Botanical surveys of western ground parrot habitat to inform translocation site selection

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Summary

Botanical surveys were conducted in sites containing currently occupied western ground parrot habitat, and potential or historic sites that are being considered as translocation sites. These include Cape Arid National Park and the adjoining Nuytsland Nature Reserve (currently occupied), Cape Le Grand National Park, Fitzgerald River National Park and the Waychinicup – Manypeaks area (all with historical records of ground parrots). In addition, we surveyed an area of heath on Middle Island, in the Recherché Archipelago. We found floristic diversity and structural habitat in the proposed western ground parrot translocation release site at Waychinicup was comparable with occupied habitat in Cape Arid National Park and Nuytsland Nature Reserve, and this area is recommended as a suitable site for a translocation of western ground parrots. Based on floristic diversity and structure Cape Le Grand also has potential as a future translocation site. The area of low heath on Middle Island is small, and not considered suitable for ground parrots in terms of floristics or size.

Background

Selection of a re-introduction site for any species being considered for a conservation translocation is complicated by the need to consider a wide range of factors, both biotic and abiotic (IUCN/SSC 2013). This is particularly the case for species such as the western ground parrot (WGP), a critically endangered species that has fairly specific habitat requirements and which is now confined to a small population in a restricted area to the east of Esperance. The WGP has become locally extinct at several other sites in recent decades and is subject to significant challenges in terms of ongoing management of fire and introduced predators (Berryman *et al.* 2020). In selecting potential release sites for WGP translocations, the South Coast Threatened Birds Recovery Team identified the importance of determining whether the vegetation characteristics (structure, food availability) important to the survival of the WGP at potential release sites were comparable with existing, occupied habitat.

A brief study of western ground parrot feeding behaviour was completed by Newbey (2016), who recorded food plants visited by a single western ground parrot. This work confirmed that WGP eat seeds, fruits and flowers from a diverse range of plant

species, where they are easily reached from on or near the ground. Vegetation in ground parrot habitat is usually relatively long-unburnt, less than 0.5m high, though often up to one metre high, with more than 50 per cent cover. Sedges and rushes are generally abundant, making up to 40 per cent of cover (Burbidge *et al*. 1990; DPaW 2014; Burbidge *et al.,* 2016). WGP have also been found to feed in habitats one to five years post-fire, provided there is older vegetation nearby (at least eight years post-fire) for roosting and breeding (S. Comer *et al*. unpubl.).

In order to provide an objective way of comparing sites, we aimed to provide a comparative botanical assessment of occupied habitat in Cape Arid National Park, an area last known to be used in Fitzgerald River National Park in 2012, two proposed translocation release sites (Waychinicup and Cape Le Grand) and an island site (Middle Island) (Figure 1).

Methods

The extent of species richness, floristic composition and structural diversity of vegetation was examined in currently occupied habitat and potential release sites in order to provide a comparative estimate of the food resource available for western ground parrots at preferred release sites. This included an assessment of vegetation structure (height, density) and floristic diversity, in particular in the families known to provide good levels of food resources (seed and flower availability) and an appraisal of vegetation health (fire age, dieback, condition).

Site selection was based on historical significance of sites for ground parrots, on the structure of the vegetation relevant for ground parrot habitat, and on the presence of known or potential food plants. Preference was given for dense, low, species-diverse shrubland or heath 0.5-1.0m in height, and we sought this kind of vegetation at each site/survey region.

Floristic composition and cover class estimates of dominant taxa were obtained from a circular relevé 10m in radius (see e.g. Mucina *et al*. 2000), marked across the diameter with a measuring tape. The area of the circular relevé was paced and position tracked with GPS, these tracks being used to confirm that all of the area within the circular relevé was covered. Several observers were involved with the survey of each relevé, where they gave assistance in noting taxa, collecting material and providing valuable information on the habitat value and food plants relevant to ground parrots. Every distinct taxon was noted with a field name, although immature and sterile plants made these distinctions difficult in some cases (e.g. sterile sedges).

We established 20 relevés: nine in Cape Arid NP, 2 in Cape Le Grand NP, 2 in Fitzgerald River NP and 5 at Waychinicup – Manypeaks (Figure 1).

