BOTANICAL SURVEY OF TUSSOCK GRASSLANDS

WITHIN THE CENTRAL HAMERSLEY RANGE (N95/050)

Progress Report 4

Prepared by: *Stephen van Leeuwen*

Date: *April 1999*

TITLE OF PROJECT:

Botanical Survey of Tussock Grasslands within the Central Hamersley Range

AGENCY:

Western Australian Department of Conservation and Land Management (CALM) - CALM**Science** Division.

PROJECT SUPERVISOR:

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PROJECT OFFICERS:

1. Dr Stephen van Leeuwen
   Research Scientist
2. Mr Robert Bromilow
   Technical Officer

AIM OF PROPOSAL:

To undertake a botanical survey of the tussock grassland communities found within the Central Hamersley Range. This survey will enable an assessment of the nature conservation values of such grasslands and their constituent species and facilitate the quantitative assessment of their representativeness and the adequacy of the existing reserve system.

SCOPE OF PROPOSAL:

a. Identify grassland sites within the study area through aerial photographic interpretation, satellite imagery and subsequent field inspections.

b. Sample each of the grassland sites via the use of permanent quadrats, supplementing flora collections with random sampling. Information recorded for each permanent quadrat will include landform unit, soil type, species presence and type of vegetation associations encountered.

c. Quantitatively analyse plant assemblage and vegetation association data, discussing patterns of community structure, species richness, species turnover and distribution. Prepare descriptions of the vegetation associations present and map their distribution. Undertake supplementary sampling.

d. Publish survey results and subsequent data analysis. Discuss implications of results with reference to conservation values and regional representativeness of the Karijini National Park and biological importance of the Central Hamersley Range tussock grasslands. Make recommendations for management and reservation where appropriate.

WORK COMPLETED

Work completed on this project since the submission of the last progress report has been negligible. The failure to progress this project in the past six months can be attributed to unfavourable conditions to undertake field work and the absence of the Project Supervisor and other Project Officers from work due to annual recreational leave commitments.

Minor progress has been made with respect to some aspects of this project, in particular:

a) The compilation of available floristic data on tussock grasslands within the project area;
b) The identification and processing of plant specimens collected during previous field activities; and
c) The chemical and physical analysis of soils samples collected during previous field activities.

a) Compilation of available floristic data.

General floristic data for five of the tussock grasslands in the project area was collated from information provided by Trudgen and Casson (1998)[a] in their botanical survey report for the Environmental Review and Management Plan of the West Angelas project. The five tussock grasslands were located on the Juna Downs, Coondewanna, Boundary Ridge, Governor Ridge and West Angelas Cracking Clay Flats (Figure 1). Trudgen and Casson (1998) enumerated 243 species from these five tussock grasslands. The majority of these species were members of the Poaceae and Asteraceae (Appendix 1). In addition to the 243 identified species another 90 taxa of uncertain taxonomic status were also recorded (Trudgen and Casson 1998).

The West Angelas Cracking Clay and Boundary Ridge flats were the most floristically rich localities sampled by Trudgen and Casson (1998) with 53% and 42% of the 243 recorded species present at each locality, respectively. This result may be an artefact of sampling effort, however, as there was a significant association ($r_5 = 0.91$, $P < 0.05$) between sampling effort, as measured by the number of survey sites, and species richness.

Multivariant interrogation of the floristic data from the five tussock grasslands distinguished three clusters although, the cophenetic correlation result ($r = 0.65$) implied that the goodness of fit for the clustering pattern was poor (Figure 2). The clustering dendrogram depicted the West Angelas Cracking Clay Flat as the most floristically distinct of the five tussock grassland localities while considerable similarity was implied in the floristic composition of the Boundary Ridge and Governor Ridge tussock grassland flats.

[a] Trudgen, M.E.T. and Casson, N. (1998). Flora and vegetation surveys of Orebody A and Orebody B in the West Angelas Hill area, an area surrounding them, and of rail route options considered to link them to the existing Robe River Iron Associates rail line. Prepared for Robe River Iron Associates. March 1998, volumes 1-10.

