

BOTANICAL SURVEY OF

CENTRAL PILBARA UPLANDS

Project (N709)

Final Report - Third Year 1997

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PRECIS

BOTANICAL SURVEY OF CENTRAL PILBARA UPLANDS

Project N706

A total of 745 uplands greater than 1 000 m elevation have been identified in the Central Pilbara. These uplands are principally located throughout the central and eastern portions of the Hamersley Range. Thirty seven of these uplands were selected as primary sites for detail botanical investigation. To ensure a representative sampling of the biophysical gradients present across the project area an additional 16 upland sites were included in the project design. These supplementary sites were less than 1 000 m elevation and were located towards the margins of the Hamersley Range.

Since the commencement of this project in 1995, 22 of the selected uplands have been surveyed. Permanent benchmark quadrats have been established on each upland visited and the flora within quadrats systematically recorded. Opportunistic sampling outside quadrats has also been undertaken along with the collection of soil samples for edaphic attribute characterisation.

A total of 327 taxa representing 133 genera in 58 families have been recorded from the uplands visited. Voucher specimens have been collected for 89% of the species encountered, with the total number of vouchers collected approaching 460. The most floristically rich families were the Asteraceae, Malvaceae, Mimosaceae and Myrtaceae. The most floristically rich genera were Acacia, Eucalyptus, Eremophila and Senna. During the project 27 species of biological significance representing 81 populations have been documented.

Differences in floristic composition between upland sites was evident and appears to be related to geological setting, in particular edaphic considerations. Augmentation of the species database through visits to unsampled uplands, continued development of the soil attribute database and refinement of the geological GIS should provide plausible explanations for observed biogeographical patterns.

TITLE OF PROJECT:

Botanical Survey of Central Pilbara Uplands

AGENCY:

Western Australian Department of Conservation and Land Management (CALM), Science and Information Division.

CHIEF INVESTIGATOR:

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AIM OF PROJECT:

To comprehensively document the flora of upland sites within the Central Pilbara in order to facilitate an evaluation of the distribution of rare, geographically restricted and endangered plant species and to assist with the identification of areas of high floristic richness.

SCOPE:

1. Finalise identification of Central Pilbara upland sites using results from previous survey.
2. Continue systematic sampling of permanent quadrats on upland sites.
3. Compile results of 1996 survey.
4. Begin data entry and preliminary analysis of previous survey results.
5. Begin preparation of quantitative descriptions of species composition of each site sampled in 1996.
6. Map the distribution of any species of conservation significance recorded in previous surveys.
7. Begin the analysis of plant species data using multivariate and ordination techniques to determine patterns of species richness, turnover and distribution between upland sites.
8. Begin the development and presentation of management recommendations based on the 1996 survey, which will be designed to ensure that sites identified as biologically significant are not affected by deleterious perturbations. Such management recommendations may also include proposals for reserve gazettal if conservation values are considered to be significantly high.

PROGRESS TOWARDS COMPLETION OF SCOPE ITEMS:

During 1997 little progress was made towards fulfilment of scope items for this project. This shortcoming in progress can be attributed principally to a nine month secondment of the chief investigator onto an inter-agency government taskforce reviewing the adequacy of the Hamersley Range conservation estate and proposed additions to augment the estate's representativeness and comprehensiveness. Logistical difficulties associated with the availability of a helicopter, which is required for access to many of the upland sites, and the delays incurred in preparation of the 1997 contract for this project also contributed to the minimal progress during 1997.

Despite these shortcomings progress was made primarily with the identification of further upland sites for survey, databasing and identification of voucher specimens and characterisation of the edaphic attributes from sites which had been surveyed. During the chief investigator's secondment extensive use was made of information collected as part of this project for upland sites in the Karijini National Park and proposed conservation estate additions. This information was used to highlight inadequacies in the existing conservation reserve system in the Hamersley Range and to identify areas of potential conflict with respect to future resource development projects, many of which impinge on upland sites. Information generated as part of the chief investigator's secondment, particularly specimen and GIS databases (flora, vegetation and geology), will also be useful to this project, especially when interpreting the patterns of species richness and turnover between upland sites and making recommendations from management and reserve gazettal to protect upland sites with significantly high conservation values.

