Characterization of wildfire regime in Madagascar savanna environments using remotely-sensed images

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Abstract

Frequent burning of the savanna is thought to result in land degradation at Madagascar. Because of their impacts on vegetation cover, these fires have strong impacts on soil erosion risks. The development of an accurate system to map burned areas and fire regime is important to study the fire effect on savanna vegetation dynamic. According the official statistics, from 0.5% to 5% of the landscape is burning each year in Madagascar whereas, estimates coming from remotely-sensed images analysis give around 6% to 7%. The study area covers 157,751ha, localised around the Marovoay irrigated perimeter, in the Mahajanga province. This work aims to determine the spatial and spectral characteristics of the burned areas using high spatial remotely-sensed images in the context of the Malagasy landscape. Three fine-scale burned area maps are generated using a series of SPOT-5 images covering the 2005 fire season for the study area. Size and fragmentation of burned areas patches are studied using landscape indicators. Burned types of vegetation are identified by combination with a landcover map produced for the same year. For these types of vegetation, we compare the efficiency of various vegetation indices to separate burned and non-burned areas. Results demonstrate a seasonal-mosaic of burned areas in which burning begins early in the dry season and continues for several months ultimately affecting 20% of the landscape. The majority of burned scars are concerning wide areas producing an homogeneous landscape pattern. Vegetation indices based on near infrared and red ratio, like NDVI, are not accurate to identify burned scars. We propose to use a brightness index based on a sum of these spectral values. A comparison of the fine-scale maps with those from a coarse-resolution product finds that the latter was well adapted to characterize these burned areas. So the next step will be to go further in the characterization of the fire regime using a time series of Terra-MODIS synthesis.

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