, both in 2004 and 2005, and their survival and height were assessed 20–22 months after planting. Survival was higher in resprouts than in planted trees in the case of oak (98% against 77% and 67%, respectively, for trees planted in 2004 and 2005) but not for ash (100% against 87% and 97%). Plant height was much higher in resprouts than in planted trees (4–5 times higher in oak; 2–3.8 times higher in ash), and a similar pattern was found for basal diameter (3.5–4.5 times higher in oak; 3–5 times higher in ash). The results suggest that using natural regeneration through resprouting may be a cheaper and more effective technique than planting to restore burned forests with a large proportion of resprouter species, as is the case of many Mediterranean broadleaved forests.

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1. Introduction

Every year about half a million hectares of forests and shrublands are burned in southern European countries. The post-fire rehabilitation of these areas is a major task for national and regional governments, as well as for forest managers (Hüttl and Gerwin, 2007), but there is still a significant lack of knowledge on the best management techniques to use. In many situations burned trees are felled (salvage logging). After clear felling, there is strong political pressure to actively reforest burned areas in the Mediterranean region and this has been a common practice since the late 19th century, mainly in conifer forests (Pausas et al., 2004b; Vallejo, 2005). As an example, following the 2006 wildfires in Galicia (Spain), which burned 150,000 ha of land, reforestation has been considered a restoration priority (Amil, 2007). In the case of Portugal, policies for the reforestation of burned forests have been common (Carvalho Mendes, 2006). All these reforestation efforts are assumed to be done by means of active restoration techniques such as plantation or direct seeding, each with its advantages and drawbacks (e.g. Duya, 2000; Lamb and Gilmour, 2003; Vallejo et al., 2006).

In contrast, taking advantage of passive restoration, by protecting areas from further disturbances and allowing natural colonization, regrowth and successional processes (Lamb and Gilmour, 2003; Vallejo et al., 2006), has not been frequently used as a restoration technique in the Mediterranean context. However, it usually entails a lower financial cost, even if some degree of intervention to assist this natural regeneration (either from seeds or resprouts) is used (e.g. Holz and Placci, 2005; Vallejo et al., 2006). Conflicts between these two approaches (active or passive) for restoration are possible, particularly if governments subsidise active restoration in areas where natural regeneration is occurring.

Passive post-fire restoration may profit from regeneration from seeds (Pausas et al., 2004a; Holz and Placci, 2005) or from resprouting of burned trees and stumps (mostly basal resprouting) (Espelta et al., 2003). Although there are several studies comparing the effectiveness of different restoration techniques, in terms of tree seedling survival and growth, they mostly compare planting and seeding methods (either natural seeding or direct seeding) (Lockhart et al., 2003; Ammer and Mosland, 2007; Dostálek et al., 2007), but not natural regeneration from basal resprouting of burned trees. However, the use of plant resprouting ability is already acknowledged as a powerful and pragmatic tool to restore some ecosystems (Wyant et al., 1995), e.g. the Atlantic rainforests of Brazil (Simões and Marques, 2007). In fact, resprouts have many

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