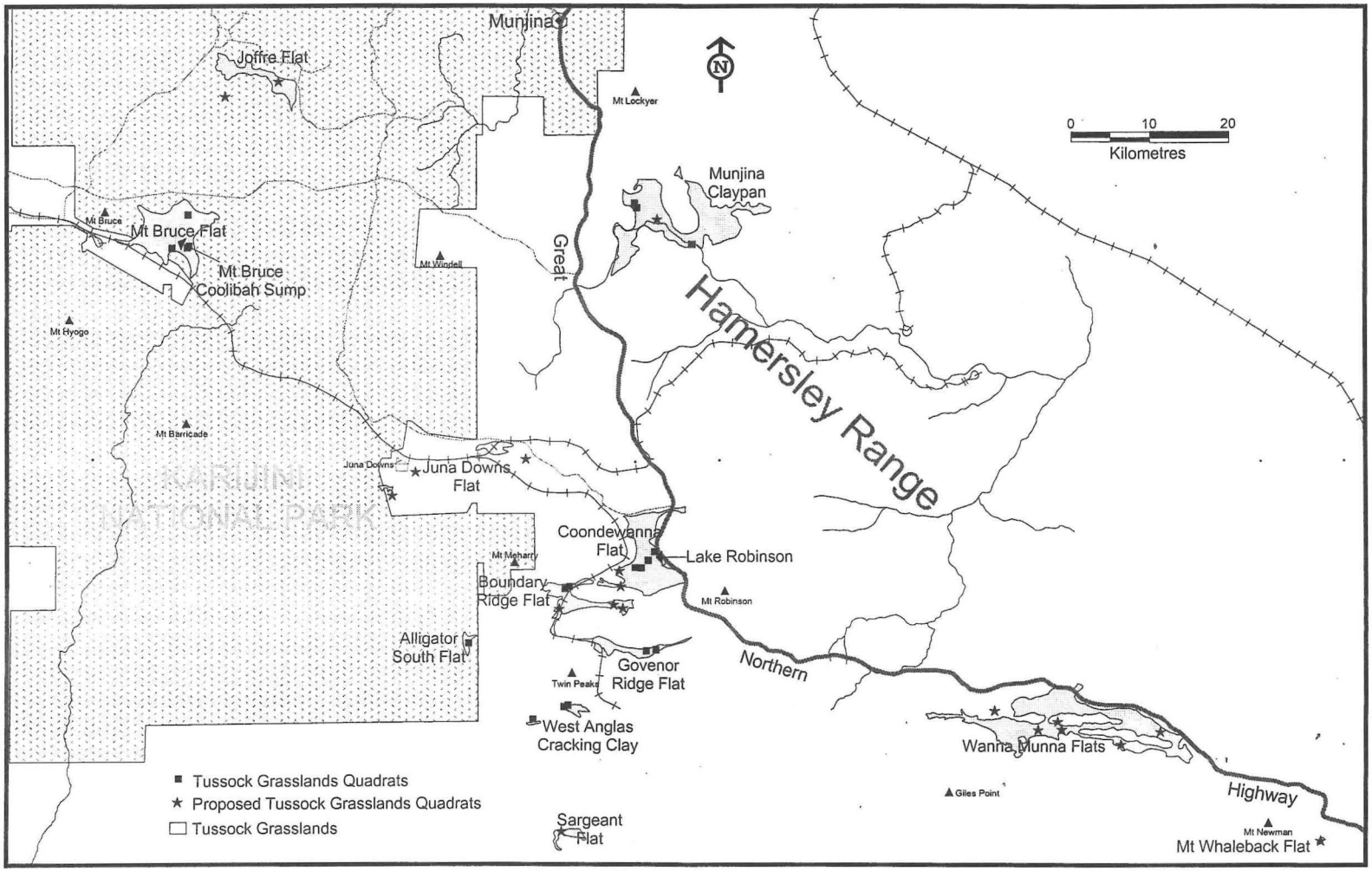

Figure 1 Distribution of Central Hamersley Range tussock grassland communities and location of permanent sampling quadrats.

