

Prescribed burning in southern Europe: developing fire management in a dynamic landscape

Paulo M Fernandes^{1,2*}, G Matt Davies³, Davide Ascoli⁴, Cristina Fernández⁵, Francisco Moreira², Eric Rigolot⁶, Cathelijne R Stoof⁷, José Antonio Vega⁵, and Domingo Molina⁸

Mediterranean landscapes are in a state of flux due to the impacts of changing land-use patterns and climate. Fuel–weather interactions determine that large, severe wildfires are increasingly common. Prescribed burning in southern Europe is therefore justified by the need to manage fire-prone vegetation types and maintain cultural landscapes that provide a range of ecosystem services. Prescribed fire has neutral or positive effects on soils and biodiversity, in contrast to wildfires, which can be extremely damaging. However, the limited extent of current applications are unlikely to reduce wildfire hazard or carbon emissions. Adoption of prescribed burning in the Mediterranean region has been slow, uneven, and inconsistent, and its development is constrained by cultural and socioeconomic factors as well as by specific factors related to demography, land use, and landscape structure. Sustainable fire management requires expansion of managers' ability to use prescribed burning, a varied response to unplanned fires, and modified regulation of burning associated with traditional agricultural land uses.

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Southern European landscapes are fire-prone due to the Mediterranean climate, the presence of flammable vegetation, and the rugged terrain (Pausas *et al.* 2008). The environmental and societal impacts of fire in the region have increased markedly during the 20th century.

Pre-industrial fire regimes were generally associated with widespread agropastoral land use and low-severity burning in heterogeneous shrublands and open woodland landscapes (Seijo and Gray 2012). Pronounced changes leading to greater fire risk have since occurred as a result of socioeconomic and political factors that led to agricultural decline, abandonment, and mechanization; rural depopulation; large-scale afforestation; poor forest management; accumulation of biomass (fuel) in shrublands; land-use conflicts; and the expansion of urban areas (Biro 2009; Moreira *et al.* 2011; Seijo and Gray 2012). These processes present southern European countries with a unique fire management challenge in the context of a landscape still undergoing rapid change.

The severity of contemporary (post-1960s) fire regimes is also the result of climatic changes, including both generally hotter, drier weather and more frequent and extreme episodes of drought (Seidl *et al.* 2011), as well as modern fire suppression strategies that have further contributed to the increase in fuel (Piñol *et al.* 2007). An increase in the number and size of large fires (that account for most of the area burned) in the Mediterranean region suggests that fire regimes have shifted from fuel-limited to weather-driven (Pausas and Fernández-Muñoz 2011). However, fire management policies in southern Europe remain strongly biased toward fire suppression and largely disregard the structural (socioeconomic and land management) roots of the problem (Biro 2009).

Prescribed burning (PB) is the planned use of fire to achieve precise and clearly defined objectives. In Europe this can be distinguished from the more haphazard use of fire in traditional agriculture, for example in the manage-

In a nutshell:

- In southern Europe, prescribed burning is used to decrease wildfire risk and to manage habitats for grazing and wildlife, but it remains underused compared with other regions of the world
- The environmental implications of more frequent or larger prescribed fires, including impacts on wildfire incidence and carbon emissions, remain poorly understood
- Because of the strong policy-related and practical barriers to prescribed burning, fire management policies should be pragmatic and should include unplanned fires as complements to prescribed burning
- Given the highly dynamic nature of Mediterranean landscapes, an evidence-based, experimental, and adaptive approach to prescribed burning and fire management is recommended

¹Centro de Investigação e de Tecnologias Agro-Ambientais e Biológicas, Universidade de Trás-os-Montes e Alto Douro, Vila Real, Portugal * (pfern@utad.pt); ²Centro de Ecologia Aplicada Prof Baeta Neves, Instituto Superior de Agronomia, Universidade Técnica de Lisboa, Lisboa, Portugal; ³Solway Centre for Environment and Culture, University of Glasgow, Dumfries, Scotland; ⁴Dipartimento di Scienze Agrarie, Forestali e Alimentari, Università di Torino, Grugliasco, Italy; ⁵Centro de Investigación Forestal de Louzán, Xunta de Galicia, Pontevedra, Spain; ⁶UR629 Ecologie des Forêts Méditerranéennes, INRA, Avignon, France; ⁷Department of Biological and Environmental Engineering, Cornell University, Ithaca, NY; ⁸Departament PVCF, Universitat de Lleida, Lleida, Spain