Progress on this project is outlined below.

Scope 1:

A total of 53 upland sites, comprising 37 primary and 16 supplementary sites, have now been identified within the project area (Figure 1). The 37 primary sites comply with stipulations for site selection as detailed in previous progress reports (ie. greater than 1 000 m in elevation and equidistant within the 15' latitude and longitude grid superimposed over the project area). The 16 supplementary upland sites were selected as a consequence of amendments to the site selection strategy. These amendments were prompted primarily by a desire to ensure that the biophysical gradients across the Hamersley Range, principally climatic and geological considerations, were sampled as part of this project. To this end many of the supplementary sites captured to ensure that biophysical gradients are represented in the sampling strategy are on the fringing edges of the project area and are less than 1 000 m in elevation. Consideration of logistical requirements, especially with respect to access to supplementary upland sites also influenced the selection of these sites.

The delimitation of upland sites throughout the project area was facilitated through the use of topographical and Landsat imagery captured or acquired in an appropriate GIS format. Interrogation of this data through MapInfo resulted in the identification of 745 upland sites (spot heights greater than 1 000 m elevation) throughout the project area (Figure 2) and assisted in the identification

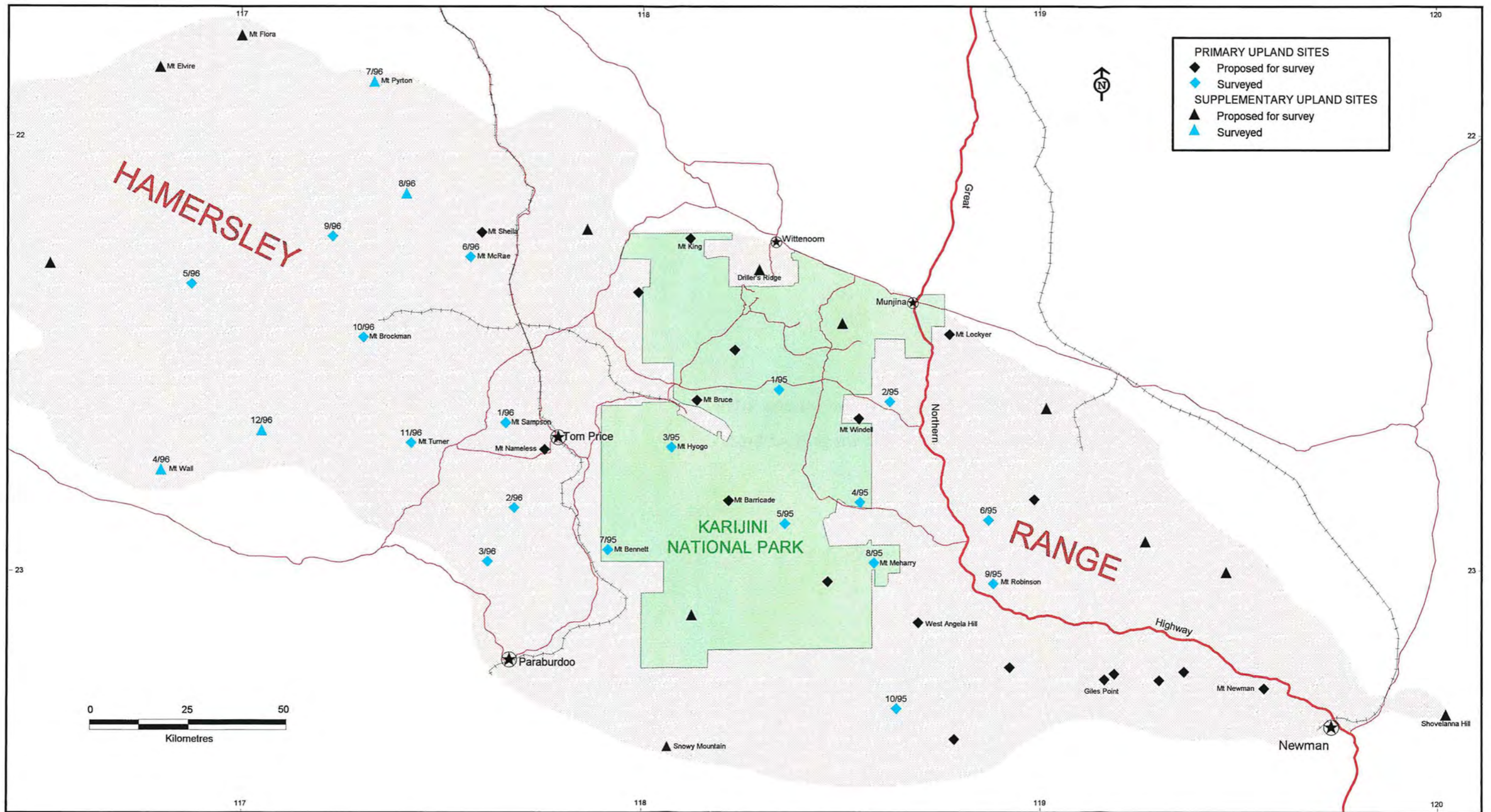


Figure 1 Location of the 53 selected upland sites within the Central Pilbara project area.