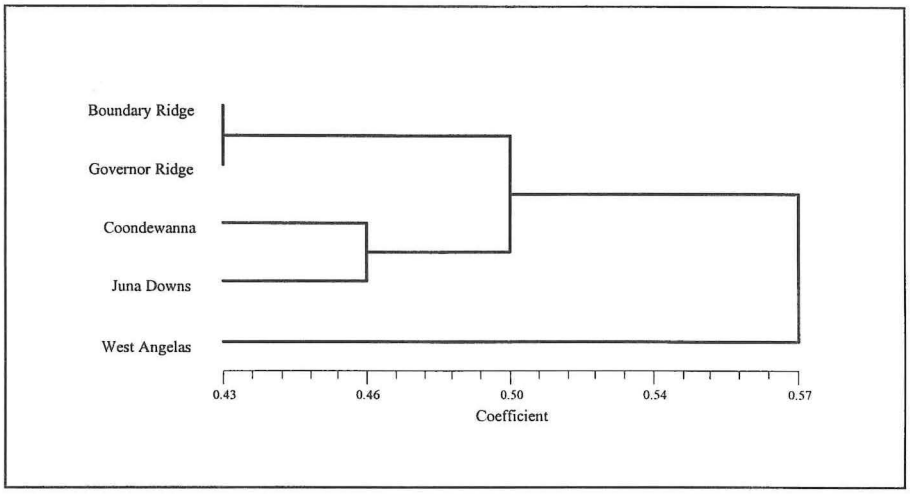

Figure 2 Clustering dendrogram of similarities in plant species compositions between five tussock grassland sites sampled by Trudgen and Casson (1998). The clustering undertaken used the Czekanowski similarity coefficient and the UPGMA fusion method ($\beta = 0.0$).

b) Identification and processing of collected plantsspecimens.

Herbarium and curatorial work has continued on the identification, processing and databasing of the 320 specimens collected during this project to date. Vouchers for many of the specimens have been duplicated to specialist taxonomists in herbaria outside Western Australia for confirmation of identification or re-determination. Many of the specimens appear to represent taxonomically difficult and poorly known genera requiring further scientific investigation. This is particularly true for specimens representing taxa in the Malvaceae, especially *Sida* and *Abutilon*, Poaceae, Myoporaceae, Goodeniaceae, especially *Goodenia* and Asteraceae.

c) Chemical and physical analysis of soil samples.

The chemical and physical analysis of soil samples collected from the 13 survey sites sample in 1998 is complete. This edaphic characterisation has now been undertaken on 19 tussock grassland sites throughout the project area. Details on the edaphic properties of the 13 most recently sampled tussock grassland sites are provided in Appendix 2.

Exploratory investigations of this edaphic data indicated a strong, significant dichotomy (cophenetic correlation, $r = 0.88$) between sites based on the expression of cracking clay soils. Indeed the primary division seen in Figure 3 separates sites with cracking clay soils from those with typically alluvial soil on hardpan flats or depositional drainage sumps. Influences over lower order divisions are not conspicuous although geological and landsystem considerations may be important. For example, within the cracking clay soils branch of the dendrogram (Figure 3) those sites on the

Jerrinah Formation (Fortescue Geological Group) are analogously clustered.

The primary division detected in Figure 3 between sample sites based on the expression of cracking clay soils is supported by results from soil physical analyses. These results indicate that the clay content of samples from sites on the cracking clay soils branch of the dendrogram was significantly higher than for sites on the non-cracking clay branch (t_{17} = 43.19, $P < 0.001$).

