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Estimating live fuel status by drought indices: an approach for assessing local impact of climate change on fire danger

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Mediterranean shrubs are an important component of both Mediterranean vegetation communities and understorey vegetation. They also constitute the surface fuels primarily responsible for the ignition and the spread of wildland fires in Mediterranean forests. Although fire spread and behaviour are dependent on several factors, the water content of live fuel plays an important role in determining fire occurrence and spread, especially in the Mediterranean shrubland, where live fuel is often the main component of the available fuel which catches fire.
According to projections on future climate, an increase in risk of summer droughts is likely to take place in Southern Europe. More prolonged drought seasons induced by climatic changes are likely to influence general flammability characteristics of fuel, affecting load distribution in vegetation strata, floristic composition, and live and dead fuel ratio. In addition, variations in precipitation and mean temperature could directly affect fuel water status, and consequently flammability, and length of critical periods of high ignition danger for Mediterranean ecosystems.
The main aim of this work was to propose a methodology for evaluating possible impacts of future climate change on moisture dynamic and length of fire danger period at local scale. Specific objectives were: i) evaluating performances of meteorological drought indices in describing seasonal pattern of live fuel moisture content (LFMC), and ii) simulating the potential impacts of future climate changes on the duration of fire danger period.
Measurements of LFMC seasonal pattern of three Mediterranean shrub species were performed in North Western Sardinia (Italy) for 8 years. Seasonal patterns of LFMC were compared with the Drought Code of the Canadian Forest Fire Weather Index and the Keetch–Byram Drought Index. Analysis of frequency distribution and cumulative distribution curves were carried out in order to evaluate performance of codes and to identify threshold values of indices useful to determine the end of the potential fire season due to fuel status. A weather generator linked to climate change scenarios derived from 17 available General Circulation Models (GCMs) was used to produce synthetic weather series, representing present and future climates, for four selected sites located in North Sardinia, Italy. Finally, impacts of future climate change on fire season length at local scale were simulated. Results confirmed that the projected climate scenarios over the Mediterranean area will determine an overall increase of the fire season length.