# BOTANICAL SURVEY OF TUSSOCK GRASSLANDS

# WITHIN THE CENTRAL HAMERSLEY RANGE (N95/050)

Progress Report 3

*Prepared by:* *Stephen van Leeuwen*

*Date:* *September 1998*

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:

Dr Stephen van Leeuwen
Research Scientist
CALM Karratha
P.O. Box 835
KARRATHA WA 6714

(08) 9143 1628
(08) 9144 1114
stephenv@calm.wa.gov.au

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 on 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 mainly directed towards the sampling of identified tussock grassland communities. Some research has also been directed towards the identification of tussock grassland communities through the use of aerial photographs, remotely sensed data and geological information. A small proportion of time has also been allocated to the identification of specimens collected and collation of edaphic attributes for the sampled tussock grassland sites.

Since submission of the last progress report a number of field trips have been undertaken as part of this research program. Unfortunately, unseasonal rainfall during the middle of the year severely restricted access to tussock grassland sites during one trip and caused the early cancellation of another two. Notwithstanding the vagaries of the weather, a total of 48 person days have been spent in the field since the submission of the last progress report. During this period field effort was directed at locating additional tussock grassland communities, re-sampling established sample sites, establishing and sampling new permanent sampling sites and undertaking short periods of random opportunistic flora specimen collection. The locating of additional tussock grassland communities was achieved with the aid of a helicopter and extensive vehicle traverses across the project area.

Research and outcomes for each of this project's scope items completed over the past 12 months are addressed below.

### Scope Item A

Attempts to delineate the tussock grassland communities within the Central Hamersley Range has continued through the interpretation of aerial photographs and remotely sensed imagery. This process has had limited success as verified by on-the-ground inspections of selected target areas. Generally, areas identified from aerial photographs as tussock grasslands were demonstrated to be scalds and hardpans dominated by bunch grasses and other ephemeral species. This incorrect identification was attributed to the poor quality of the black and white aerial photographic coverage used and the interpreters ability to distinguish between tussock grasslands and ephemeral bunch grass communities. A similar problem was encountered with the remotely sensed data and the ability with which the interpreter could reliably distinguish between tussock grasslands and other community types.

An attempt was made to resolve this problem through interrogation of the remotely sensed data in a GIS format. The remotely sensed data was linked, after being validated and spatially corrected, to a data set of geological themes covering the Central Hamersley Range. These themes were then subjected to a signature/pattern recognition analysis using a reference signature/pattern obtained from a known tussock grassland community. This interrogation was useful with a number of previously unknown communities being identified. However, the reliability of the delineation process was restrained as several known tussock grasslands were not identified. Upon reflection it was apparent that geological considerations and inherent edaphic differences between tussock grasslands precluded the identification of a cosmopolitan signature/pattern which was common to all sites.

Similarly, differences in species composition and productivity, combined with climatic incongruences across the study area, precluded the identification of tussock grasslands based on a signature/pattern recognition analysis that was based on a floristic signature. The characteristics of the floristic signature were obtained from known tussock grassland sites and the analysis employed remotely sensed data in the form of the Normalised Difference Vegetation Index (NDVI). Resolution problems associated with pixel size and scale, in terms of the aerial extent of a tussock grassland patch, also limited the usefulness of NDVI remotely sensed data in this delineation process.

A final attempt to identify all the tussock grassland communities within the Central Hamersley Range study area was made through the ground truthing and aerial inspection, via helicopter, of all potential tussock grassland sites identified in the above mentioned delineation processes. These field inspections resulted in the identification of 14 areas containing tussock grassland communities (Figure 1).

**Scope Item B**

A total of 19 permanently marked sampling sites have been established in eight of the identified tussock grassland areas (Figure 1). All quadrats have been sampled on at least one occasion. Several quadrats have been sampled on at least three occasions since the commencement of this project. Opportunistic random sampling outside permanent quadrats, but within the tussock grassland community, has also continued throughout the study area.

