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Foreword

Advances in remote sensing and GIS applications in support of forest fire management

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Introduction

In recent years, the importance of wildfires as a natural or a human-induced phenomenon has gained recognition not only at local but also at regional and global levels. Improved remote sensing and computational capabilities enable the rapid processing of large image datasets in near-real time. As a result, remote sensing and geographic information systems are becoming common tools for fire monitoring at local, regional and global levels (San-Miguel-Ayanz *et al.* 2012).

Wildland fires, a hot topic of research since the early days of satellite remote sensing, have been used extensively for developing and testing new image analysis techniques and methods and Geographical Information System (GIS) models (Fernández *et al.* 1997, Chuvieco *et al.* 2002). The European Association of Remote Sensing Laboratories Special Interest Group on Forest Fires (EARSeL FFSIG) actively promotes the integration of remote sensing and GIS into the day-to-day activities of forest managers at all scales, supporting researchers, local governments and global organizations.

Since the launch of the Landsat satellite program in the early 1970s, various satellite sensors with different spectral and spatial resolutions have provided increasing capabilities for monitoring natural resources and disturbances (Lu *et al.* 2004, Xie *et al.* 2008). However, a gap between research and operational use of remote sensing and GIS still exists. The complexity in automating pre-processing and the subsequent classification of remotely sensed imagery poses a challenge for wildfire and civil protection managers. It is thus important for the remote sensing research and applications community to develop user-friendly systems and tools that facilitate the access to ready-to-use information on wildland fires for managers and policy-makers.

The EARSeL FFSIG was created in 1995, following the initiative of several researchers studying fires in Mediterranean Europe. Since its start, the group has involved international wildland fire researchers on diverse topics such as fire danger (Chuvieco, 2003), damage assessment (San-Miguel-Ayanz *et al.* 2009), vulnerability, ecosystem fire effects (Lentile *et al.* 2006), and emissions (van der Werf *et al.* 2010). It has organised several technical meetings and specialised publications over the past 18 years and is one of the most active groups within EARSeL.

The 8th International EARSeL FFSIG Workshop on Advances in Remote Sensing and GIS Applications in Forest Fire Management, held in Stresa, Italy (20–21 October 2011), was organised by the Joint Research Centre of the European Commission in collaboration with the Laboratory of Forest Management and Remote Sensing, School of Agriculture, Forestry and Natural Environment, Aristotle University of Thessaloniki.

The focus of the workshop was on local, regional, national and global applications of remote sensing in forest fire management. More specifically the aim was to identify requirements for the use of remote sensing at different scales ranging from local to global. As a result, the program included papers related to pre-fire planning and management, real-time detection and monitoring of active fires, and evaluation of the effects of forest fires.

The workshop was attended by 60 participants from 14 different countries, including European Mediterranean countries, other European countries such as Belgium, Bulgaria, the Czech Republic, Germany, and the UK, and non-European countries such as Australia, Canada, Mexico, and the USA. This workshop was planned in conjunction with two additional fire-relevant events, the European Space Agency (ESA) 'Fire Critical Climate Initiative' Workshop and the 'Global Observation of Forests – Global Observation of Land Dynamics Fire Monitoring & Mapping Implementation Team' meeting. This coordinated planning helped to ensure broad international participation. Papers included in this section originate from work presented during the EARSeL FFSIG workshop.

As a result of the workshop discussions, the following final conclusions were made (Lasaponara *et al.* 2011):

- There are a large number of 'mature' applications of remote sensing related to different phases of forest fire management (see e.g. San-Miguel-Ayanz *et al.* 2012).
- The number of research studies dealing with remote sensing applications at continental to global scale is rather small. There is an opportunity for researchers to collaborate in order to jointly work more at these scales. Programs such as that of the Group on Earth Observations (GE)) are supporting a partnership for the development of a Global Wildfire Information System (GWIS) (see ftp://ftp.earthobservations.org/GEO-X/GEO-X_10_GEO%202012-2015%20Work%20Plan%20Update.pdf, accessed 15 June 2014).
- Apart from the advancements in methods and techniques, data availability also has improved in recent years. Considerable remote sensing datasets from US agencies are already available, and data from European agencies are becoming more easily accessible through, e.g. the Copernicus program (see http://ec.europa.eu/enterprise/policies/space/copernicus/index_en.htm, accessed 15 June 2014). The fire remote sensing research community will need to be prepared to deal with the large amount of data from new and existing sensors that soon will be available.
- Although some applications of remote sensing related to forest fires are mature enough to be used operationally (e.g. burned area mapping), others (e.g. fuel type mapping, fire severity mapping) require further research and development.
- Product validation at continental/global level and model 'sensitivity analysis' are currently important topics of research (see http://gofc-fire.umd.edu/meeting/static/Netherlands_2013/Fire_IT_Netherlands/Boschetti.pdf, accessed 15 June 2014).

The workshop included invited lectures and poster sessions focussed on four topics: 'Pre-fire Planning and Management at local to regional level', 'Fire effects assessment: burned land mapping, fire severity determination and vegetation recovery assessment at local to regional level', 'Pre-fire Planning and Management at national to global level'), and 'Fire effects assessment: burned land mapping, fire severity determination and vegetation recovery assessment at national to global level'.

Based on the suggestions of the workshop scientific committee, manuscripts were recommended for publication in this issue of the IJWF. The six papers presented in this special section, cover major topics of remote sensing applications in forest fire management.

- Chuvieco *et al.* (2014), describe how to integrate geospatial information into fire risk assessment.
- Oliveira *et al.* (2014), assess the way fire selectivity is related to land cover and topography in different Southern European countries.
- Polychronaki *et al.* (2014), propose a method for monitoring post-fire vegetation recovery in the Mediterranean using SPOT and ERS imagery.
- Pettinari *et al.* (2014), propose a method for mapping fuel characteristics and associated fire potentials in South America.
- Veraverbeke *et al.* (2014) describe a method for mapping the daily progression of large wildland fires using MODIS active fire data.
- Katagis *et al.* (2014) employ trend analysis of medium- and coarse-resolution time series image data for burned area mapping in a Mediterranean ecosystem.

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