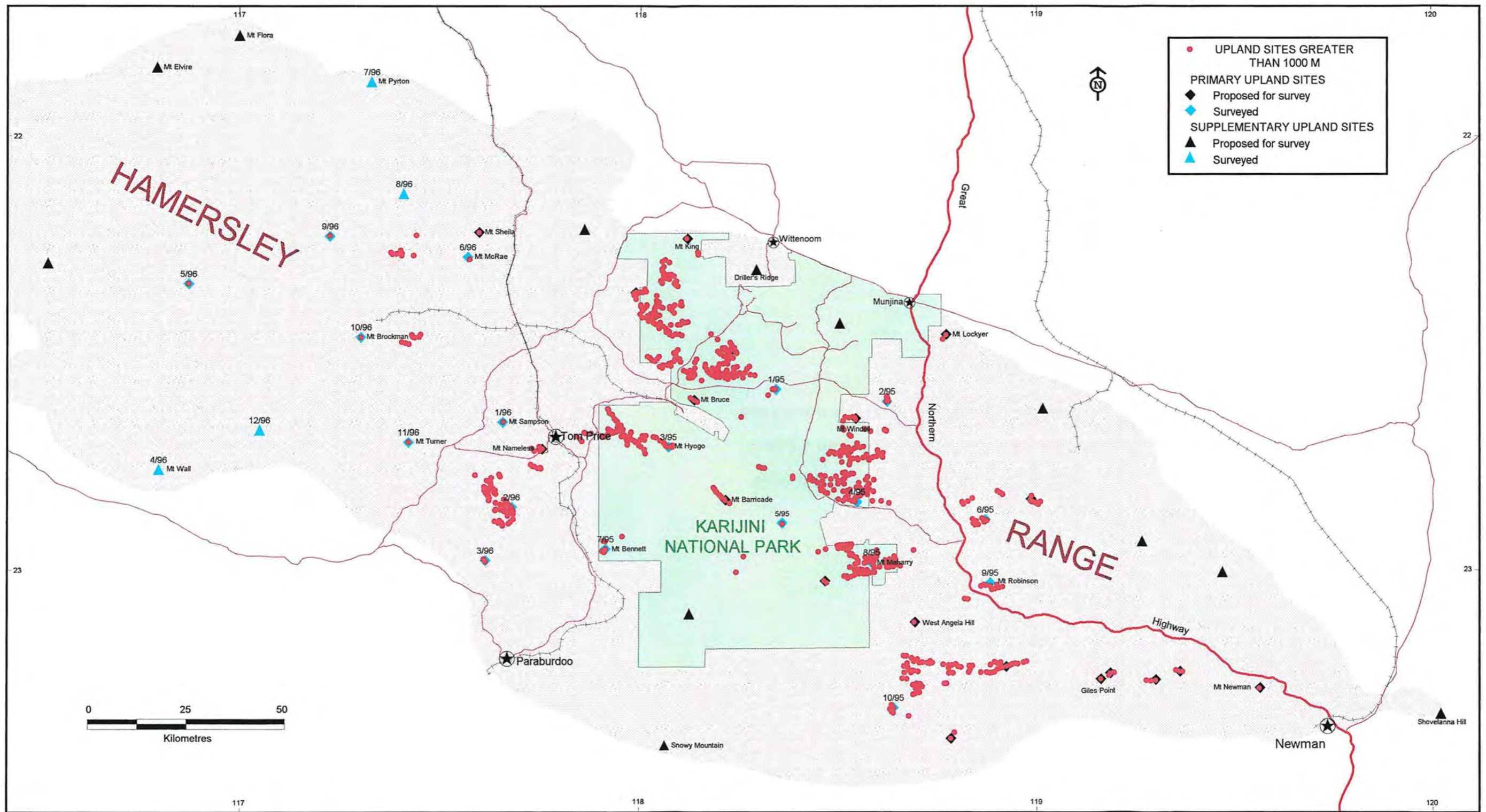


Figure 2 Location of selected upland survey sites and other uplands greater than 1000 m within the Central Pilbara project area.

of areas overlooked during the initial site selection process. These interrogations have also aided in the identification of areas for possible supplementary survey sites.

Scope 2:

A total of 22 uplands sites, comprising 18 primary and four supplementary sites have been sampled throughout the project area. The majority of these sites were in the central and western portion of the Hamersley Range (Figure 1). A helicopter was used to access most of these sites as they were remote and difficult to approach by vehicle or on foot.

On each of the sampled sites a permanent benchmark quadrat has been established within which all plant taxa have been recorded. Wherever possible this quadrat is positioned to include the upland summit and the adjacent areas incorporating 1 600 m². Quadrats this size in the Pilbara capture approximately 90% of the plants species present within a given community (van Leeuwen and Start, unpublished data). To ensure uniformity in sampling effort across all sites these quadrats were searched systematically over a one person hours period. In addition to the systematic sampling of permanent quadrats, random opportunistic sampling was also undertaken over the entire upland site. This was achieved by walking over the site and opportunistically collecting and recording all plant species encountered. A minimum of three person hours random opportunistic sampling was undertaken at each upland site.

Soil samples have been obtained from all upland sites visited. Analyses of the physical and chemical attributes for 12 of these soils samples has been undertaken and is progressing for the remainder using standard analytical procedures. Information gathered from these samples will provide an additional database to help interpret patterns of species composition and turnover between upland sites throughout the study area.

In summary, the sampling methodology being employed to sample upland site throughout the study area includes the:

