Integrating GIS and Remote Sensing Techniques for Studying Forest Fires

Dimitris Sykas[1,3] and Vijay Kumar Vohora[2]

[1] Laboratory of Remote Sensing, National Technical University of Athens,
Heroon Polytechniou 9, Zographos, 15780, Greece, dimsyk@gmail.com

[2] Infotech Enterprises Europe Limited
52-54 High Holborn, London WC1V 6RL, United Kingdom, v.vohora@gmail.com

[3] MapTronic Limited
2 Woodberry Grove, London N12 0DR, United Kingdom, dsykas@maptronic.co.uk

Abstract: Forest fires are one of the main causes of destruction of natural resources and this is observed on a global scale. Many countries worldwide are affected by this calamity which is induced by nature and human activities. Using satellite data it is revealed that in last decade nearly 350 million hectares of land was affected by vegetation fires worldwide. Remote sensing and GIS technologies are useful disciplines in studying land surfaces, monitoring, knowing the causes of forest fires and finding how to reduce its affects.

In this research, we developed two systems. First one is the Thermal Mapping of Forest Fires (TMFF), which is based on GIS. The input to this system is MODIS fire products in raster format (MOD14A1 and MYD14A1). A set of algorithms were developed for the system that traces and maps forest fire areas in shape files. This system works in an automatic mode. The second system is Index Mapping for Image Analysis (IMIA) that calculates the Normalized Difference vegetation Index (NDVI), the Normalized Difference Moisture Index (NDMI), the Normalized Burn Ratio Index (NBRI) and the Fire Susceptibility Index (FSI). This system works in a semi-automatic mode and the users use the indices to classify the land surface conditions and derive conclusions.

In this paper, a few forest fire incidents are discussed which occurred in Greece. MOD14A1 and MYD14A1 MODIS fire products were used in the TMFF system to obtain forest fire maps of the burnt area. The IMIA system was used with LANDSAT 7 ETM images to calculate the indices and classify land surface patterns before the forest fire events and on images of subsequent years after the forest fire occurrence. The result showed that burned areas and its surroundings with high productivity were destroyed completely. After the event these areas showed very weak growth of crops and in some areas none at all. The outcome clearly indicated that disastrous forest fire events have huge social and economic setback. It may take ages to recoup and recover losses and that also to some extent.

Further work is needed to develop the whole system to work in automatic mode and make it robust without the human interaction. The system will include ingredient of producing risk maps for reducing the impact of forest fires.

Keywords: forest fires, automation, classification, change detection, risk-mapping