We used RStudio 1.3.1073 (RStudio, Inc., Boston, MA, USA) running R version 4.0.2 to analyse patterns in plant species composition across sites using the ‘vegan’

package version 2.5-6 (Oksanen *et al*. 2019). Ordinations (non-metric multi-dimensional scaling: nMDS) were carried out using the Bray-Curtis association measure, which is appropriate and robust when used with ecological data (e.g. Clarke and Warwick 2001). We first analysed the data using species occurrences. However, plant species richness, and species turnover on the south coast is high, including in known WGP habitat (Burbidge *et al*. 1990; Mucina *et al*. 2014) and it was felt that WGPs would be choosing food plants at the genus level rather than species level, so the analysis was repeated at genus level. The analysis is dependent on consistency in species identifications, which we attempted to achieve through data collection by a botanist (AM) experienced with the south coast flora, and with data collection achieved in a single field trip lasting less than two weeks.

Based on known WGP food plant preferences, we calculated the frequency at which selected plant families occurred on each of the relevés. Newbey (2016) showed that sedge seeds constituted 32% of 555 feeding events by a bird studied in Fitzgerald River National Park. Species (mostly shrubs) from dicot families were also used frequently, with the most important families being Ericaceae, Fabaceae and Proteaceae. Across the 20 relevés we therefore calculated the frequency of occurrence of families of sedges, rushes and sedge-like plants (Anarthriaceae, Cyperaceae and Restionaceae) and the dicot families mentioned above.

