

Volume 41, Issue 2

June 2014 , pp. 144-156

Using spatial simulations of habitat modification for adaptive management of protected areas: Mediterranean grassland modification by woody plant encroachment

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<https://doi.org/10.1017/S037689291300043X>

Published online: 15 November 2013

Summary

Spatial simulation may be used to model the potential effects of current biodiversity approaches on future habitat modification under differing climate change scenarios. To illustrate the approach, spatial simulation models, including landscape-level forest dynamics, were developed for a semi-natural grassland of conservation concern in a southern Italian protected area, which was exposed to woody vegetation encroachment. A forest landscape dynamics simulator (LANDIS-II) under conditions of climate change, current fire and alternative management regimes was used to develop scenario maps. Landscape pattern metrics provided data on fragmentation and habitat quality degradation, and quantified the spatial spread of different tree species within grassland habitats. The models indicated that approximately one-third of the grassland area would be impacted by loss, fragmentation and degradation in the next 150 years. Differing forest management regimes appear to influence the type of encroaching species and the density of encroaching vegetation. Habitat modifications are likely to affect species distribution and interactions, as well as local ecosystem functioning, leading to changes in estimated conservation value. A site-scale conservation strategy based on feasible integrated fire and forest management options is proposed, considering the debate on the effectiveness of protected areas for the conservation of ecosystem services in a changing climate. This needs to be tested through further modelling and scenario analysis, which would benefit from the enhancement of current modelling capabilities of LANDIS-II and from combination with remote sensing technologies, to provide early signals of environmental shifts both within and outside protected areas.

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