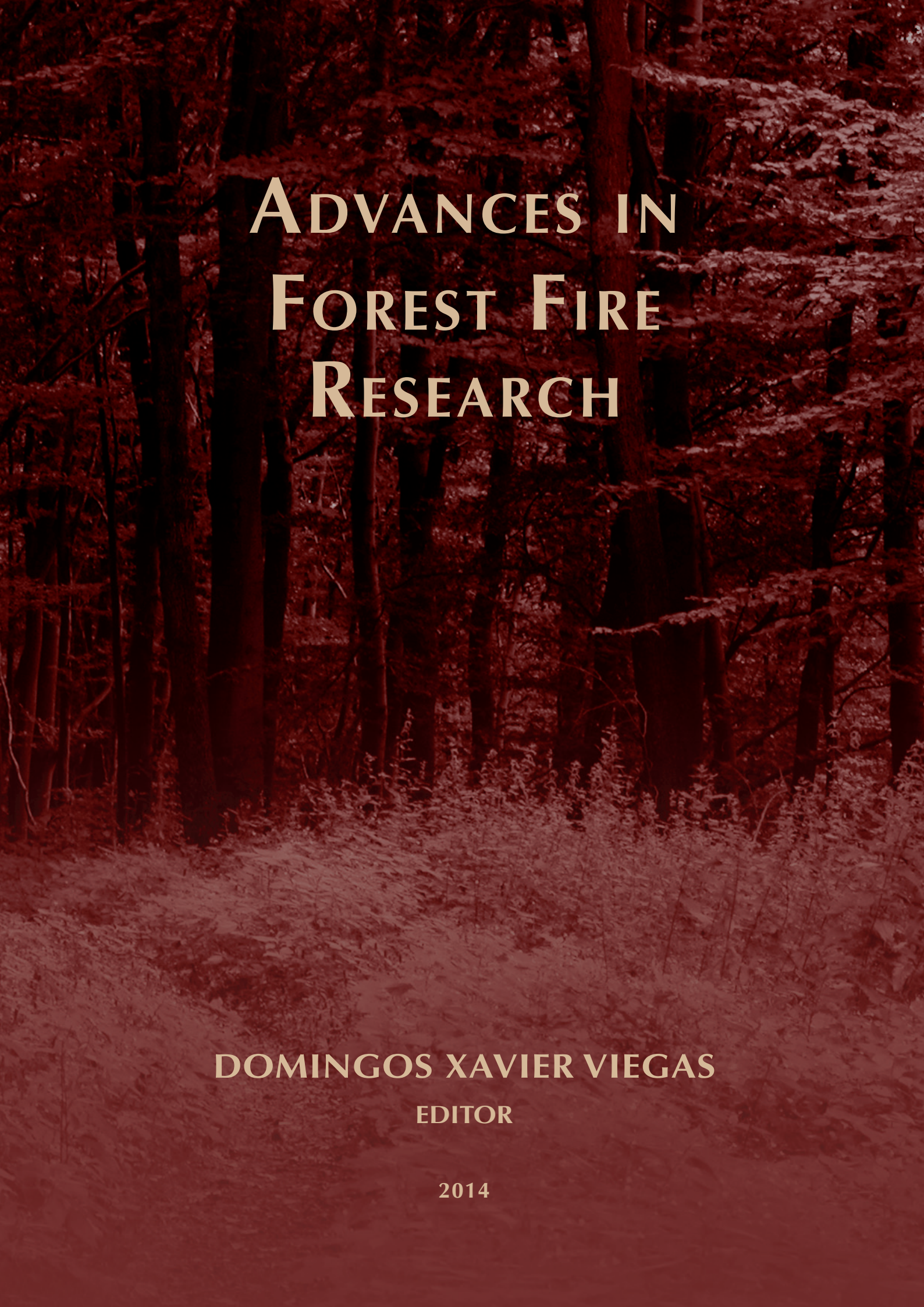

Advances in Forest Fire Research

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EDITOR

2014

Spatio-temporal monitoring of burned area to evaluate post-fire damage: application on Fontanès wildfire (France)

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***Keywords**: Wildfire, post-fire damage, spatio-temporal monitoring, remote sensing data*

Extended Abstract

1. Introduction

Even if the contribution of temporal series of remotely sensed data is well-admited, the use of temporal series of high spatial resolution images is limited because of the lack of data allowing developing these applications. The French project TOSCA is related to the analysis and the applications of multi-temporal remote sensing Landsat images. The aim of this project is showing the interest of multi-temporal series of data to obtain accurate information on large territories. For this project, multi-temporal Landsat images were tested for the spatio-temporal monitoring of burned area to evaluate post-fire damage.

The application of temporal Landsat images was realized on the Fontanès wildfire which occurred in Herault French department on the 30th August 2010 and which burned 2,590 hectares area.

Figure 1. Localisation of the study area according to Google Earth data (left side) and Fontanes wildfire on post fire Landsat 5 image (right side).

Two Landsat 5 images with 30 metres spatial resolution were considered: one acquired before the wildfire on the 12th September 2009, one acquired immediately after the wildfire on the 15th September 2010.

2. Methods to evaluate post-wildfire damages

2.1. Damages evaluation on the field

The monitoring of burned area consisted to relate post-fire damage levels evaluated on the field after the wildfire with vegetation there before the fire. 90 field surveys were spread uniformly on the study site to evaluate post-fire damage on homogenous vegetation types. For each field survey, damages were observed on four height strata of the vegetation (0-1 metres, 1-4 metres, 4-10 metres and more than 10 metres) and on each structural element of the vegetation (trunk, branch, leaf, fruit). Then, a level of damage was affected to each field survey:

- 0: no damage observed,
- 1: partially burned,
- 2: completely burned,
- 3: deep damages.