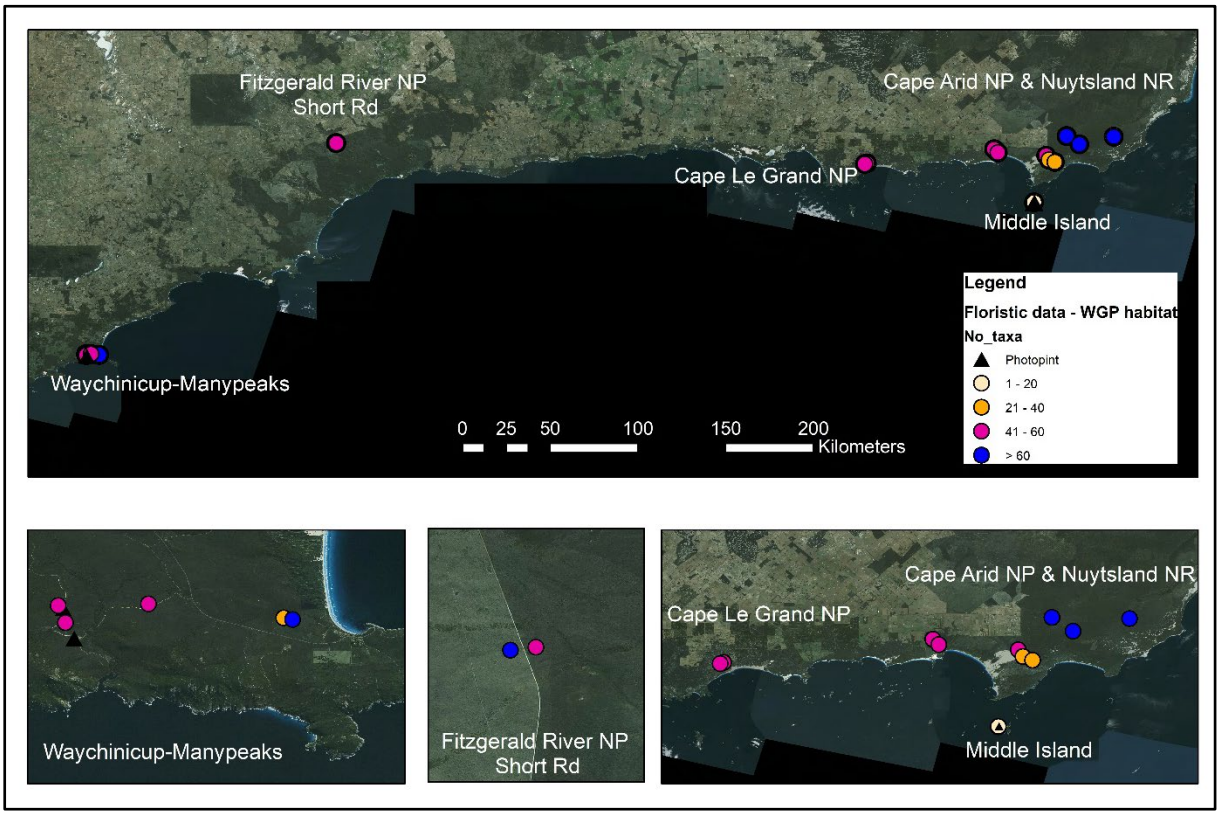

Figure 1: Locations of botanical surveys, with comparative species richness for relevés and locations of photo points.

Results

- Species and family richness varied greatly across the 20 relevés that were sampled, with the lowest values being recorded on Middle Island, and the highest in Cape Arid NP, Fitzgerald River NP and Waychinicup -Manypeaks (Figure 2).
- Relevés sampled in Cape Le Grand NP, Fitzgerald River NP and the Waychinicup- Manypeaks area showed plant species and genus composition patterns similar to sites known to be occupied (or recently occupied) by WGPs in Cape Arid National Park.
- Most of Middle Island appeared completely unsuitable for WGPs, and the two relevés sampled in the only heath habitat (which covers an area of less than 4 ha) that was conceivably of possible use to WGPs were depauperate in terms of species and family richness (Figure 2), and differed greatly in species and genus composition patterns from all mainland sites (Figures 3 and 4).
- All but one relevé at the mainland sites supported at least two of the three sedge, rush and sedge-like families, with only one of the Cape Arid plots supporting only one of these families. Neither of the Middle Island plots had any species from these families (Figure 5a), suggesting that the area would be unlikely to provide an adequate food supply for WGPs.
- Of the 20 relevés sampled, only one (on Middle Island) did not support at least one species from each of the favoured dicot families (Figure 5b). The two relevés on Middle Island had the lowest count of species from these three families (Table 1).

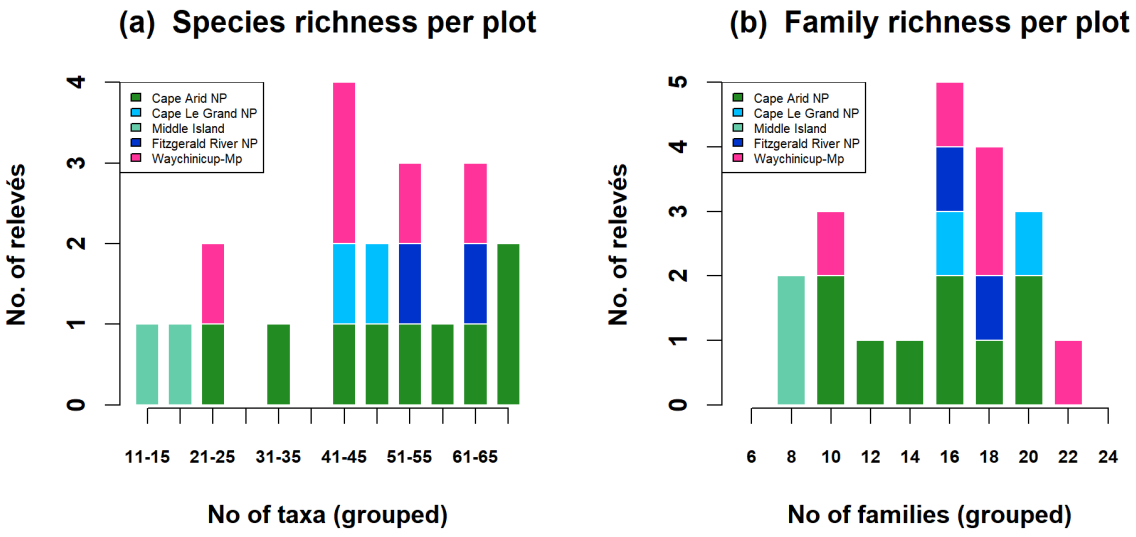

Figure 2: (a) Number of species per plot and (b) number of families represented in each plot, for the 20 relevés sampled in known or potential ground parrot habitat.

