Preliminary field observations on fire and the endangered and data deficient *Pultenaea* sp. *'Olinda'*

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Introduction

Pultenaea sp. *'Olinda'* is an erect to procumbent shrub reaching a height of 0.5-1m with a similar spread. The needle like leaves are 5-10mm long and 0.5-1mm wide. It bears 'egg and bacon' pea flowers with a bright yellow standard and red/brown keel in spring. The fruit is 5-6mm long. The species has a restricted distribution east of Rylstone in the NSW Central Western Slopes botanical subdivision where it is confined to ledges and clefts associated with pagoda rock formations within a matrix of Eucalypt woodland. It occurs as a component of heath communities with or without a sparse *Eucalyptus* and/or *Callitris* canopy. Soils are shallow, sandy and infertile. *P*. sp. *'Olinda'* was listed as an endangered species under the NSW *Threatened Species Conservation Act* in 1998.

During June-Aug 2012, this author discovered a number of new locations supporting this taxon. Fortuitously some of these sites had been burnt a few years previously allowing preliminary field comparison between burnt and nearby unburnt sites. This has provided insights into key aspects of the previously unknown fire ecology of the species. As fire is the most widespread, recurrent disturbance occurring across the species' distribution, an understanding of its' fire ecology is considered essential as appropriate fire management is likely to prove fundamental to ensuring this species remains viable in the wild.

Preliminary observations on fire ecology

Field observation confirms *P.* sp. *'Olinda'* is a geospore. Accessions to the soil stored seedbank appear to occur on an annual basis. The presence of juveniles in burnt sites together with their absence from unburnt sites points to fire cued recruitment. As with many Fabaceae from fire prone environments, seeds of *P.* sp. *'Olinda'* appear to possess a hard impermeable seed coat that imposes a physical dormancy that is overcome when the seed coat is cracked by the heat of a fire. Fire therefore, appears to play a pivotal role in providing recruitment opportunities and perhaps early competitive advantage in the post fire environment. More significantly perhaps, the presence of large, multi-stemmed, reproductive individuals amidst a scattering of small, single stemmed, non-reproductive juveniles in burnt sites points to post fire resprouting (contrary to expectations that the species would prove to be fire sensitive). Living stems have been positively associated with the bases of charred stems killed by 100% crown scorch thus confirming the resprouting habit.

Small numbers of empty fruits have been observed persisting 6-8 months after seed dispersal. The absence of such fruits on resprouting plants indicates that 2012 may have been the first post fire flowering season.

Pultenaea *sp.* 'Olinda'.
Photo: Steve Clarke

The wildfire that affected these sites occurred in the 09/10 fire season indicating a secondary juvenile period (time from resprouting to first flowering) of 3 years although this is likely to vary depending on average environmental conditions in the first few years post fire. While data is required to quantify the effect of fire on growth and fecundity, initial field observation indicates long unburnt plants are woody with small numbers of leaves and flowers crowded near the branch tips whereas resprouting plants have leaves along the entire length of the branches, many more flowers and appear much more vigorous and healthy than unburnt plants.

Further research questions

The following research questions reflect significant gaps in current knowledge relating to the fire ecology of *P.* sp. *'Olinda':*

- What is the average lifespan of an individual?
- What is the primary juvenile period? (time from seedling emergence to first flowering/ability to resprout). This would give some indication of what minimum fire interval would be appropriate.
- Is the ability to resprout a general trait or restricted to certain populations as is known to occur in other species?
- Are a percentage of adults killed during the passage of a fire and how might this vary with fire intensity?
- What is the magnitude of fruiting in relation to time since fire, plant age and plant size?


Multiple stems arising from the bases of burnt plants after 100% crown scorch. Photos: Steve Clarke

- What is the percentage of viable seed set?
- Are rates of pre and post dispersal seed predation significant? Losses to predation of entire first post fire seed crops have been reported for other Fabaceae. This has implications for calculating minimum fire intervals.
- What is the longevity of soil stored seed? This would give an indication of what maximum inter fire interval would be appropriate.

Fire related threats

While the ability to resprout gives some insurance against occasional short fire intervals, field observation suggests inappropriately long fire intervals may be occurring across much of the species distribution. As there is a high public/private land interface across this species' distribution, the area is subject to periodic hazard reduction burning. Contrary to normal expectations, this may be imposing an inappropriately low fire frequency as low intensity fires burning under benign weather conditions are unlikely to invade the protected niches inhabited by this species. Furthermore, if such fires do reduce the frequency and intensity of wildfires burning under conditions of high temperature and wind, when embers raining down as incendiaries *are* likely to invade these niches, fire disturbances could be being limited even further. Given that seed germination appears to be fire dependent, this type of fire management and the suppression of natural ignitions may be inducing an artificial recruitment limitation on this species. Interestingly, where *P.* sp. *'Olinda'* occurs with *Leionema sympetalum*, which also has fire cued germination, individuals of both species are old and woody with no evidence of recruitment for many years. Targeted burning of niches containing this species may be a viable strategy for overcoming this problem.

Conclusion

In 1998, the NSW Scientific Committee cited evidence of decline over the previous 40 years as one of the reasons for listing this species as endangered. Given that nothing was known of its ecology at the time, and it was suspected to be fire sensitive, a cautious approach in interpreting any loss of individuals and/or contraction of range as 'decline' is understandable and justified. Had there been a real decline (loss of individuals and propagules) or was perceived decline related to replacement of above ground plants with soil stored seed with increasing time since fire as old plants die? While knowledge of its' ecology is still rudimentary, in this authors' opinion, the passage of a moderate/high intensity fire over parts of its range that have not seen such a fire for many years may be all that is required to substantially recover this species in the wild. As has been demonstrated in the sites burnt in 09/10, such a fire has the potential to rejuvenate the vegetative vigour and reproductive fecundity of old woody plants via resprouting and produce a pulse of seedlings. It is also possible the species may appear in 'new' sites that may still contain viable soil stored seed but from which all above ground plants have long since died. Such a fire could demonstrate that populations of *P.* sp. *'Olinda'* are resilient and self-sustaining given appropriate fire management. While that in itself may not be sufficient to warrant the removal of *P.* sp. *'Olinda'* from the endangered species list, as numbers would still be low and distribution limited, we may be able to breathe a little easier in regards to its' long term future.

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References

Auld, T.D. (1996) Ecology of Fabaceae in the Sydney Region: fire, ants and the soil stored seedbank. *Cunninghamia* 4 (4): 531-551

Auld, TD. and Myerscough, P.J. (1986) Population Dynamics of the shrub *Acacia suaveolens* (sm.) Willd.: seed production and predispersal predation. *Australian Journal of Ecology* 11: 219-234

Office of Environment and Heritage. Pultenaea sp. Olinda (a shrub) – endangered species listing NSW Scientific Committee –final determination (1998) http://www.environment.nsw.gov.au/determinations/PultenaeaspOlindaEndSpListing.htm (accessed 4/10/2013)