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## **MEMORANDUM: EARLY GREY LITHIUM PROJECT**

### **STATISTICAL COMPARISON OF VEGETATION WITHIN THE EARL GREY LITHIUM PROJECT WITH THE IRONCAP HILLS VEGETATION COMPLEX**

**Chris & Matthew,**

In response to one of the queries raised in respect of the ERD, we have undertaken a statistical analysis of the vegetation recorded by Mattiske Consulting Pty Ltd (Mattiske Consulting) within the Earl Grey Lithium Project (EGLP; Mattiske Consulting 2018) with the vegetation recorded by the Department of Conservation and Land Management on the Middle and South Ironcap, Digger Rock and Hatter Hill (Gibson 2004).

#### Introduction

Mattiske Consulting, in its flora and vegetation assessment of the EGLP (Mattiske Consulting 2018) reviewed the vegetation recorded by Gibson (2004) on the Middle and South Ironcap, Digger Rock and Hatter Hill areas. This survey formed part of a series of surveys of the flora and vegetation of the Eastern Goldfield Ranges. In the context of the Earl Grey Lithium Project, which is situated within the Ironcap Hills Vegetation complexes (Mt Holland, Middle, North and South Ironcap Hills, Digger Rock and Hatter Hill), a Priority 3 ecological community (Department of Biodiversity, Conservation and Attractions, DBCA, 2018a), the data recorded by Gibson (2004) is directly relevant. Mattiske Consulting (2018) formed the conclusion, that given that none of the landforms nor species communities described by Gibson (2004) were recorded within the EGLP, there was a basis for concluding that the landforms on which the EGLP is situated would not be associated with the PEC.

One of the issues raised by the Environmental Protection Authority in response to the Environmental Review Document submission was to have a statistical comparison made between the Ironcap Hills Vegetation Complexes and the Vegetation defined within the EGLP. This memorandum summarises the results of the statistical comparison between survey sites situated within the EGLP and those associated with the Ironcap Hills Vegetation Complexes.

The EGLP is situated approximately 50 km north of Middle Ironcap, 75 km north of Digger Rock and 85 km NNE of Hatter Hill.

#### Methods

Flora survey data from the vegetation quadrats established on the Middle and South Ironcap, Digger Rock and Hatter Hill areas by Gibson (2004) was obtained from the DBCA (2018b). Prior to statistical analysis, species names in the DBCA dataset were checked, and where required updated to reflect contemporary nomenclature (DBCA 2018c).

Plymouth Routines in Multivariate Ecological Research version 7 (Primer v7) statistical analysis software was used to analyse species by site data (Clarke and Gorley 2015). To down weight the relative contributions of quantitatively dominant species a presence/absence transformation of the data was applied to the dataset. The dataset consisted of both the data

obtained from the DBCA (2018b), which comprised data from 38 survey quadrats, and that recorded by Mattiske Consulting (2018), which comprised 214 survey quadrats.

## Results

The results of the Analysis of Similarity (ANOSIM) analysis broadly comparing all quadrats surveyed within the EGLP and those recorded at Digger Rock, Hatter Hill, Middle and South Ironcap is set out in Table 1. Vegetation survey quadrats established by Mattiske Consulting (2018) showed low levels of similarity with the vegetation of Digger Rock, Hatter Hill, Middle and South Ironcap. Whilst the highest level of similarity was exhibited between the EGLP and Digger Rock, with an  $R$  value of 0.294, the  $p$ -value ( $<0.002$ ) indicates that the two groups were still significantly dissimilar.

**Table 1: ANOSIM  $R$  values for comparisons between vegetation survey quadrats established within the Middle and South Ironcap, Digger Rock, Hatter Hill and EGLP areas.**

Pairwise Comparisons	$R^a$	$P^b$	$n^c$
EGLP, Digger Rock	0.294	0.2	252
EGLP, Hatter Hill	0.3	0.1	252
EGLP, Middle Ironcap	0.405	0.1	252
EGLP, South Ironcap	0.380	0.1	252

<sup>a</sup> An ANOSIM  $R$  value of 1 indicates complete dissimilarity between groups of sites; an ANOSIM  $R$  value of 0 indicates complete similarity between groups of sites.

<sup>b</sup> Significance level of sample statistic (%); 0.1% =  $<0.001$ .

