Forest@

An overview of passive remote sensing for post-fire monitoring

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Abstract: Monitoring of forest burnt areas has several aims: to locate and estimate the extent of such areas; to assess the damages suffered by the forest stands; to check the ability of the ecosystem to naturally recover after the fire; to support the planning of reclamation interventions; to assess the dynamics (pattern and speed) of the natural recovery; to check the outcome of any eventual restoration intervention. Remote sensing is an important source of information to support all such tasks. In the last decades, the effectiveness of remotely sensed imagery is increasing due to the advancement of tools and techniques, and to the lowering of the costs, in relative terms. For an effective support to post-fire management (burnt scar perimeter mapping, damage severity assessment, post-fire vegetation monitoring), a mapping scale of at least 1:10000-1:20000 is required: hence, the selection of remotely sensed data is restricted to aerial imagery and to satellite imagery characterized by high (HR) and, above all, very high (VHR) spatial resolution. In the last decade, HR and VHR passive remote sensing has widespread, providing affordable multitemporal and multispectral pictures of the considered phenomena, at different scales (spatial, temporal and spectral resolutions) with reference to the monitoring needs. In the light of such a potential, the integration of GPS field survey and HR (Landsat 7, Spot HVR) and VHR satellite imagery (Ikonos, Quickbird, Spot 5) is currently sought as a highly viable option for the post-fire monitoring.

Keywords: Burnt scar perimeter mapping, Damage severity assessment, Post-fire vegetation monitoring, High and very high spatial resolution satellite sensors.

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Introduction

Designing post-fire management (reclamation and restoration interventions, etc.) in forest burnt stands requires the functional and structural assessment of the landscape mosaic and of the size and behavior of the considered wildfires. In this framework, monitoring may have several aims to support post-fire management: to locate and estimate the extent of the burnt areas (burnt scar perimeter mapping); to assess the damages suffered by the forest stands; to check the ability of the ecosystem to naturally recover after the fire; to support the planning of reclamation interventions; to assess the dynamics (pattern and speed) of the natural recovery; to check the outcome of any eventual restoration intervention.

Remote sensing is a relevant source of information to support all such tasks. However, it must be taken into account that in most Mediterranean countries the average size of forest fires is currently less than 10 ha and that over 80-90% of fires has an area smaller than 10 ha. In European central and northern countries the average burnt area is even much smaller, generally less than 1 ha (European Community 2004). In the light of this, satellite images with low (e.g. Noaa Avhrr, Modis, Spot-Vegetation) or medium (e.g. WiFS-IRS) spatial resolutions may be exploited only for monitoring the largest wildfires, as, for instance, carried out by the European Fire Damage Assessment System (EFFDAS, see European Community 2004) which consider just those ones larger than 50 ha.

For an effective support to post-fire management, a