Copper Butterfly Ecological Experimental Burn Trial

It is proposed that a field trial and collection of experimental data to determine the value of "cool" burning be conducted within one site (B14) of the 35 known locations for the endangered Purple Copper Butterfly in 2017 and within two other sites (B3 Eusdale Road, B6 Turners) in 2018 (pending data review of first site and lack of negative responses from both butterflies and *Bursaria spinosa* food-plants). In autumn 2017 (April –June, weather dependent) site B14 (Kennedy Park) will have 10 random clumps of *B. spinosa* cool burnt within the grass layer around the bases of the plants. These burn treatments are paired with control non-burn sites. The experimental design of the treatments and controls has been determined through consultation with Terry Koen (Statistician, Office of Environment and Heritage). A similar burn design is planned for B3 and B6 pending results from B14.

Cool Burn

The term "cool burn" refers to a methodology used extensively by Indigenous Australians as a tool for managing vegetation for a multitude of purposes including enhanced sustainable production of vegetables for food and medicine, as well as hunting and access across the landscape. These burns were practiced throughout the year depending on the required outcome but the large majority of fires were ignited during late autumn and winter (southern Australia). The general purpose of fire at this time of the year was to reduce competition by some unfavourable more aggressive vegetative species and promote increased production in desirable species. An example of a food species cultivated in this manner and now reliant on fire is the yam daisy *Microseris lanceolata*. Cool fire differs from most other fires observed in the modern landscape in its low flame height (less than 0.5m), slow progress across leaf litter and the resulting mosaic of numerous unburnt patches of vegetation. Ground surface temperature reach maximum temperatures not exceeding 36^0C (mean = 20.5, n=30, unpublished personal data). This technique also allows fire to proceed across the landscape without burning logs and branches that form habitat for vertebrates and invertebrate.

The team that will conduct the burn has been formed through partnership with the Rural Fire Service and Central Tablelands Local Land Services. In addition members of the Local Aboriginal Land Council will assist Dr Milton Lewis in coordinating and conducting the appropriate methodology. As team leader for the burn, Dr Milton Lewis has more than 20 years experience in this methodology from previous work in the Northern Territory and Queensland. Local Land Services Staff and some members of the Local Aboriginal Land Council have in addition participated in cultural burning training camps in Cape York that were facilitated by northern Indigenous Traditional Owners. All members of these groups in addition to cultural fire training have undergone RFS fire training, awareness and safety courses. The Rural Fire Service will provide equipment during the burn, including water tankers for managing wet fire-breaks around the prescribed burn areas. Together, this team has now been conducting highly successful cool burns throughout New South Wales for five years with an unblemished record of no fires breaching control lines and no fires requiring the use of water tankers during operations.

Methodology

All monitoring described in the following document will be funded and conducted by Central Tablelands Local Land Services within the Targeted Ecosystems Project structure for the planned 3

year duration. Where appropriate additional field assistance will be provided by community volunteers.

Statistical Design

Variation in the responses of butterflies and *B. spinosa* with low intensity burning will be assessed using Repeated Measures Analysis of Variance. At B14 and B3, there will be ten paired experimental sites containing randomly determined treatments of burnt and non-burnt (control) clumps of *B. spinosa* (fig. 1, 2). Site B6 will only contain 5 paired treatment areas because of the overall size of the site and distribution of bushes. Each treatment site will cover about 25 m^2 (1 clump of *B. spinosa* containing 15-20 bushes) with the paired design controlling for external variables such as slope, aspect and soil type. These sites have all been seen to support past adult purple copper butterflies and oviposition sites during observations in 2008 (most recent complete survey during flight period), although there have been no recent sightings in the past 2 years. In total the area of prescribed ecological cool burning will consist of 250 m^2 in a total area of 18,768 m^2 *B. spinosa* (less than 1.5% of known food plant area for the B14 site).

