Reconstructing the fire history of an unmanaged semiarid shrubland using remote sensing and dendrochronology - Lake Johnston Region, southern Western Australia

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The Lake Johnston region encompasses around 17,000 km^2 of relatively undisturbed eucalypt woodland and shrubland at the eastern margins of the southern wheatbelt in Western Australia. Much of this land is Unallocated Crown Land that has had only minimal intervention by active fire management, both in terms of ignition and suppression. While the incidence of human-caused fires is relatively low, extensive wildfires, often ignited by summer lightning storms, are known to occur every few years. For these reasons, the Lake Johnston region provides a unique opportunity to characterise and investigate a relatively "natural" fire regime and provide insight and comparison for land managers in adjacent or similar areas subject to altered fire regimes.

Fire boundaries have been manually digitised from available aerial (1958) and satellite imagery (1972-2004) into a fire history database for the Lake Johnston region. Because of the high frequency of satellite imagery over the Lake Johnston region since the early 1980s, more recent fires (since 1985) can be dated with annual or monthly resolution. However, fires that occurred before 1985 cannot be accurately dated using aerial and satellite imagery alone, owing to a lower frequency of the data. In order to validate the fire history database and to more accurately define dates of older (pre-1985) fires, stands of native cypress pine (Callitris) within the mapped fire scars have been aged by assessing the annual growth rings of individual trees. Callitris spp. occurring within the Lake Johnston region are fire sensitive (killed outright by moderate to high intensity fire) and are serotinous obligate seeders (release seed and germinate following fire disturbance). Consequently, stand age structure can potentially be used as a proxy measure of the time since last fire.

Callitris samples (cores and sections) were collected from mapped fire scars of both known (post-1985) and uncertain (pre-1985) age in order to calibrate for a potential delay in germination and/or wood (ring) development following a fire event. Callitris samples were dated using standard dendrochronology techniques – tree rings were cross-dated by visually matching ring width patterns among samples and with an already existing chronology from within the region (Cullen and Grierson, unpublished). Preliminary data suggest a one to two year lag in germination / ring development post-fire with fire-regenerated stands exhibiting even age structure (within-stand age variation of two to three years), despite large variation in tree stem diameter. These outcomes suggest that Callitris stand age is a strong proxy for time since last fire; hence, these data will be used to assign calendar dates to mapped fire events. Once completed, this fire history database will be used as a basis for 1) examining fire attribute (e.g. frequency, size, interval, and age class) distributions, 2) identifying drivers and constraints of fire occurrence and spread, and 3) investigating influences of spatiotemporal patterns of fire on vegetation distribution and structure within the Lake Johnston region.