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Fire danger estimation based on MODIS data for alpine and sub-alpine ecosystems of Northern Italy

A. Lanorte (1) and **R. Lasaponara** (1)
(1) CNR -IMAA C/da S. Loya Tito Scalo – Potenza, Italy

Winter fires represent a remarkable damage for a few European countries, such as Alps, Apennines, Pyrenees, Cantabria, Jura, Massif Central, Ardennes; characterized by continental climate and complex topography. Winter fires usually strike mature conifer woods or mixed woods located in areas hard accessible and far from big water surfaces. Moreover, fire-fighting activities, for facing winter fires, are made arduous by the possible water freezing and the limited day light time.

Up to now, several satellite based indices have been developed for the estimation and mapping of fire danger to support fire management activities. The existing satellite danger -indices are generally based on the analysis of the NDVI (Normalized Difference Vegetation Index) temporal evolution. NDVI decreases are generally supposed to be related to an increase in fire danger. Other methods are based on a jointly use of (i) NDVI decreases and (ii) surface temperature increases used as an indicator of water stress. Such methods are useful for the assessment of “summer” fire danger, but they are generally not feasible for fires occurring during winter season when the surface temperatures are decreasing and the dormant status of vegetation causes flat responses in NDVI.

This paper deals with the use of satellite MODIS imagery for the estimation of fire danger in the winter seasons for a test area located in the alpine ecosystems of Northern Italy.

The following products were obtained from MODIS data:

a) fuel types map obtained through supervised classification techniques and spectral

analysis methodologies performed at sub-pixel level;

b) fire danger maps obtained from both the (i) Relative Greenness (RG) derived from NDVI series and (ii) MSI (Moisture Stress Index) which is an index specifically developed for the estimation of live fuel moisture.

Areas characterized by a decreasing in Relative Greenness and moisture content are supposed to be related to an increase in fire danger.