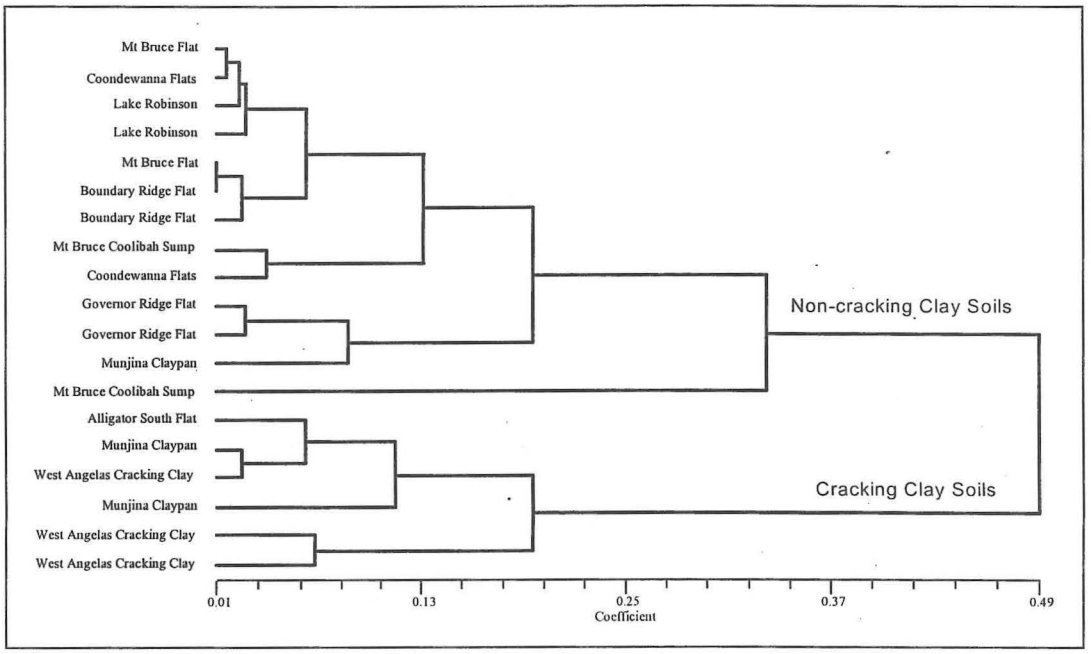

Figure 3 Dendrogram of similarities in soil chemical properties between 19 tussock grassland sites. The clustering undertaken used the Bray-Curtis association measure and the UPGMA fusion method (β = 0.0).

The 1999 field program for this project will commence in June with the re-sampling of several established sampling sites in the West Angelas - Coondewanna Flats area. Field sampling will be ongoing over subsequent months until October. Research will continue in the laboratory and Pilbara Regional Herbarium on the identification and databasing of plants specimens and the development of the GIS atlas. Exploratory multivariant pattern analyses will also be ongoing during this time to provide a better appreciation and understanding of the floristic composition, community structure and partitioning of different tussock grasslands across the project area.

The next progress report for this project will be submitted at the end of August 1999.

EXPENDITURE TO DATE

An expenditure statement from the Administration Assistant in the Pilbara Regional Office is attached as Appendix 3. As of the 31st March a total of $13 670 or 40% of the $34 100 NEGP budget for this project had been consumed.

Expenditure since the commencement of the project has been principally related to the expenditure associated with plant (vehicle and helicopter) hire. This item has accounted for 52% of current expenditure. The other major item of current expenditure is associated with the purchase and acquisition of materials, in particular topographical maps, remotely sensed data and digital GIS themes. Approximately 41% of expenditure has been incurred against these material costs. Only 7% of current expenditure has been incurred through field and travel allowances.

Since the last progress report the expenditure of $8 885 has been on plant (vehicle and helicopter) hire (75%) materials (19%), in particular remotely sensed digital data, and staff field and travel allowances (6%). No major accounts are currently outstanding.

During the coming months it is anticipated that expenditure will be associated primarily with the identification and incorporation of specimens into herbaria and the ongoing development of specimen and GIS databases.