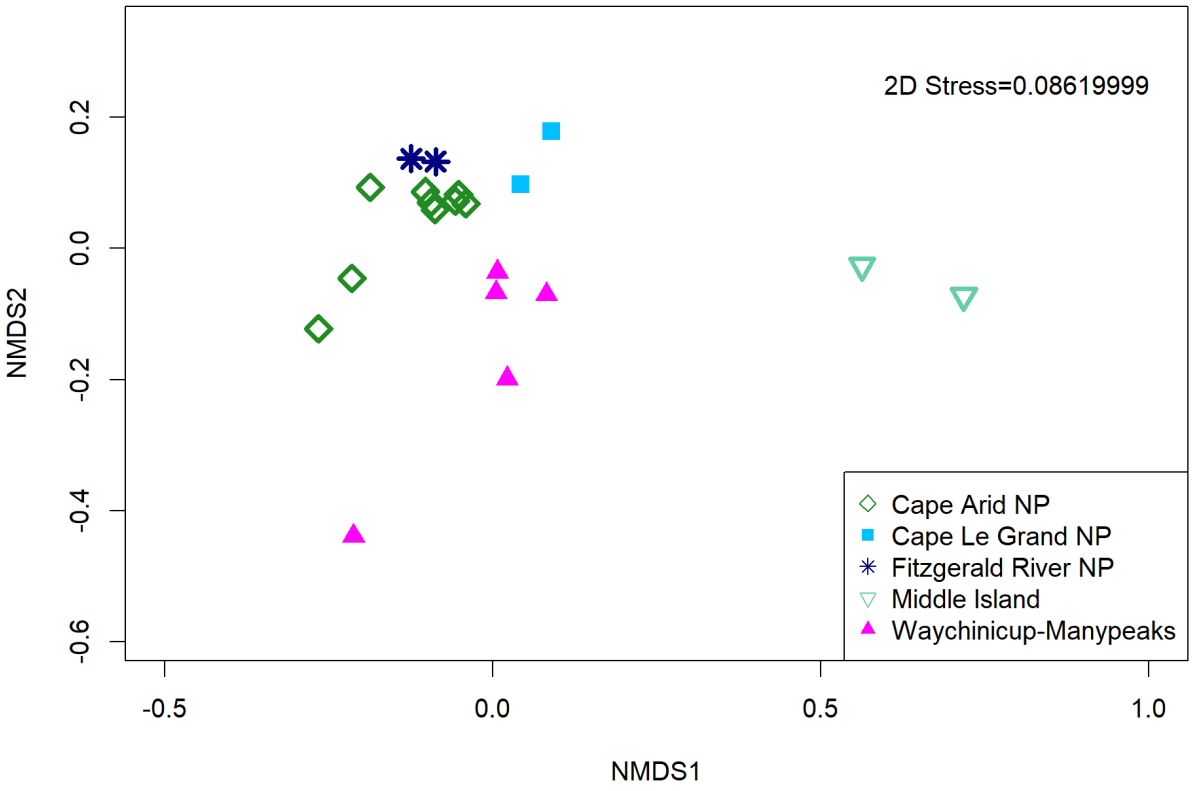

Figure 3: Results of a non-metric multi-dimensional scaling (nMDS) ordination of the plant species detected at each of the 18 relevés from mainland sites known to be occupied currently by WGPs or previously known to have been occupied, together with two relevés of heathland on Middle Island (never known to be occupied by WGPs). The site in the lower left hand part of the figure is WP080, which is on the edge of Cheyne Road swamp, a site believed to have been used for feeding, but probably not breeding.