The weight given to the highest strata is more important than the other strata in order to take into account to the perception of the satellite sensor which considers the highest strata of the vegetation.

2.2. Damages evaluation according remote sensing techniques

Atmospheric corrections to detect clouds and aerosol and corrections to reduce environmental effects (fuzziness due to the atmosphere, lightning variation due to topography, etc.) were made by the CESBIO. Then, according to the field survey, supervised classifications were performed on the principal component analysis of the images: before the fire to identify fuel types, after the fire to characterize damage levels.

3. Results

3.1. Damages evaluation on the field in relation with the strata height

High and very high levels of damages concern lowest strata (0-1 m and 1-4 m strata) whereas moderate or low damages concern strata more than 4 metres. So damages decrease at the same time the height of the strata increases.

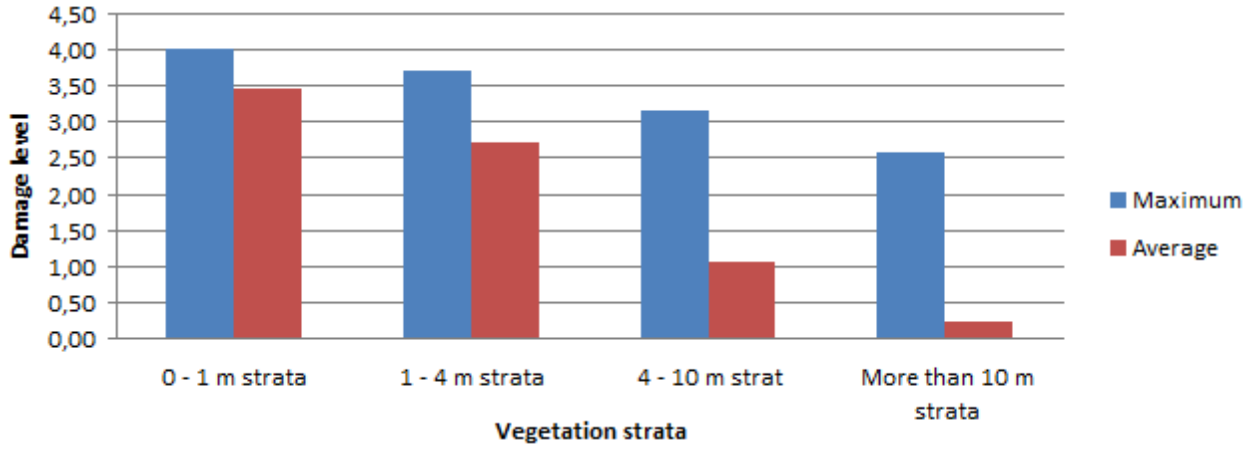

Figure 2. Damage observed on field data on the different vegetation strata

3.2. **Damages evaluation by remote sensing techniques in relation with fuel type**

The image before the wildfire allowed distinguishing 6 land cover classes, 5 of them characterizing fuel types: mature pine stand, young pine stand, hardwood, high and low shrublands, bare-ground. The image after the wildfire allowed distinguishing 6 levels of damage: no damage, moderate damage, high and very high damage on shrublands (high S, very high S), high and very high damage on tree stands. The comparison between observed damage and fuel types showed the most important damage on young pine stand and high shrublands. Damages are less important in mature pine stand characterized on your study site by vertical and horizontal continuity of the vegetation.

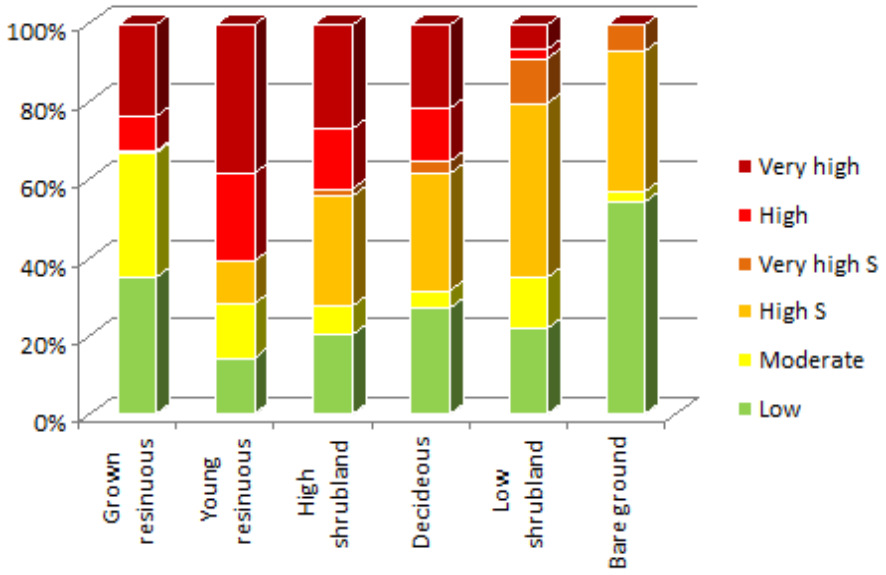

Figure 3. Damage observed according the post-wildfire image on the different fuel types

4. Conclusion

The spatio-temporal monitoring of burned area with remote sensing data allows the identification of the most sensitive fuel types against wildfire which is an important help to wildfire managers in the post-crises analysis but also in the wildfire prevention.