A cost overrun in the budget for this project is not anticipated.

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APPENDIX ONE

List of plant species recorded on five tussock grassland sites in the project area by Trudgen & Casson (1998).

Taxon	Tussock Grassland Flat				
	Boundary Ridge	Coondewanna	Governor Ridge	Juna Downs	West Angelas Cracking Clay
Adiantaceae					
Cheilanthes sieberi	✓		✓		
Marsileaceae					
Marsilea hirsuta		✓			✓
Poaceae					
Amphipogon caricinus	✓				
Aristida contorta	✓	✓	✓	✓	✓
Aristida holathera		✓			
Aristida inaequiglumis			✓		
Aristida latifolia		✓			✓
Aristida obscura	✓		✓		
Astrebla elymoides					✓
Astrebla pectinata					✓
Bothriochloa bladhii					✓
Bothriochloa ewartiana			✓		
Brachyachne convergens				✓	✓
Chloris pectinata		✓		✓	
Chloris virgata	✓	✓		✓	✓
Chrysopogon fallax	✓	✓	✓	✓	✓
Dactyloctenium radulans	✓	✓			✓
Dichanthium sericeum	✓	✓	✓	✓	✓
Digitaria brownii	✓		✓		
Digitaria ctenantha	✓		✓	✓	
Enneapogon caerulescens	✓		✓	✓	✓
Enneapogon intermedius			✓		
Enneapogon polyphyllus	✓	✓	✓	✓	✓
Eragrostis cumingii	✓	✓		✓	✓
Eragrostis dielsii		✓			
Eragrostis eriopoda	✓			✓	
Eragrostis leptocarpa		✓			✓
Eragrostis pergracilis	✓	✓	✓	✓	
Eragrostis setifolia		✓			✓
Eragrostis tenellula		✓		✓	✓
Eragrostis xerophila					✓
Eriachne benthamii	✓			✓	✓
Eriachne flaccida	✓	✓		✓	
Eriachne mucronata					✓
Eriachne pulchella	✓	✓	✓	✓	✓
Eulalia aurea	✓	✓			
Ischaemum albovillosum					✓
Iseilema dolichotrichum				✓	✓
Iseilema eremaeum			✓		
Iseilema membranaceum	✓			✓	✓
Iseilema vaginiflorum		✓		✓	✓
Panicum decompositum		✓			✓
Panicum effusum	✓	✓			
Panicum laevinode				✓	✓
Paraneurachne muelleri	✓		✓		
Paspalidium clementii	✓	✓	✓	✓	
Paspalidium rarum	✓	✓		✓	
Perotis rara	✓			✓	
Plectrachne melvillei	✓	✓	✓	✓	
Setaria dielsii					✓
Sporobolus australasicus		✓		✓	✓
Themeda triandra	✓	✓	✓	✓	
Tragus australianus		✓			
Triodia longiceps				✓	
Triodia pungens	✓	✓			✓
Triodia wiseana			✓		
Triraphis mollis			✓	✓	✓
Urochloa pubigera	✓			✓	✓
Cyperaceae					
Bulbostylis barbata					✓

