**Melbourne’s grasslands: Long-term grassland monitoring field methods**

*1. Site inventory (Level 1)*

In order to provide a reference point for future changes to the presence and absence of species, and to locate meta-populations of interest, the initial level of monitoring is to develop a site inventory of vascular plants within each of the grassland reserves. This will involve a walking search of each site in a systematic pattern (Fig. 1). At each site, the walking route will be tracked with GPS as a continuous transect, with waypoints marked every 15 mins. Observations along the transect are to be limited to an approximate 3 m width. However, any addition species observed outside of this 3 m width are to be recorded separately (most likely to include large plants such as trees, shrubs, and tall forbs and graminoids). This will help to identify the approximate location of first encounter for each species in each of the reserves, allowing for future comparisons in a time efficient manner.

As reserves vary greatly in size, the amount of time allocated to each site will also need to vary (Table 1). As each species is detected during the search the time-to-detection is also recorded. This will help to identify which species require the greatest search effort. At the conclusion of each search, an additional five minutes is allocated for the discovery of any new species. If no new species are discovered the search is concluded. If new species are found, then another five minutes is allowed. This is to continue until no new species are discovered.

This method may overlook species that have been previously recorded. Species of which there is prior knowledge of, but are not discovered during the search, are to be added to the site inventory for the development of the initial reference list. However, the absence of these species during the search is to be noted.

**Fig. 1. Systematic search pattern to be followed in each grassland reserve when undertaking species inventory.**

**Table 1: Time allocated to grassland reserves depending on reserve size.**

|  |  |
| --- | --- |
| Reserve size (ha) | Time spent (mins) |
| < 2  | 30 |
| 2 - 10  | 60 |
| 11 - 20  | 90 |
| 21 - 50 | 120 |
| 51 - 100 | 180 |
| > 100 | 240 |

*2. Vegetation cover (Level 2)*

The vegetative cover of the grasslands will be determined using transects. The number of transects in each grassland will vary depending on reserve size (Table 2). The placement of transects is to be stratified according to zones of differing management histories, and placed randomly within these zones (as described by Rolecek et al. 2007). Random selection of exact sampling sites will be done in the field by selecting random coordinates with a GPS receiver. Each transect will be 25 m long. A pin point (4 mm in diameter) is to then to be placed at 50 cm intervals along the transect with the upper layer of dominant cover beneath the pin point recorded. This may be recorded according to species, litter (including dead plants), cryptogrammic crust, rock, or bare ground in the event of no cover. Variations of this method have been commonly used in grassland studies (e.g. Hayes and Holl, 2003; Hickman et al. 2004; Noy-Meir, 1995; Wahren et al. 1994). Transects are to be marked with GPS and with permanent metal markers. While GPS will provide the approximate location of transects in the future, metal markers will allow for precise re-located using a metal detector.

*3. Vegetation structure (Level 3)*

Sward structure will be determined by assessing the visibility of golf balls, with 18 golf balls dropped individually within a 1x 1 meter quadrat (Shultz, 2006; Parks Victoria, 2008). A photo is then to be taken of the quadrat from 1.3 meters above the ground. In order to control for observer variability, three observers are to count the number of visible golf balls in each photo, with the average number of golf balls observed for each quadrat recorded. The number of quadrats will vary depending on reserve size (Table 2), with the placement of quadrats stratified according to differing management zone, with random placement within these zones. Based on this method, if 15-18 golf balls are visible the quadrat is considered to have a low level of biomass. However, if five or less golf balls are visible the quadrat is considered to have high biomass.

**Table 2. The number of transects and quadrats (for assessing sward cover) in each grassland depending on reserve size**

|  |  |  |
| --- | --- | --- |
| Reserve size (ha) | Number of transects | Number of quadrats |
| < 2  | 8 | 10 |
| 2 - 10 | 12 | 14 |
| 11 - 20 | 14 | 18 |
| 21 - 50 | 18 | 22 |
| 51 - 100 | 22 | 26 |
| > 100 | 26 | 30 |

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