<sup>c</sup> number of quadrats included in the ANOSIM analysis.

The results of the ANOSIM between the vegetation communities defined by Mattiske Consulting within the EGLP (Mattiske Consulting 2018) and the vegetation quadrats at Digger Rock, Hatter Hill, Middle and South Ironcap is set out in Table 2. Vegetation communities defined by Mattiske Consulting (2018) showed low levels of similarity with the vegetation of Digger Rock, Hatter Hill, Middle and South Ironcap.

**Table 2: ANOSIM  $R$  values for comparisons between vegetation survey quadrats established within the Middle and South Ironcap, Digger Rock, Hatter Hill and Vegetation Communities defined in the EGLP.**

Pairwise Comparisons	$R^a$	$P^b$	$n^c$
S3, Digger Rock	0.967	0.4	252
S3, Hatter Hill	0.566	0.1	252
S3, Middle Ironcap	0.906	0.1	252
S3, South Ironcap	0.542	0.1	252
W5, Digger Rock	0.972	0.5	252
W5, Hatter Hill	0.406	0.4	252
W5, Middle Ironcap	0.81	0.1	252
W5, South Ironcap	0.384	0.6	252
W6, Digger Rock	0.989	0.1	252
W6, Hatter Hill	0.605	0.1	252
W6, Middle Ironcap	0.93	0.1	252
W6, South Ironcap	0.591	0.1	252
S2, Digger Rock	0.815	0.1	252
S2, Hatter Hill	0.632	0.1	252
S2, Middle Ironcap	0.892	0.1	252
S2, South Ironcap	0.696	0.1	252
W18, Digger Rock	0.979	2.9	252
W18, Hatter Hill	0.321	1.3	252
W18, Middle Ironcap	0.795	0.3	252
W18, South Ironcap	0.471	0.1	252
W12, Digger Rock	0.785	0.1	252
W12, Hatter Hill	0.589	0.1	252

Pairwise Comparisons	$R^a$	$P^b$	$n^c$
W12, Middle Ironcap	0.71	0.1	252
W12, South Ironcap	0.611	0.1	252
W13, Digger Rock	0.956	0.1	252
W13, Hatter Hill	0.742	0.1	252
W13, Middle Ironcap	0.96	0.1	252
W13, South Ironcap	0.755	0.1	252
W11, Digger Rock	0.916	0.1	252
W11, Hatter Hill	0.86	0.1	252
W11, Middle Ironcap	0.899	0.1	252
W11, South Ironcap	0.864	0.1	252
W22, Digger Rock	0.875	0.8	252
W22, Hatter Hill	0.385	0.6	252
W22, Middle Ironcap	0.723	0.1	252
W22, South Ironcap	0.476	0.1	252
W16, Digger Rock	0.864	0.3	252
W16, Hatter Hill	0.549	0.1	252
W16, Middle Ironcap	0.845	0.1	252
W16, South Ironcap	0.54	0.1	252
W19, Digger Rock	0.975	0.8	252
W19, Hatter Hill	0.457	0.1	252
W19, Middle Ironcap	0.665	0.4	252
W19, South Ironcap	0.465	0.1	252
W8, Digger Rock	0.968	0.5	252
W8, Hatter Hill	0.412	0.1	252
W8, Middle Ironcap	0.637	0.2	252
W8, South Ironcap	0.425	0.3	252
W9, Digger Rock	0.968	0.1	252
W9, Hatter Hill	0.771	0.1	252
W9, Middle Ironcap	0.924	0.1	252
W9, South Ironcap	0.743	0.1	252
MW8, Digger Rock	0.917	20	252
MW8, Hatter Hill	0.472	7.1	252
MW8, Middle Ironcap	0.755	12.5	252
MW8, South Ironcap	0.666	6.7	252
W4, Digger Rock	0.897	0.5	252
W4, Hatter Hill	0.449	0.2	252
W4, Middle Ironcap	0.719	0.5	252
W4, South Ironcap	0.533	0.1	252
MW6, Digger Rock	0.989	0.3	252
MW6, Hatter Hill	0.568	0.1	252
MW6, Middle Ironcap	0.912	0.1	252
MW6, South Ironcap	0.618	0.1	252
W7, Digger Rock	0.941	0.1	252
W7, Hatter Hill	0.564	0.1	252
W7, Middle Ironcap	0.805	0.1	252