Taxon	Tussock Grassland Flat				
	Boundary Ridge	Coondewanna	Governor Ridge	Juna Downs	West Angelas Cracking Clay
Cyperus difformis					✓
Cyperus iria		✓			✓
Fimbristylis dichotoma	✓		✓		✓
Proteaceae					
Grevillea berryana	✓	✓	✓	✓	
Hakea suberea	✓	✓	✓	✓	
Santalaceae					
Anthobolus leptomerioides		✓			
Santalum spicatum		✓			
Loranthaceae					
Amyema fitzgeraldii		✓			
Amyema gibberula			✓		
Lysiana casuarinae		✓			
Polygonaceae					
Muehlenbeckia florulenta		✓			
Chenopodiaceae					
Chenopodium auricomum					✓
Chenopodium melanocarpum	✓	✓			
Dysphania glomulifera	✓				
Dysphania kalpari	✓	✓	✓	✓	
Dysphania rhadinostachya		✓		✓	
Enchylaena tomentosa		✓			✓
Maireana planifolia	✓	✓	✓	✓	✓
Maireana villosa	✓	✓	✓	✓	✓
Rhagodia eremaea		✓		✓	✓
Salsola kali	✓	✓	✓		✓
Sclerolaena convexula			✓		
Sclerolaena cornishiana	✓	✓	✓	✓	✓
Sclerolaena tetragona	✓	✓	✓	✓	
Amaranthaceae					
Alternanthera nana	✓	✓			
Alternanthera nodiflora		✓		✓	
Amaranthus interruptus				✓	
Amaranthus mitchellii	✓				
Ptilotus aervoides	✓	✓		✓	✓
Ptilotus carinatus				✓	✓
Ptilotus exaltatus	✓	✓	✓		✓
Ptilotus gaudichaudii	✓	✓	✓	✓	✓
Ptilotus gomphrenoides				✓	✓
Ptilotus helipteroides	✓	✓	✓		✓
Ptilotus macrocephalus		✓			✓
Ptilotus obovatus	✓	✓	✓	✓	✓
Ptilotus polystachyus		✓	✓		✓
Ptilotus roei			✓		
Nyctaginaceae					
Boerhavia coccinea			✓		
Boerhavia paludosa					✓
Boerhavia repleta	✓				
Aizoaceae					
Trianthema kimberleyi	✓				
Portulacaceae					
Calandrinia ptychosperma	✓	✓			
Portulaca oleracea	✓				✓
Caryophyllaceae					
Polycarpaea corymbosa			✓		
Capparaceae					
Capparis lasiantha		✓			
Cleome viscosa	✓	✓		✓	✓
Brassicaceae					
Lepidium echinatum		✓	✓		
Lepidium phlebopetalum			✓		✓
Menkea villosula	✓				
Stenopetalum anfractum			✓		
Stenopetalum nutans	✓	✓	✓		
Mimosaceae					
Acacia ancistrocarpa					✓
Acacia aneura	✓	✓	✓	✓	✓
Acacia ayersiana	✓				
Acacia bivenosa				✓	

Taxon	Tussock Grassland Flat				
	Boundary Ridge	Coondewanna	Governor Ridge	Juna Downs	West Angelas Cracking Clay
Acacia farnesiana				✓	
Acacia kempeana	✓				
Acacia pachyacra	✓				
Acacia paraneura			✓		
Acacia pruinocarpa	✓	✓	✓	✓	
Acacia synchronicia					✓
Acacia tetragonophylla		✓	✓		✓
Acacia victoriae					✓
Neptunia dimorphantha					✓
Caesalpiniaceae					
Cassia artemisioides	✓		✓		✓
Cassia chatelainiana					✓
Cassia ferraria		✓			✓
Cassia glutinosa					✓
Cassia hamersleyensis				✓	✓
Cassia helmsii					✓
Cassia luerssenii					✓
Cassia notabilis	✓	✓		✓	
Cassia oligophylla			✓		✓
Papilionaceae					
Cullen cinereum		✓			
Cullen graveolens				✓	✓
Desmodium muelleri					✓
Glycine canescens			✓		
Indigofera linifolia				✓	✓
Indigofera monophylla			✓		✓
Indigofera trita					✓
Lotus cruentus					✓
Swainsona canescens	✓	✓	✓		
Swainsona kingii		✓		✓	✓
Swainsona maccullochiana			✓		✓
Swainsona oroboides		✓			
Tephrosia clementii					✓
Tephrosia supina					✓
Vigna lanceolata		✓		✓	✓
Geraniaceae					
Erodium cygnorum					✓
Polygalaceae					
Polygala isingii	✓				
Euphorbiaceae					
Euphorbia australis				✓	✓
Euphorbia boophthona		✓			
Euphorbia coghlanii	✓	✓	✓	✓	✓
Euphorbia myrtoides	✓				
Euphorbia tannensis		✓			
Phyllanthus lacunellus	✓				
Phyllanthus maderaspatensis					✓
Tiliaceae					
Corchorus lasiocarpus		✓			
Corchorus tridens					✓
Malvaceae					
Abutilon cryptopetalum			✓		
Abutilon fraseri	✓	✓	✓		
Abutilon lepidum			✓		
Abutilon malvifolium					✓
Abutilon otocarpum	✓	✓	✓	✓	
Abutilon oxycarpum				✓	
Hibiscus brachysiphonius					✓
Hibiscus burtonii	✓		✓	✓	
Hibiscus sturtii			✓		
Hibiscus trionum				✓	✓
Malvastrum americanum		✓		✓	✓
Sida atrovirens	✓	✓			
Sida calyxhymenia	✓		✓		
Sida fibulifera	✓	✓	✓	✓	✓
Sida laevis					✓
Sida spinosa				✓	✓
Elatinaceae					
Bergia pedicellaris					✓
Thymelaeaceae					
Pimelea holroydii				✓	✓