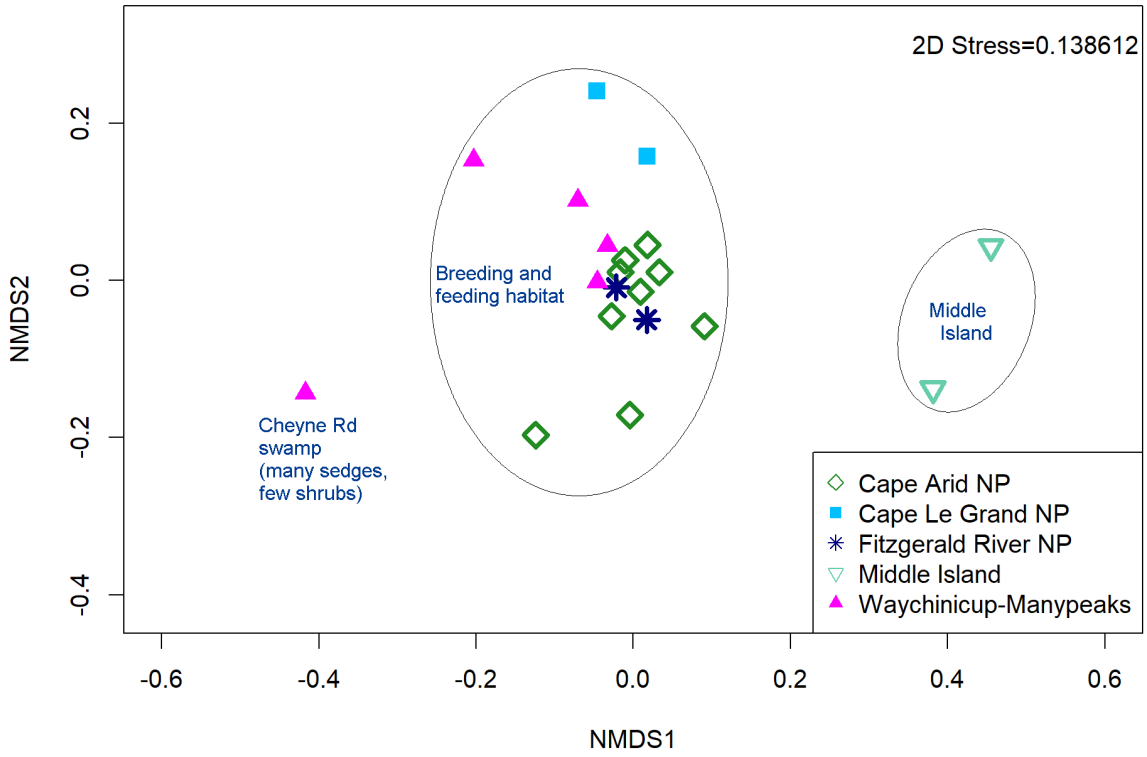

Figure 4: Results of a non-metric multi-dimensional scaling (nMDS) ordination of the plant genera detected at each of the 18 relevés from mainland sites known to be occupied currently by WGPs or previously known to have been occupied, together with two relevés of heathland on Middle Island (never known to be occupied by WGPs). The site in the upper part of the figure is WP080, which is on the edge of Cheyne Road swamp, a site believed to have been used for feeding, but probably not breeding.

