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Satellite Images to Determine Levels of Fire Severity in a Native Chilean Forest: Assessing the Responses of Soil Mesofauna Diversity to a Fire Event

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Abstract : The edaphic fauna is the main factor involved in the transformation of nutrients and soil decomposition processes. Edaphic organisms are highly sensitive to soil disturbances, which normally causes changes in the composition and abundance of such organisms. Fire is known to be a disturbing factor since it affects the physical, chemical and biological properties of the soil and the whole ecosystem. During the summer (December-March) of 2017, Chile suffered the major fire events recorded in its modern history, which affected a vast area and a number of ecosystem types. The objective of this study was first to use remote sensing satellite images and GIS (Geographic Information Systems) to assess and identify levels of fire severity in disturbed areas and to compare the responses of the soil mesofauna diversity among such areas. We identified four areas (treatments) with an ascending level of severity, namely: mild, medium, high severity, and free of fire. A non-affected patch of forest was established as a control. Three samples from each treatment were collected in the form of a soil cube (10x10x10 cm). Edaphic mesofauna was obtained from each sample through the Berlese-Tullgren funnel method. Collected specimens were quantified and identified, using the RTU (Recognisable Taxonomic Unit) criterion. Diversity was analysed using inferential statistics to compare Simpson and Shannon-Wiener indexes across treatments. As predicted, the unburned forest patch (control) exhibited higher diversity values than the treatments. Significantly higher diversity values were recorded in those treatments subjected to lower fire severity. We conclude that remote sensing zoning is an adequate tool to identify different levels of fire severity and that an edaphic mesofauna is a group of organisms that qualify as good bioindicators for monitoring soil recovery after fire events.

Keywords : bioindicator, Chile, fire severity level, soil
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