The identification and databasing of specimens has progressed since the last progress report, however, a considerable backlog of specimens still exists as a result of ongoing sampling trips. To date in excess of 320 specimens representing approximately 210 taxa from 39 families and at least 73 genera have been collected during this project. Dominant taxonomic groups, in order of taxon number, are the Poaceae, Asteraceae, Papilionaceae, Brassicaceae, Convolvulaceae and Malvaceae.

Vegetation descriptions, based on the Muir[1] classification, with slight refinements to allow for the low cover estimates obtained for many stratum in the arid zone, have been detailed for each of the 19 permanent sampled sites. Similarly, photographic records of each sampled site, taken from standardised fixed points have been obtained.

Soil samples have been collected from all sampled sites. As detailed in the previous progress report six of these soil samples have been analysed to define the chemical and physical attributes of the sampled sites. The remaining samples will be analysed over the next few months.

[1] Muir, B.G. (1977). Biological Survey of the Western Australian Wheatbelt, Part 2: Vegetation and Habitat of Bendering Reserve. *Records of the Western Australian Museum, Supplement No. 3.* pp 3-142.

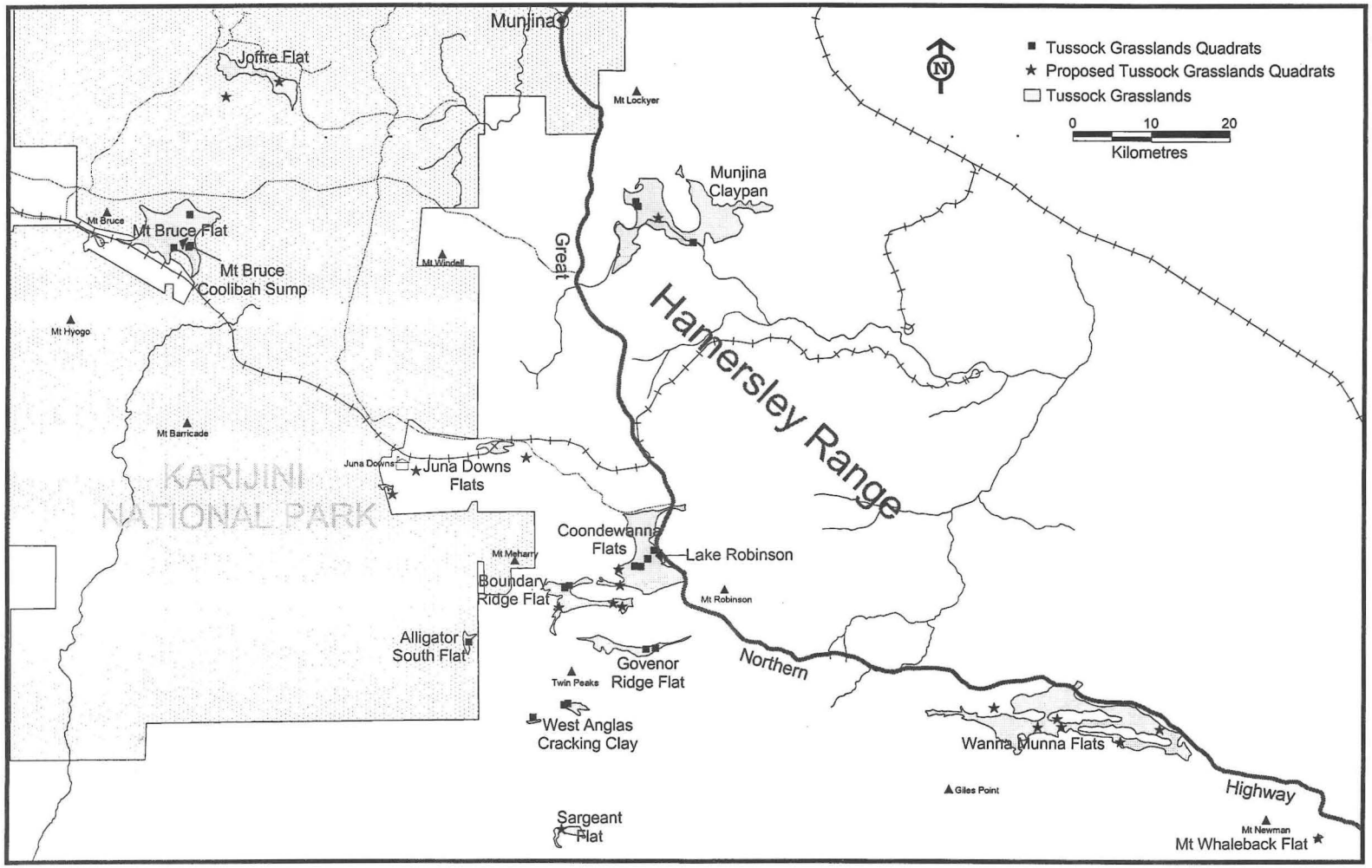


**Figure 1** **Distribution of Central Hamersley Range tussock grassland communities and location of permanent sampling quadrats**

**Scope Item C**

No qualitative analysis of plant specimen or vegetation association data has been undertaken. Databases and GIS themes to facilitate such analyses are currently being developed. Ongoing systematic and opportunistic sampling of the quadrats over the next twelve months will assist with the development of these data sets, as will the installation of additional sampling sites. Similarly, the ongoing identification and curation of specimens collected during this project will augment the validity of data stored in the databases and facilitate a comprehensive quantitative analysis of the data.

Several interesting flora specimens have been recorded from the sampled tussock grassland communities over the past 12 months. These records include:

*Boerhavia* sp. Cracking Clay (SVL 3401)