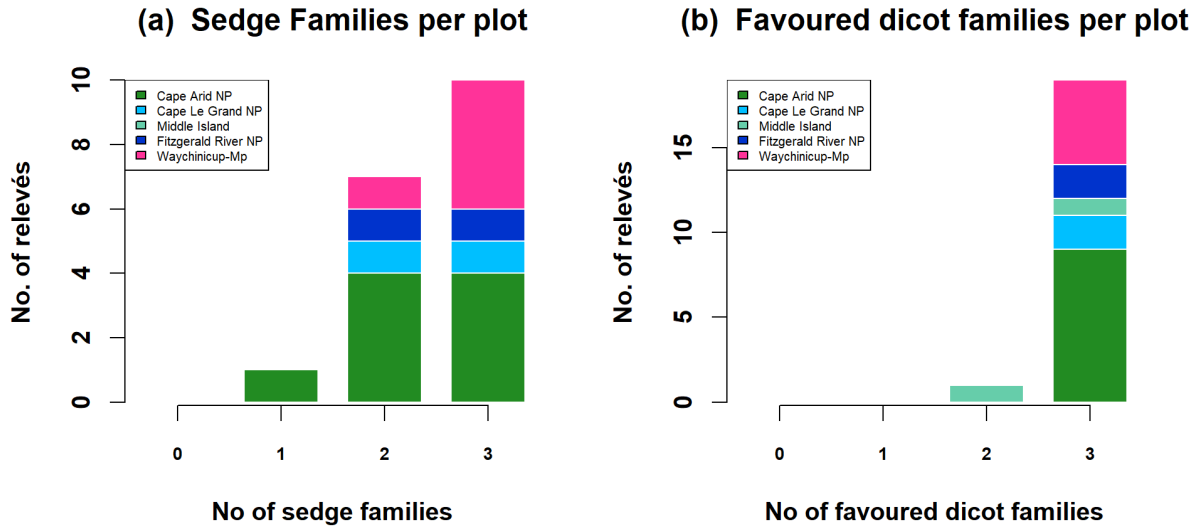

Figure 5: (a) Number of families of sedges, rushes and sedge-like plants (Anarthriaceae, Cyperaceae, Restionaceae) per plot. There were no sedges nor rushes in the Middle Island plots. (b) Number of dicot families favoured by western ground parrots (Newbey 2016: Ericaceae, Fabaceae, Proteaceae) per plot.

Table 1: Number of species from the three favoured dicot families in each of the 20 relevés. CANP = Cape Arid National Park, CLGNP = Cape Le Grand National Park, MI = Middle Island, FRNP = Fitzgerald River National Park, W-MP = Waychinicup-Manypeaks.

Location	Relevé label	Total species from favoured dicot families	Ericaceae (no. of species)	Fabaceae (no. of species)	Proteaceae (no. of species)
CANP	WP058	21	2	5	14
CANP	WP059	11	1	3	7
CANP	WP060	15	5	4	6
CANP	WP061	28	3	6	19
CANP	WP062	27	4	4	19
CANP	WP063	29	4	5	20
CANP	WP064	28	3	6	19
CANP	WP065	20	3	5	12
CANP	WP066	16	3	2	11
CLGNP	WP067	7	2	1	4
CLGNP	WP068	13	3	3	7
MI	WP073	4	1	2	1
MI	WP074	7	3	4	0
FRNP	WP076	25	5	3	17
FRNP	WP077	19	4	2	13
W-MP	WP078	9	5	2	2
W-MP	WP079	17	5	2	10
W-MP	WP080	10	4	3	3
W-MP	WP081	31	3	7	21
W-MP	WP082	21	5	3	13

Discussion

The difference between the W-MP plots and other mainland plots may be due to species turnover along the south coast (Burbidge *et al*. 1990; Mucina *et al*. 2014). In this context, species level turnover may be less relevant than turnover in genera, because different species of the same genus are likely to have similar values as food plants for WGPs. There is some evidence for tighter clustering in the ordination by genera compared with the ordination by species (Figures 3 and 4) but the differences are slight, and the overall patterns are similar.

In terms of vegetation composition, structure and patchiness, the similarity of the relevés in the Waychinicup-Manypeaks area to the occupied sites in Cape Arid National Park indicates that the area appears eminently suitable as a translocation site for the WGP. This should provide multiple opportunities for the birds to find suitable roosting and breeding sites, together with a range of opportunities for feeding.

The vegetation on Middle Island is highly unlikely to be able to support a population of WGPs. Relative to occupied and known historical sites on the mainland, the Middle

Island heathland is depauperate in terms of plant species composition, consistent with classical island biogeography theory (MacArthur and Wilson 1963), as well as data on plants and animals from Western Australian islands (Abbott and Wills 2016). In particular, sedges and rushes are completely absent from the heathland vegetation community on Middle Island. These species are an important component of WGP habitat on the mainland (Newbey 2016) and it is therefore highly unlikely that the Middle Island vegetation could provide a year-round food resource for western ground parrots. In addition, the small area of this heathland (ca. 4ha) would be likely to support only about one pair of birds at best, even if the habitat was suitable.

Conclusions

In terms of habitat availability and suitability:

- Middle Island is unsuitable for western ground parrots.
- Waychinicup-Manypeaks is recommended as a suitable site for a translocation of western ground parrots.

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