Pairwise Comparisons	$R^a$	$P^b$	$n^c$
W7, South Ironcap	0.633	0.1	252
W10, Digger Rock	0.969	2.9	252
W10, Hatter Hill	0.479	0.1	252
W10, Middle Ironcap	0.587	0.6	252
W10, South Ironcap	0.431	0.1	252
MW7, Digger Rock	0.917	2.9	252
MW7, Hatter Hill	0.312	2.1	252
MW7, Middle Ironcap	0.698	0.3	252
MW7, South Ironcap	0.397	0.9	252
W15, W14	0.941	0.1	252
W15, W17	0.71	11.1	252
W15, S1	0.768	0.2	252
W15, Digger Rock	0.933	0.2	252
W15, Hatter Hill	0.521	0.1	252
W15, Middle Ironcap	0.874	0.1	252
W15, South Ironcap	0.573	0.1	252
W14, Digger Rock	0.825	0.3	252
W14, Hatter Hill	0.546	0.1	252
W14, Middle Ironcap	0.658	0.1	252
W14, South Ironcap	0.499	0.1	252
W17, Digger Rock	0.667	20	252
W17, Hatter Hill	0.466	7.1	252
W17, Middle Ironcap	0.782	12.5	252
W17, South Ironcap	0.601	6.7	252
S1, Digger Rock	0.792	2.9	252
S1, Hatter Hill	0.397	0.8	252
S1, Middle Ironcap	0.683	0.6	252
S1, South Ironcap	0.392	0.7	252
H1, Digger Rock	0.929	6.7	252
H1, Hatter Hill	0.301	3.8	252
H1, Middle Ironcap	0.532	2.8	252
H1, South Ironcap	0.337	2.5	252
W20, Digger Rock	1	20	252
W20, Hatter Hill	0.534	7.1	252
W20, Middle Ironcap	0.701	12.5	252
W20, South Ironcap	0.406	6.7	252
W21, Digger Rock	0.813	0.8	252
W21, Hatter Hill	0.327	0.5	252
W21, Middle Ironcap	0.617	0.1	252
W21, South Ironcap	0.501	0.1	252

<sup>a</sup> An ANOSIM  $R$  value of 1 indicates complete dissimilarity between groups of sites; an ANOSIM  $R$  value of 0 indicates complete similarity between groups of sites.

<sup>b</sup> Significance level of sample statistic (%); 0.1% = <0.001.

<sup>c</sup> number of quadrats included in the ANOSIM analysis.

## Discussion

Vegetation recorded in the EGLP showed significant dissimilarity with vegetation recorded at Digger Rock, Hatter Hill, Middle and South Ironcap. The dissimilarity was primarily due to the different suite of species recorded between the EGLP and those associated with the current dataset for the Ironcap Hills Vegetation Complexes, as well as the differences in species assemblage. Three pairwise combinations between the vegetation communities defined by Matiske Consulting within the EGLP (Matiske Consulting 2018) and vegetation quadrats established at Digger Rock, Hatter Hill, Middle and South Ironcap, namely W18 & Hatter Hill, MW7 & Hatter Hill, and W21 & Hatter Hill, showed a measure of similarity (Table 2). However, the significance level of each is low and tends to indicate that the levels of similarity amongst these pairwise combinations is low.

The lack of similarity between the survey quadrat data for the Digger Rock, Hatter Hill, Middle and South Ironcap and that recorded at the EGLP is not unsurprising. The EGLP survey area was situated primarily on sandy to sandy clay loam soils on flats, which supported a mixed eucalypt woodland with an understorey dominated by a mixed suite of *Melaleuca* species. This was in contrast to the landforms and topography associated with the survey quadrats established on Digger Rock, Hatter Hill, Middle and South Ironcap (Gibson 2004), which consisted of either banded ironstone or massive laterites (Gibson community types 1 & 2) or from quadrats on deeper soils derived from greenstone or decomposing laterites (Gibson community types 3 & 4). The manner in which the Ironcap Hills Complex data is supplied (DBCA 2018b) precluded undertaking a comparison between the four community types delineated by Gibson (2004) with those defined by Matiske Consulting at the EGLP (Matiske Consulting 2018).

In conclusion, based on the statistical comparison of the available data, we believe that there is poor correlation between the vegetation of the Ironcap Hills Complexes and that recorded within the EGLP.

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