An upright, tuberous perennial taxon which is only known from two localities in the Hamersley Range, one near West Angelas and the other near Mt Brockman, north of Tom Price. This taxon has also been collected on three other occasions from tussock grasslands in the Chichester Range.

*Bulbine 'pendula'*

This is a Priority Three species on CALM's Declared Rare and Priority Flora list. It is known from a few localities on Hamersley Station, west of the Karijini National Park. During the recent field program this taxon was collected from the Alligator South, Munjina Claypan and West Angelas Cracking Clay tussock grassland communities.

*Euphorbia* sp. Harding (M.E. Trudgen 15683)

This novel taxon, which is endemic to the Pilbara, has been collected from five locations. During this project it was collected from the Alligator South tussock grassland community. Other localities for this species are in the Chichester Range where the taxon also grows in a tussock grassland community.

*Josephinia* sp. Marandoo (M.E. Trudgen 1554)

This taxon was collected from the Governor Ridge tussock grassland community. This taxon is a Priority One species. This species is known from two other locations to the east of the Karijini National park in the vicinity of Marandoo.

*Myriocephalum* sp. Coondewanna Flats (S. van Leeuwen 975)

This taxon was recorded within the Coondewanna and Mt Bruce Flats tussock grassland communities. Prior to the commencement of this survey this taxon was only known from the Coondewanna Flats and West Angelas areas.

*Senna* sp. Karijini (M.E. Trudgen 10392)

This taxon was collected from the West Angelas Cracking Clay tussock grassland. The taxon has also been collected from the Hamersley Station Flats west of the Karijini National Park.

Further collecting and ongoing taxonomic research will undoubtedly result in the identification of additional specimens of conservation and biological significance. Such research will also provide a clearer understanding of the status of taxa already collected.

Subjectively several different tussock grassland community types have been identified within the study area based on vegetation descriptions and floristics data collected from the established sampled sites. The different types are:

