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Foreword

Fire regime and ecosystem responses: adaptive forest management in a changing world (Part 2)

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Abstract. Fire is an ecological factor in ecosystems around the world, made increasingly more critical by unprecedented shifts in climate and human population pressure. The knowledge gradually acquired on the subject is needed to improve fire behaviour understanding and to enhance fire management decision-making. This issue (Volume 28, issue 7, *International Journal of Wildland Fire*) is Part 2 of a special issue aimed at synthesising ongoing research on preventive management and post-fire restoration, including characterisation of the wildland–urban interface (WUI) and assessing the post-fire restoration of wilderness and WUI areas. Landscape management was also investigated using remote sensing techniques and simulation modelling to improve ecosystem resilience. As in Part 1 (Volume 28, issue 5, *International Journal of Wildland Fire*), the current issue covers diverse forest settings under scenarios of changing climate and land use. The broad geographical range of these studies highlights key similarities of wildfire issues around the world, but detailed data show unique local circumstances that must be considered. The new information from these six papers helps advance fire ecology and management during a period of rapid change.

Additional keywords: ecological restoration, fire effects on ecosystems, wildland-urban interface.

Introduction

This special issue of *International Journal of Wildland Fire* was conceived because the long-term resistance and resilience of forests to wildfires, considering the current and future changes in land-use and climate, is a main goal of adaptive forest management (Moya *et al.* 2019).

Wildfires are a key ecosystem process, but fire regimes are changing around the world, mainly due to land-use or land-cover change (LULCC) and changing climate. Influence of LULCC is especially strong in Mediterranean areas (Pausas and Keeley 2014; Syphard *et al.* 2018). Larger and more severe fires reduce suppression options and may have increasingly adverse effects on ecosystems, depending on fire recurrence and ecosystem resistance and resilience (Moreira *et al.* 2012). However, recent advances in remote sensing techniques have provided better information to scientists and decision-makers for modelling fire behaviour and post-fire effects. The resulting data and tools can improve management planning in a cost-effective way (Chuvieco and Kasischke 2007).

This issue contains a variety of studies covering diverse ecosystems and tools to provide reliable data for fire risk mitigation, restoration, rehabilitation, and future management focused on conservation of ecosystem functions and services. Forest restoration treatments seek to favour resilience to wildfires and a changing climate while avoiding negative impacts to the ecosystem. The extent and intensity of treatments are often constrained by operational considerations and concerns over uncertainty in the trade-offs of addressing different management goals. Recent advances in remote sensing techniques have provided valuable information for scientists and decision makers related to landscape management to maintain a sustainable fire regime.

Contents

Part 2 of this special issue (Volume 28, issue 7 of *International Journal of Wildland Fire*) includes six papers. The topics of the studies include field research on the increasing concerns related to the wildland–urban interface (WUI) and its restoration, as well as the post-wildfire ecosystem restoration of mixed forests. In addition, assessments linking landscape and fuel properties to fire severity and ecosystem resilience were carried out using remote sensing techniques and simulation modelling.

Godoy *et al.* (2019) studied the growth of the WUI in a natural amenity-rich region in Argentina. They found that rapid WUI growth related to increasing resources of middle-class people covered less than 10% of the land area, but more than 95% of burned area and more than 75% of fires were in WUI. These results highlight the need to balance development with wildfire risk and other human-environmental problems. Mapping of the WUI and associated fuel hazards is useful for urban planning, homeowners and fire management organisations. Facing a similar problem in Israel, Tessler *et al.* (2019) focused on restoration and rehabilitation of burned urban forest areas ('urban fires') in Haifa. The authors proposed a protocol to collect information about the main vegetation species, fire severity and other characteristics of interest. Plans for management were developed, based on the characteristics of specific areas (land structure and fire severity). The goals were to minimise risk to population and infrastructure, provide essential ecological services to the residents and restore the areas damaged by wildfire.

To assess the effects of restoration treatments on forest resilience, Lydersen *et al.* (2019) conducted a long-term study of the benefits of restoration treatments in mixed-conifer forests in the southern Sierra Nevada (California, USA). They assessed changes in forest structure due to previous thinning and understory burning of managed mixed-conifer forests before a drought event. They found that common constraints to many restoration treatments may limit their ability to mitigate the impacts of severe drought.

The special issue concludes with three papers that used remote sensing techniques and simulation modelling to evaluate landscape effects related to fire severity and ecosystem resilience. In north-western Spain, fuel conditions were evaluated through different biophysical variables. The Visible Atmospherically Resistant Index, evapotranspiration and the live fuel amount were the most useful predictors for fire severity (García-Llamas *et al.* 2019). These variables provided important information on fuel conditions to define preventive management actions to reduce negative fire effects. In Greece, and to assess the role of landscape characteristics in post-fire recovery, Christopoulou *et al.* (2019) developed remote sensing techniques, including time series of high-resolution images, to explore the correlation between post-fire regeneration and underlying topography, soils and basement rock. These landscape characteristics influenced post-fire vegetation recovery, which allowed them to determine the resilience of different vegetation types and identify vulnerable areas which should be actively restored.

Finally, ecological resilience under different levels of wildfire suppression was evaluated by Keane *et al.* (2019) using landscape simulation modelling. Results obtained from the landscape model FireBGCv2, in the northern Rocky Mountains of the USA, were oriented towards determining the appropriate level of fire suppression associated with maintaining ecological resiliency.

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