Spatial techniques for grassland curing across Australia and New Zealand

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This paper will describe progress in developing a satellite-based assessment of grassland curing across Australia and New Zealand, and present prototype maps of curing and rate of curing change.

Grass curing describes the annual or seasonal cycle of grass senescence (specifically their dying and drying out following flowering). The degree of grassland curing refers to the proportion of cured and/or dead material in a grassland fuel complex, and has a significant effect on fire behaviour, in particular potential fire spread. As such, it is a critical input into fire behaviour and fire danger models for grassland fuels. The current curing input into fire behaviour models and fire danger rating systems in Australia and New Zealand is generally based on visual estimates, which are widely recognised by both researchers and end-users as being inaccurate and thus causing uncertainty in system outputs. Curing is also assessed in south-eastern Australia using AVHRR (Advanced Very High Resolution Radiometer) satellite data based on research by CSIRO and CFA (Victoria) in the 1980s. The Bushfire Cooperative Research Centre (CRC) is conducting a project to develop methods to assess grassland curing across Australia and New Zealand. This project will establish algorithms to produce a better satellite-based grassland curing estimate, using field data from a range of grasslands. This paper reports PhD research, which is one component of the CRC project, and which has focussed initially on vegetation indices derived from EOS MODIS (MODerate resolution Imaging Spectroradiometer) satellite data.

Field data were collected from a number of selected grassland sites, which cover a variety of climate, topography, soil and grass types. The three methods used to estimate curing were destructive sampling (also used to estimate fuel moisture content), visual observations and Levy rod sampling. The field data were then correlated with vegetation indices, derived from a MODIS surface reflectance product (MOD09A1). This product, at 500-m resolution, is an 8-day composite of atmospherically corrected surface reflectance in MODIS bands 1 to 7. MODIS provides better quality and more extensive information on vegetation than does AVHRR. AVHRR has only two reflective bands (in the red and infrared spectral regions), the difference between which (expressed, for example, by the Normalised Difference Vegetation Index, NDVI) responds to a range of biophysical variables including plant pigmentation, cell structure, leaf area, and fractional cover. The MOD09 product has, in addition to two bands in the red and infrared, bands in the shortwave infrared spectral region that respond more directly to vegetation moisture. MODIS-like measurements are planned to continue with the VIIRS (Visible Infrared Imaging Radiometer Suite) satellite instrument from 2009 to beyond 2020.

Initial work has explored which MODIS bands correlate well with field measured curing. Also, effort has been put into comparing MODIS NDVI with field measured curing, for comparison with previous studies that have used AVHRR NDVI. Preliminary results of these relationships will be shown. While the analysis is not developed enough for application, we will show prototype satellite curing maps to stimulate discussion on the presentation formats for operational use. These include real-time snapshots of current curing levels and of rate of curing, and also historical maps of dates of curing onset and dates of attainment of critical curing levels.