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Exploring the two-way relationships between fire and two Australian fire-adapted plant invaders to support ecosystem management

Joaquim S. Silva [1, 2], Ernesto Deus [1, 2], Mauro Nereu [1, 2], Luís Queirós [1, 2], Sheila F. Riveiro [3], Dionathan Gerber [2, 4] and Paulo Fernandes [5]

[1] Polytechnic Institute of Coimbra, Agriculture School, Bencanta, 3045-601, Coimbra, Portugal
[2] University of Coimbra, Centre for Functional Ecology, Department of Life Sciences, Coimbra, Portugal
[3] University of Santiago de Compostela, Department of Functional Biology, BIOAPLIC Group, 15782 Santiago de Compostela, Spain
[4] Polytechnic Institute of Bragança, Mountain Research Centre (CIMO), Campus Santa Apolónia, 5300-253 Bragança, Portugal
[5] University of Trás-os-Montes and Alto Douro, Centre for the Research and Technology of Agro-Environmental and Biological Sciences, Portugal

jss@esac.pt

The invasion by fire-adapted plants may create a feedback loop in which fire facilitates invasion, which in turn facilitates fire, due to fuel accumulation and increased fire hazard. This two-way relationship may have challenging implications for ecosystem management, namely by increasing the needs for fuel reduction and invasion control, while limiting the use of prescribed fire and other disturbance-based control approaches. This is the case of *Hakea sericea* and *Acacia dealbata* , two woody species of Australian origin that constitute a serious threat to native ecosystems in Central and Northern Portugal. *Hakea sericea* is a seeder featuring a canopy seed bank, while *A. dealbata* is a facultative resprouter that develops a soil seed bank. Both species form thick monospecific stands where native vegetation is in many cases totally suppressed. We studied the two-way relationships between fire and these two species, aiming at: a) assessing the changes in fire hazard in invaded areas and b) testing the use of disturbance-based treatments, including fire, for their control. *Hakea sericea* strongly increases fire hazard when compared with the most hazardous native fuel models of Central Portugal, as shown by fire behaviour simulations. In *A. dealbata* there is a considerable difference between young and adult stands, with the latter showing lower fire hazard compared to several native fuel models, due to the compacted litter and the suppression of understorey vegetation. The use of control techniques was tested through eight experimental blocks of treatments for each of the two species. Each block featured four treatments: slash, burn, slash-and-burn, and an undisturbed plot. Plots were monitored over 3 years to record stem density and stem height. Disturbance treatments applied to *A. dealbata* revealed to be ineffective showing an increase in stem density compared with the undisturbed plots. However, *H. sericea* stands were successfully eradicated by applying slash-and-burn treatments. A high residence time of the fire front seems to produce the best results. Therefore, the two fire-adapted invasive species revealed very distinct fire-related characteristics, and a very different response to the same treatments. Our results show that a one-size-fits-all approach is far from being appropriate in the management of fire-adapted invasive woody plants, calling for deep knowledge of the ecology and fuel characteristics of each particular species.