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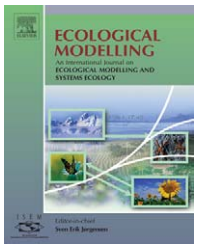

Short communication

Estimating spectral separability of satellite derived parameters for burned areas mapping in the Calabria region by using SPOT-Vegetation data

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ABSTRACT

In the Mediterranean regions, fires are considered a major cause of land degradation. Every year, around 45,000 forest fires break out in the Mediterranean basin causing the destruction of about 2.6 million hectares (FAO, 2001). In Italy, as in other countries of the Mediterranean Basin, a small number of fires generally destroy a large percentage of the total burned areas every year. In these cases, the use of coarse resolution satellite sensors appears to be very useful for the discrimination of burned areas.

In this study, SPOT-Vegetation (SPOT-VGT) data at full spatial resolution were analysed in order to investigate the spectral features of burned areas observed in the Mediterranean ecosystems in the Calabria Region during the 1998 fire season. Among the total fire events occurred in the considered period wildland fires larger than 1000 ha were selected for this study. SPOT-VGT imagery acquired before and after fire events were considered. Single channels or spectral indices suitable/or specifically designed for burned areas mapping were analysed. In particular near-infrared (NIR), short-wave infrared reflectance (SWIR), albedo, normalized difference of vegetation index (NDVI), normalized difference of infrared index (NDII), burned area index (BAI), global environmental monitoring index (GEMI) and soil adjusted vegetation index (SAVI), were considered in this study. The changes observed before and after fire occurrence in the considered parameters were presented and discussed. Results showed that among the spectral indices considered in this work, the highest discrimination capability was generally observed for NDII, SAVI, GEMI, BAI and NIR, nevertheless, strongly differences were observed from one fire event to another, and this fact suggests that the discrimination capability must be analysed coupled with the specific land covers affected by fire.

1. Introduction

Forest fires are one of the most critical issues in global change. Yearly, they affect vast areas throughout the world and cause devastating damages, such as, loss of biodiversity, decrease in forests, alteration of landscape, soil degradation, increase in greenhouse, etc. In the Mediterranean regions, fires are considered a major cause of land degradation. Every year, around

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45,000 forest fires break out in the Mediterranean basin causing the destruction of about 2.6 million hectares (FAO, 2001). Several studies (Malanson, 1987; Trabaud and Lepart, 1981; Vila et al., 2001) dealing with the effects of fires on the vegetation within the Mediterranean basin found that fires induce significant alterations in short as well as long-term vegetation dynamics. Fires lead permanent changes in the composition of vegetation community, cause decrease in forests, loss of biodiversity, soil degradation, alteration of landscape patterns and ecosystem functioning thus speeding desertification processes up. Moreover, recent studies found that fires facilitate alien plant invasion, patch homogenization and create positive feedbacks in future fire susceptibility, fuel loading, fire spreading and intensity (Cochrane et al., 1999; Rahman and Dedieu, 1994; Malamud et al., 1998).

In Italy, as in other countries of the Mediterranean Basin, a small number of fires generally destroy a large percentage of the total burned areas every year. In these cases, the use of coarse resolution satellite sensors appears to be very useful for the discrimination of burned areas.

In this study, SPOT-Vegetation (SPOT-VGT) data at full spatial resolution were analysed in order to investigate the spectral characteristics of burned areas observed in the Mediterranean ecosystems of the Calabria Region (Southern Italy) during the 1998 fire season. VGT data have been successfully used for burnt area detection in boreal forests (Fraser and Li, 2002), Australia (Stroppiana et al., 2002a,b). This study represents one of the first examples of application of VGT data for burned land mapping in the Mediterranean ecosystems. These investigations can be very useful in helping the evaluation of the feasibility of SPOT VGT data for burned area discrimination and also for improving the capability of algorithms developed for burned area mapping. Satellite-based burned area mapping can be suitably used for comparing performance and reliability of fire spreading simulator and fire behaviour models which are useful tools to assist fire management (Miller and Yool, 2002). Currently, the inclusion of disturbance and other extreme events in coarse scale dynamic model is still in its infancy (Keane et al., 2004). An accurate mapping of fire-affected areas can

