Fire and El Niño

Jennifer Robinson
State University of New York, Buffalo
Buffalo, NY

The How, Where, When, and Why of ENSO-Fire Relationships

Fire responds strongly to climatic factors, e.g., precipitation, temperature, and wind, and thus should respond to ENSO. This relationship must be put in the context of a specific climate and ecosystem before much can be said about the value of ENSO information for fire management. In the east and north of Australia, where ENSO is strong, and bushfire management is an ordinary part of the rural landscape, there is obvious value in using ENSO information to understand probable fire intensities in the coming season or seasons. For the US, where statistically significant ENSO signals are found for some regions and not others, it is much more difficult to build a case for using ENSO forecast information in fire planning.

Deficiencies in historical fire data exacerbate the problem of finding pattern over vagueness of ENSO itself. For example, so far as I am aware, the only published attempt to relate published fire statistics to ENSO occurrence, that of Simard et al., (1985), found only weak relationships, and the strongest relationship found is the depression of fire by heavy rains in the Southeast. In this case, the lack of results does not mean there is no correlation between fire and ENSO. The statistical base of the study was the US National Forest Fire Statistics--a data base that covers only fires in national forest, and aggregates into broad regions which correspond poorly to the geography of ENSO response. Obviously, if you have a fire reporting region that takes in both an area that is wetter and less fire prone during El Niño events, and an area that is drier and more fire prone during El Niño events, it is likely to depress the statistical significance of any relationship of fire-El Niño pattern that might be present in nature. There is every reason to believe that this sort of thing has occurred. However, without reasonably complete spatially-detailed information about fire occurrence over a period of a decade or more--and for the US such data are unavailable--fire-climate relationships of any sort cannot be studied. Given the scarcity of historical fire data, the next best thing is to specify the relationship of ENSO to the causes of fire, e.g., the availability of dry fuel. In this case, data abundance are more of a problem than data scarcity. Green vegetation index data are available globally, on a ten day period, dating back to 1982. As demonstrated in Figure 1 with Australian imagery, the decline in greenness in the year following an El Niño year can be dramatic. Visually obvious ENSO responses can also be seen in many other parts of the world.

Weather, especially moisture, ultimately drives fire. In this case causality runs in two opposite directions. First, to have fuel, you need plant growth, and to have plant growth, you need moisture. More moisture equals more potential fuel equals more potential combustion.

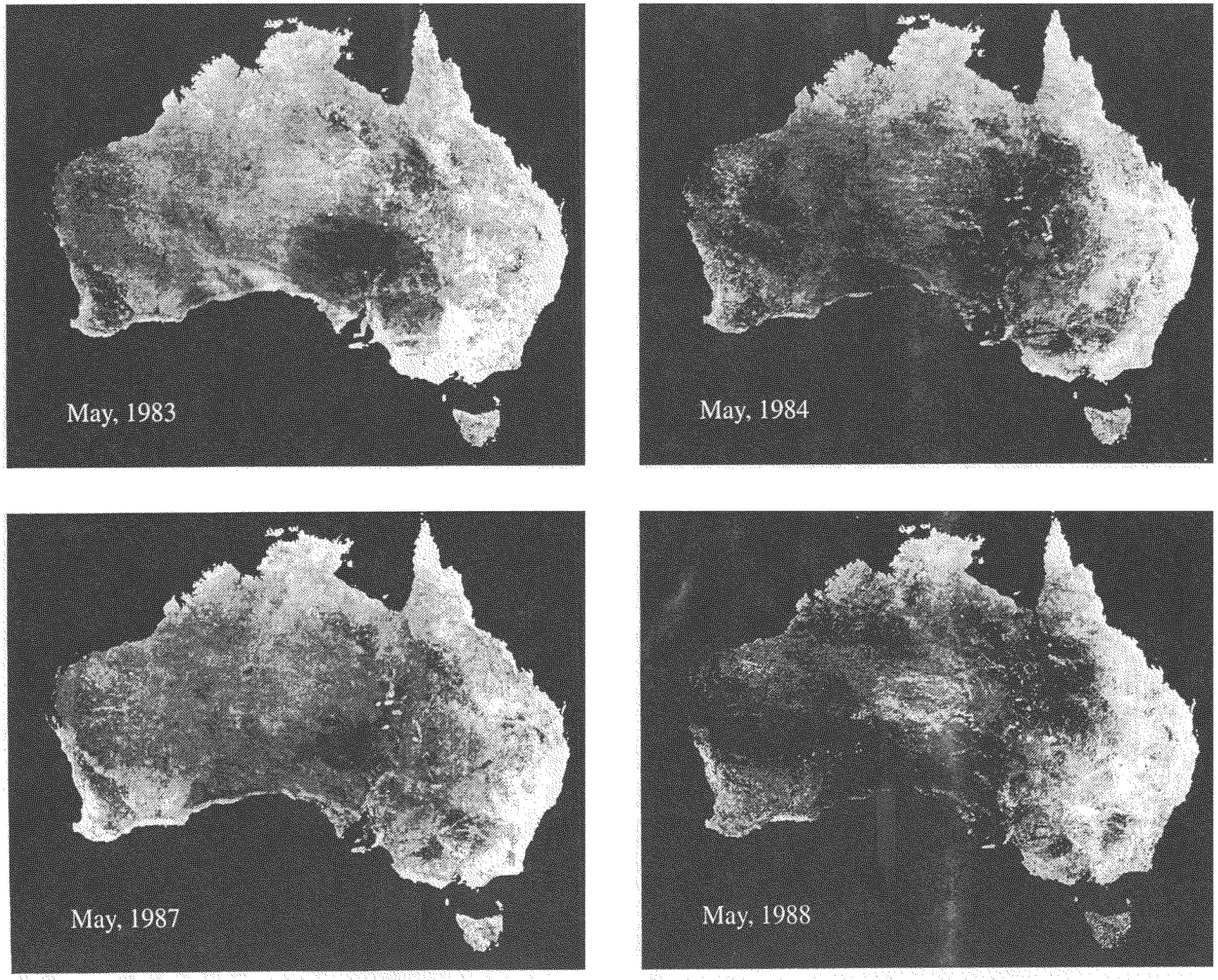

Figure 1. May Green Vegetation Index data for Australia in El Niño years (1983 and 1987) and subsequent years (1984 and 1988). Data from Graetz, D., and M. Wilson, 1993, AusWatch Version 1.0 CD-ROM, CSIRO, Canberra, Australia.