Taxon	Tussock Grassland Flat				
	Boundary Ridge	Coondewanna	Governor Ridge	Juna Downs	West Angelas Cracking Clay
Myrtaceae					
Corymbia aspera			✓		
Eucalyptus gamophylla		✓			
Eucalyptus trivalvis		✓			
Eucalyptus victrix		✓			
Eucalyptus xerothermica	✓	✓	✓	✓	✓
Haloragaceae					
Haloragis gossei	✓	✓		✓	✓
Apiaceae					
Daucus glochidiatus					✓
Trachymene oleracea		✓			
Asclepiadaceae					
Rhyncharrhena linearis	✓				
Convolvulaceae					
Convolvulus erubescens	✓	✓	✓	✓	✓
Evolvulus alsinoides	✓	✓	✓	✓	✓
Ipomoea lonchophylla					✓
Operculina aequisepala				✓	✓
Porana commixta		✓	✓		✓
Boraginaceae					
Heliotropium conocarpum				✓	✓
Heliotropium heteranthum				✓	
Trichodesma zeylanicum		✓	✓		
Chloanthaceae					
Spartothamnella teucriiflora	✓				
Lamiaceae					
Prostanthera striatiflora		✓			
Solanaceae					
Nicotiana rosulata	✓	✓	✓	✓	
Nicotiana simulans				✓	
Solanum ferocissimum	✓				
Solanum horridum		✓		✓	
Solanum lasiophyllum	✓	✓	✓	✓	✓
Scrophulariaceae					
Mimulus gracilis		✓			✓
Striga squamigera					✓
Acanthaceae					
Dipteracanthus australasicus					✓
Myoporaceae					
Eremophila forrestii	✓	✓	✓	✓	✓
Eremophila lachnocalyx					✓
Eremophila lanceolata	✓		✓		
Eremophila latrobei	✓	✓			
Rubiaceae					
Canthium latifolium			✓		
Canthium suaveolens	✓			✓	
Spermacoce brachystema				✓	
Cucurbitaceae					
Cucumis melo					✓
Campanulaceae					
Wahlenbergia tumidifructa	✓	✓	✓	✓	
Lobeliaceae					
Lobelia heterophylla			✓		
Goodeniaceae					
Brunonia australis	✓	✓	✓		
Goodenia microptera		✓			✓
Goodenia muelleriana			✓	✓	✓
Goodenia prostrata	✓		✓		✓
Goodenia stellata	✓				
Goodenia triodiophila	✓				
Asteraceae					
Bidens bipinnata	✓	✓	✓	✓	✓
Blumea tenella		✓			✓
Brachyscome iberidifolia	✓	✓	✓	✓	✓
Bracteantha bracteata	✓				