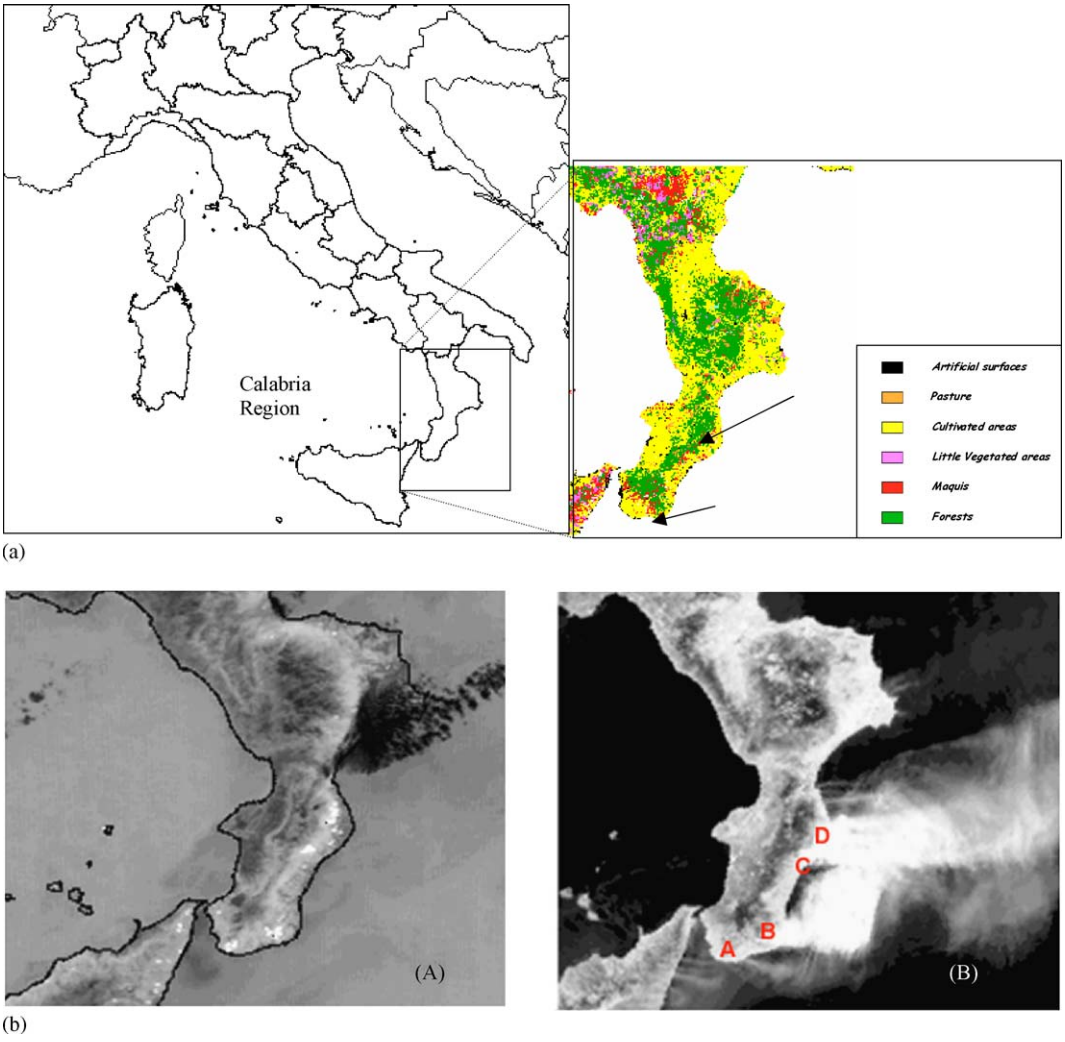

Fig. 1 – (a) land use of study area obtained from the Corine Land Cover map. Stars, arrows and black boxes indicate the areas most affected by fires during the 1998 fire season (b) (A) Hot spot from active fires shown by AVHRR channel 3 image acquired on 3rd July, 1998. (B) Smoke plumes rising the from active fires shown by AVHRR channel 1 image acquired on 3rd July, 1998.