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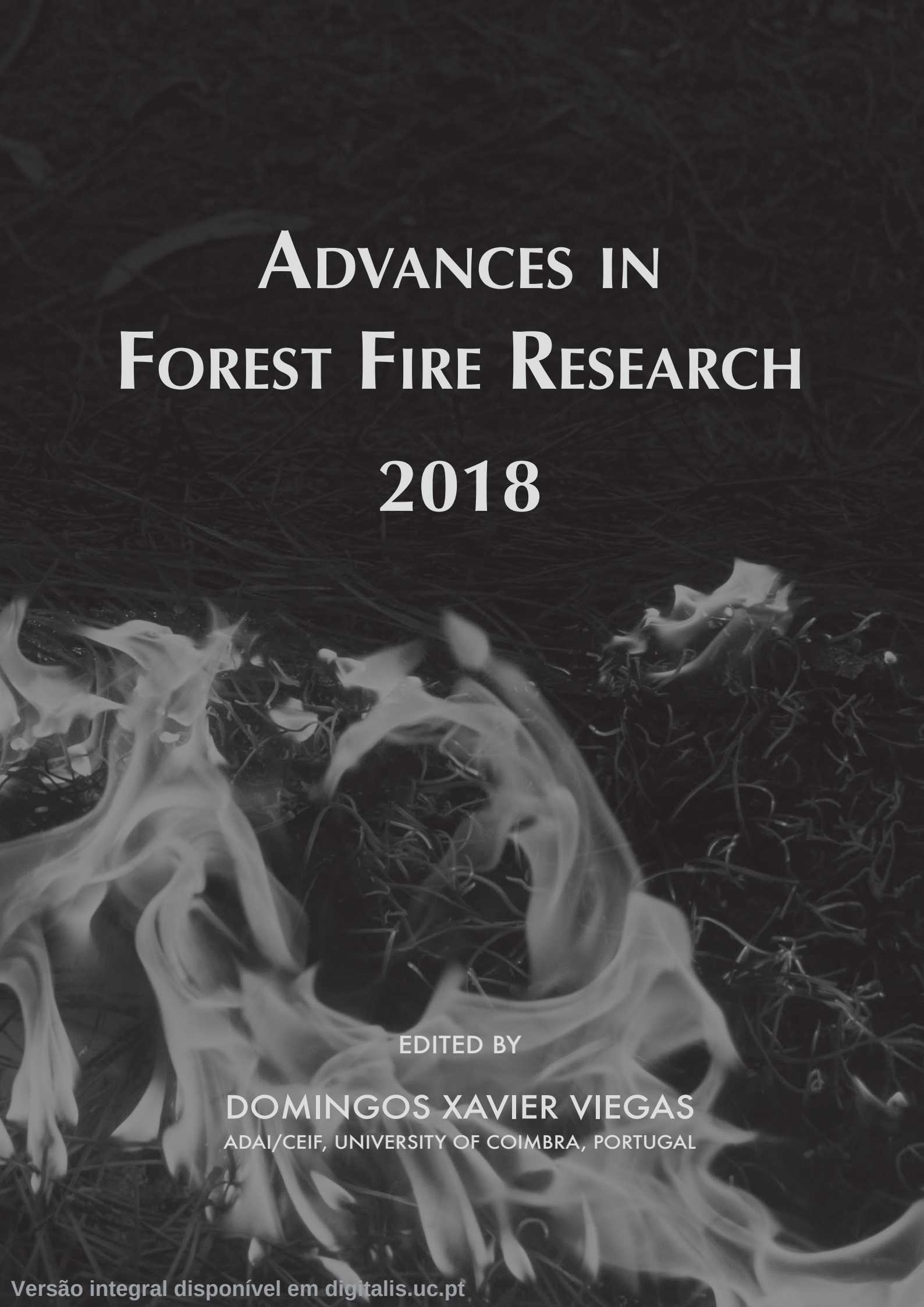

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The impact of climate change on fire weather of Daxing'anling

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Abstract

There are amount of natural forests in Daxing'anling, and wildfires occurred in the region every year. Assessing the changes in fire weather in the future under multi-climate scenarios would contribute to our understanding of the influences of climate change for the region and provide a reference for applying adaptation measures for fire management. This study analysed the changes in fire weather indices and the fire season under four climate scenarios (RCP2.6, RCP4.5, RCP6.0, RCP8.5) for 2021-2050 using data from five global climate models together with observation data. The results showed that the analog data could project the average state of the climate for a given period but were not effective for simulating extreme weather conditions. Compared with the baseline period (1971-2000), the average temperature and annual precipitation were predicted to increase by 2.02℃ - 2.65 ℃ and 25.4 - 40.3 mm during 2021-2050, respectively. Multiple comparisons revealed that all of the indices would increase in 2021-2050 except for DC. The average FWI (fire weather index) was 4.53 at baseline, which would increase by 6.2%, 11.3%, 10.6%, and 11.2% under scenarios RCP2.6, RCP4.5, RCP6.0, and RCP8.5, respectively. SSR (seasonal severity rating) would increase by 5.5%, 16.2%, 15.1%, and 17.2% in 2021- 2050 under scenarios RCP2.6, RCP4.5, RCP6.0, and RCP8.5, respectively. The DMC (duff moisture code), ISI (initial spread index), BUI (build-up index), FWI and SSR were predicted to increase significantly under scenarios RCP 4.5, RCP 6.0, and RC P8.5. Furthermore, days with high or higher fire danger rating were predicted to prolong 3-6 days in 2021-2050.

Keywords: climate change; forest fire; fire season; Daxing'anling

1. Introduction

The main features of climate change are warming and drying, and wildfires are closely linked these features (Hu *et al.* 2012; Flannigan *et al.* 2013; Sun *et al.* 2014). Fire activity is expected to increase in most regions worldwide with increasing temperature (Pechony and Shindell 2010). Fire is a natural disturbance in most forest ecosystems. The boreal forest is exhibiting responses to climate change. An average of 5-15 million hectares of boreal forest are burned each year in northern Siberia, Alaska and Canada, and serious fire years are occurring more frequently (Flannigan *et al.* 2009). Global warming will increase the potential for prolonged fire storms, causing fuel dryness (via increased evapotranspiration and drying of litter) and leading to more wildfires; i.e., fire severity is sensitive to global warming (Flannigan *et al.*, 2013). Landscape fires are expected to change during the 21st century in response to multiple agents of global change. Important controlling factors include climate controls on the length and intensity of the fire season, fuel availability, and fire management, which are already anthropogenically perturbed at present and are predicted to change further in the future (Kloster *et al.* 2012). By 2030 and the end of the century, the number of forest fires in northern regions of Canada will increase by 30% and 75%, respectively (Wotton & Flannigan 2010). The fire season in western North America would prolong due to the advance of the spring snowmelt date and rising temperatures in spring and summer (Westerling *et al.* 2006; Running 2006). Spracklen *et al.* (2009) predicted that by the 2050s, the average annual burned area in the western United States will increase by 54%, and forest fires in this region and in the Pacific Northwest area of the Rocky Mountains will increase by 78% and 175%, respectively. Wildfires would increase by 179% in Portugal under a