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Power-law Behaviour of Wildland Fires Reflects Fractality of Fire Weather?

Matthias M. Boer (1,2), Pauline F. Grierson (1,2) and A. Malcolm Gill (1,3,4)

(1) Bushfire Cooperative Research Centre (2) Ecosystems Research Group, School of Plant Biology, University of Western Australia (3) CSIRO Plant Industry, Canberra, Australia (4) School of Resources, Environment and Society, Australian National University, Canberra, Australia. (email: mboer@plants.uwa.edu.au, pfgblue@plants.uwa.edu.au, Malcolm.Gill@csiro.au)

Power-law frequency-area statistics over several orders of magnitude have been reported for wildland fires in the Mediterranean, the USA, Australia and China. The scale-invariance of real fires has been interpreted as a signature for these landscape systems being in a self-organised critical (SOC) state because the empirical power-laws resembled those of fires simulated by simple cellular automata models with well-documented SOC characteristics. However, fire behaviour in forest landscapes in Australia suggests that fires in modelled landscapes are driven by a different set of processes than fires in real landscapes. This implies that the power-law behaviour of modelled and observed fires might coincide for reasons other than SOC. An alternative explanation for power-law frequency-area distributions of real fires is sought in the temporal scale-free behaviour of fire-driving weather. Preliminary analyses of time-series of the McArthur's Forest Fire Danger Index (FFDI), calculated from half-hourly observations at automatic weather stations in Victoria and south-west Western Australia, suggests that scale invariance of fire weather may be a rather common phenomenon and a plausible explanation for the power-law behaviour of real fires. The relationship between time-integrated FFDI and fire size is currently being studied in greater depth using remotely-sensed data and fire behaviour models to provide further support for this hypothesis.