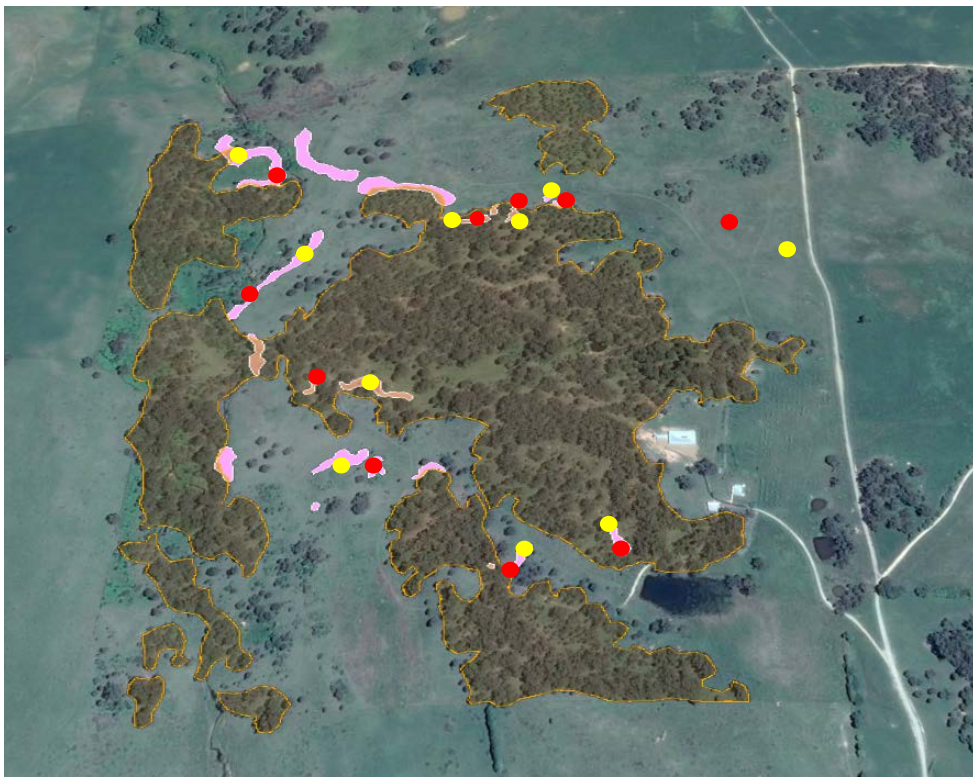

Figure 1: Aerial view of B14 Kennedy Park Study Site. *Bursaria spinulosa*, Tableland Basalt Forest community Burn Treatment Sites, Control Sites

Figure 2: Aerial view of B3 Study Site. *Bursaria spinosa*, Burn Treatment Sites, Control Sites

Figure 3: Aerial view of B6 Study Site. *Bursaria spinosa*, Burn Treatment Sites, Control Sites

Site Evaluation and Placement of Treatment Sites

On the 22nd November 2016 sites B14, B3 and B6 were visited by Central Tablelands Local Land Services Officers and Ecological Consultant Ray Mjadwesch to evaluate condition of *B. spinosa* plants and locations of shrub clumps for the purpose of burning. All clumps of *B. spinosa* were mapped using GPS and burn and control paired replicates randomly allocated treatments.

Pre-burn Data Collection

Prior to the commencement of burning, sites will be assessed to determine if there are existing statistically significant differences between plants in controls and treatments. This will be achieved through the collection of a variety of shrub measurements that may be considered relevant to adult and larval copper butterflies. It is intended that all shrubs will be tagged (if one is not already present) and the site logged using a Trimble Geoexplorer 6000 GPS (accurate to 2cm). Shrub features measured will include height, basal diameter, mid-height foliage diameter, general health and lichen coverage. In addition, 5 terminal shoots (10 nodes in length) will be collected from each shrub for determination of total leaf area.

Burn

Prescribed burn plans will be developed in coordination with the Rural Fire Service prior to any work commencing at the sites. These plans will provide risk assessments and guidelines for ignition points, working weather conditions and safety. This is standard procedure for all burning currently performed in partnership with the Rural Fire Service.

Point ignition burning will be used within each burn treatment area in accordance with cool ecological burning methodology. The ignition point will be in the centre of each treatment area and burn outwards in a ring pattern. Before ignition, a wet line will be placed around the periphery of the burn area as increased insurance that the fire does not escape the prescribed burn zone.

During the burn an evaluation of fire intensity will be conducted through photography of flame height and the use of ground surface and below ground temperature sensors. Five of each sensor (total = 10 per site) will be placed at random locations within the burn. To evaluate flame height five stakes with graduated marks will be located randomly in the burn area and as the flame moves around the stake multiple photographs will be collected.

Immediate Post-burn Evaluation

Within the first week after burning, each site will be assessed for quantities of remaining leaf litter, living plant ground cover and ash depth. This will be achieved by 5 random placed $1m^2$ quadrats within the burn area. All marked *B. spinosa* will be assessed for scorching and heights of scorching recorded.

Post-burn Monitoring

All treatment sites will be visited monthly after burning to record commencement of regrowth and assess if there are differences between treatments and controls. This will be recorded qualitatively by noting when regrowth commences, followed by quantitative counts of bud numbers and bud

emergence to form leaves. Five terminal shoots (10 nodes in length) will be monitored from each shrub for determination of these measurements.

Spring Bursaria Monitoring

During the spring/summer when mature leaves are present on the terminal branchlets of growth formed in the 2016 season a complete assessment of *B. spinosa* fire response will be conducted. This will follow a similar protocol to the pre-burn assessment. Shrub features measured will include height, basal diameter, mid-height foliage diameter, general health and lichen coverage. In addition, 5 terminal shoots (10 nodes in length) will be collected from each shrub for determination of total leaf area.

Adult Post-burn PCB Monitoring

Adult copper butterfly population counts will be conducted three times within controls and treatments during the active period of oviposition in September and October. A count will consist of a 10 minute walk around the periphery of each of the treatment and control sites recording the number of butterflies observed. Five people will separately assess all sites on the same day using the same methodology and their results will be pooled to provide a mean count number for each site on the same day. If the results for each of the three site visits are verified as statistically independent these will again be used to give a mean population estimate for each site over the entire active adult period. These counts will be conducted in 2017, 2018 and 2019.

Larval Post-burn Monitoring

Following protocols of past purple copper butterfly larval surveys (Mjadwesch pers comm.), counts of all larvae within all treatment sites will be conducted during the first two weeks of December 2017, 2018 and 2019. Ant presence at all sites will also be monitored during this component.

References

Cayzer, L. W., M. D. Crisp and I. R. H. Telford (1999) Bursaria (*Pittosporaceae*): a Morphometric Analysis and Revision Australian Systematic Botany 12, 117–143

New, T. (2000) Fire and the management of habitat quality in an Australian Lycaenid butterfly Parlucia Pyrodiscus lucida Crosby, the Eltham Copper. Metamorphosis 11: 154-163.