Geophysical Research Abstracts
Vol. 14, EGU2012-3852, 2012
EGU General Assembly 2012

Divergent responses of fire to recent climate change: evidence from bio-regional patterns across south-eastern Australia

R. Bradstock (1), M. Boer (2), T. Penman (1), and O. Price (1)

(1) Centre for Environmental Risk Management of Bushfires, University of Wollongong, Wollongong, Australia (rossb@uow.edu.au), (2) Hawkesbury Institute for the Environment, University of Western Sydney, Richmond, Australia (M.boer@uws.edu.au)

Fire activity is dependent on the growth of biomass (fuel), sufficient dryness of biomass (availability to burn), weather condition such as temperature, wind and humidity (rate of fire spread) and ignitions (natural or human caused). Differing fire regimes are predicted to emerge from differing syndromes of limitation by these fundamental drivers. These processes are in turn governed by complex relationships with vegetation and climate, as well as human populations. Fire regimes should therefore vary systematically across biophysical gradients as highlighted in recent, global analyses of fire patterns. In particular, fire in dry ecosystems may be fundamentally constrained by the growth of herbaceous biomass (fuel limitation), whereas in mesic, forested ecosystems the principal constraint on fire is predicted to be availability to burn (i.e. episodes where litter fuels derived form dominant woody plants are sufficiently dry to burn). This means fire oocurs primarily in response to rain in arid ecosystems (i.e. promotion of herbage growth) and, alternatively, to drought in mesic ecosystems (i.e. drying of fuel beds). These contrasting syndromes of fire provide scope for divergent responses to warmer and drier conditions under climate change, with fire potentially declining in arid ecosystems and increasing in mesic ecosystems as a result.

We tested this prediction by examining the response of area burned from 1975 to 2009 across 32 bioregions covering south-eastern Australia, using mapped data derived from land and fire management archives. This range extends from arid grasslands through woodlands and sclerophyll forests to rainforests in the mesic, coastal fringe. Recent research has highlighted an increase in the severity of fire weather (i.e. annual sum of daily fire danger index) for the corresponding period across the part of the continent. We found that area burned tended to remain static or declined in semi-arid and arid bio-regions. By contrast in forested bioregions there was a consistent increase in area burned. Analyses indicate that these respective trends are being most strongly influenced by changes in temperature and precipitation anomaly across the time series. Thus, recent hotter, drier conditions are associated with: i) a decline in fire in interior grasslands, and; ii) an increase in fire in forests. These results confirm that the conceptual model outlined above is robust. Therefore there is potential for fire activity to diverge among ecosystems in response to climatic change in Australia, and elsewhere.