- *Eulalia aurea* tussock grassland under a canopy of *Eucalyptus victrix* forming a low forest over low scrub of *Muehlenbeckia* aff. *florulenta*. This community is found in sumps on the Mt Bruce flats and has a substrate comprising loamy alluvial material with calcareous pediments.
- *Astrebla pectinata, Astrebla elymoides* and *Aristida latifolia* open tussock grassland with scattered emergent *Acacia aneura*, *Acacia tetragonophylla.* This community comprises many annual and ephemeral taxa (*Ptilotus carinatus*, *Swainsona kingii*) in conjunction with several perennials (*Themeda triandra, Sida fibulifera*). This community is found on gilgai soils with a mantle of pebbles in the West Angelas and Alligator South areas.
- *Eriachne* aff. *benthamii, Chryspogon fallax* and *Aristida holathera* open tussock grassland under low woodland of *Acacia aneura* emergent from dwarf scrub of *Eremophila 'lanceolata'* and *Maireana planifolia* over herbs. This community is generally found on alluvial pediments and outwash fans. The soils are a gritty loam with a pebble fraction. The community has been identified in the Governor Ridge, Boundary Ridge, Coondewanna Flats and Mt Bruce Flats areas.
- *Eriachne benthamii* dense tussock grassland with scattered herbs under a woodland of *Acacia aneura* with scattered *Eucalyptus victrix*. This community appears to be restricted to the Coondewanna Flats on the apron to Lake Robinson. The community occurs on flat terrain with substrates which are comprised of gritty loam with fine buckshot pebbles. The underlying hardpan appears to be close to the surface being exposed in numerous situations.
- *Eriachne benthamii* tussock grassland with herbs (*Swainsona* sp., *Myriocephalum* sp., *Stenopetalum anfractum*) under *Muehlenbeckia* aff. *florulenta* open low scrub within an open woodland of *Eucalyptus victrix.* This community was confined to Lake Robinson where the substrate is a gritty cracking red clay material.
- *Astrebla pectinata, Eriachne benthamii* dense tussock grassland over herbs (*Dicanthium sericeum, Goodenia* sp., *Lotus cruentus*). This community type was located on the Munjina Claypan in the 'Brockman' landsystem type. The substrate comprised a gilgai material with a stony mantle of pebbles. In situations where grazing pressure was high the appearance of the community was considerably more open.
- *Eragrostis* sp. (S. van Leeuwen 3917) low tussock grassland under an open low woodland of *Eucalyptus 'xerothermica', Acacia aneura* and *Hakea chordophylla*. This community grows on a substrate of fine alluvial material over a calcareous hardpan and was only located on the eastern end of the Munjina Claypan.

The distribution of the identified tussock grassland areas within the Central Hamersley Range has been determined and mapped, as depicted in Figure 1. Delineation of separate community types within these areas has however, not occurred and will not be attempted until quantitative analyses of the floristic dataset has been completed and distinct community types have been identified.

Sampling of the unsampled tussock grassland areas will occur in 1999 together with a re-sampling of many of those permanent quadrats already established.

**Scope Item D**

No progress has been made with the publication of survey results or subsequent data analyses which will be undertaken as part of this project. Such activities are not planned until late 1999 after all field work has been completed and the majority of plant specimens identified.

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

EXPENDITURE TO DATE

An expenditure statement from the Administration Assistant in the Pilbara Regional Office is attached as Appendix One. As of the 30th September a total of $4 785 or 14% 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 purchase of materials, in particular topographical maps, remotely sensed data and supplementary digitising and GIS software. Approximately 20% of expenditure incurred to date has been associated with plant hire.

Since the last progress report the expenditure of $2 215 has been on materials (73%), in particular GIS data, plant hire (23%) and staff travel allowances (4%). Accounts for the most recent field activities are outstanding. Approximately $9 000 will be debited from the budget for this project when these accounts are forthcoming from the service providers. These accounts will predominantly be for helicopter time and plant hire.

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. Some expenditure will be associated with the purchase of field consumables in preparation for the next sampling session.

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

* * * * * * * * * * *

# APPENDIX ONE

## 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 | 2 570.00 |
| 1997-98 (30/09//97 - 30/09/98) | |
| Materials & Equipment | 1 620.00 |
| Plant Hire | 505.00 |
| Staff Allowances | 90.00 |
| **TOTAL EXPENDITURE** (30/09/98) | **$ 2 215.00** |
| TOTAL EXPENDITURE ON PROJECT | $4 785.00 |

M. Sermon
Admin. Assistant
7/10/98