Taxon	Tussock Grassland Flat				
	Boundary Ridge	Coondewanna	Governor Ridge	Juna Downs	West Angelas Cracking Clay
Calotis hispidula	✓				
Calotis plumulifera	✓	✓			
Centipeda minima		✓		✓	✓
Centipeda thespidioides		✓		✓	✓
Gnephosis arachnoidea	✓	✓	✓		
Helichrysum gilesii			✓		✓
Pterocaulon serrulatum	✓				
Pterocaulon sphacelatum	✓	✓	✓	✓	✓
Rhodanthe charsleyae	✓	✓			✓
Rhodanthe floribunda	✓	✓			✓
Rhodanthe propinqua	✓		✓		
Rutidosis helichrysoides		✓			
Streptoglossa adscendens				✓	✓
Streptoglossa bubakii					✓
Streptoglossa cylindriceps					✓
Streptoglossa decurrens	✓				
Streptoglossa tenuiflora					✓
Vittadinia arida	✓			✓	
Vittadinia pustulata				✓	✓

APPENDIX TWO

Chemical and physical attributes of the soils from 13 survey sites established on tussock grasslands within the Central Hamersley Range project area during 1998.

Tussock Grassland Quadrat	EC (1:5) mS/m	pH (H_2O)	pH ($CaCl_2$)	OrgC (W/B) %	N (total) %	P (total) mg/kg	P (HCO_3) mg/kg	Ca (exch) me%	Mg (exch) me%	Na (exch) me%	K (exch) me%	Al (exch) me%	Mn (exch) me%	Sand %	Silt %	Clay %
07	5	7.6	6.7	0.39	0.045	240	7	13.95	11.86	0.48	0.07	-99	-99	41	22	37
08	3	7.6	6.4	0.71	0.085	737	26	9.71	2.5	2.04	0.02	-99	-99	29.5	25	45.5
09	1	6.3	5	0.88	0.087	1079	60	8.05	1.79	1.47	0.02	-99	-99	54	21	25
10	2	7	5.9	0.49	0.06	297	9	11.49	9.65	1.68	0.03	-99	-99	21.5	32	46.5
11	2	7.2	6.1	0.34	0.046	233	5	13.27	8.1	1.15	0.04	-99	-99	21.5	27.5	51
12	5	7	6.2	1.39	0.129	396	25	12.13	3.2	1.49	0.02	-99	-99	39	41	20
13	2	8	6.8	0.54	0.058	165	8	24.09	9.59	1.28	0.08	-99	-99	24.5	25.5	50
14	4	8.6	7.5	0.38	0.047	158	4	24.25	3.37	1.42	0.08	-99	-99	34	28	38
15	2	7.7	6.5	0.31	0.045	233	4	12	7.22	1.71	0.1	-99	-99	30	23	47
16	4	6.1	5	0.5	0.073	527	15	7.03	4.02	0.96	0.08	0.02	0.1	40	38	22
17	5	5.8	4.9	0.62	0.093	716	31	7.58	3.76	0.91	0.04	0.03	0.16	23	44.5	32.5
18	2	6.2	5.1	0.47	0.071	557	20	6.48	3.94	1.06	0.04	0.02	0.08	41	39	20
19	3	6.2	5.2	0.35	0.058	538	13	5.37	2.86	1.07	0.06	0.02	0.07	45.5	33	21.5

APPENDIX THREE

HERITAGE COUNCIL OF WESTERN AUSTRALIA
NATIONAL ESTATE GRANT PROGRAM
(N95/050)

Project: **BOTANICAL SURVEY OF TUSSOCK GRASSLANDS WITHIN THE CENTRAL HAMERSLEY RANGE.**

EXPENDITURE STATEMENT

	$
Balance brought forward	4 785.00
1998-99 (30/09//98 - 31/03/99)	
Materials & Equipment	1 688.00
Plant Hire (vehicle & helicopter)	6 664.00
Staff Allowances	533.00
TOTAL EXPENDITURE (31/03/99)	**$ 8 885.00**
TOTAL EXPENDITURE ON PROJECT	$13 670.00

M. Sermon
Admin. Assistant
30/04/99