- establishment of a 40 x 40 m permanently marked benchmark quadrat on the summit of each upland site;
- sampling of all plants within this quadrat for a duration of one person hour;
- opportunistic sampling of the flora on fringing slopes and screes outside the quadrat over a minimum of three person hours; and
- collection of a soil sample.

Scope 3:

A total of 327 taxa (Appendix One) representing 1 149 records have been recorded during the field program from the 22 upland sites visited. Within the permanent benchmark quadrats a total of 141 taxa representing 431 records were registered. Voucher specimens have been collected for 89% of the plant species encountered, with the total number of vouchers collected for the project approaching 460 specimens.

A total of 133 genera in 58 families have been registered during the course of this project (Appendix One). The most floristically rich families were the Asteraceae, Malvaceae, Mimosaceae and Myrtaceae with in excess of 20 taxa each. The most floristically rich genera were *Acacia*, *Eucalyptus*, *Eremophila* and *Senna* being represented by 28, 26, 15 and 14 taxa, respectively. The dominance of these families and genera are likely to change with the continued identification of numerous undetermined specimens, although their relative floristic importance will probably remain unaltered as they represent important constituents of the flora of arid inland Australia.

Populations of numerous taxa of conservation and taxonomic significance have been identified during this survey. The location of these taxa are illustrated in Figure 3. The taxa of significance were:

Acacia sp. West Angelas (M. E. Trudgen 16163)

This recently recognised taxon, which superficially resembles *Acacia hamersleyensis*, has been collected from one upland site during this project. The four other known populations are all in the Central Hamersleys and are all upland sites, with the exception of the Dales Gorge locality. This taxon is most closely allied to a species from the east coast of Australia, although further taxonomic investigations are required to confirm these affinities.

Brachychiton acuminatus

This species is listed as a Priority Four taxon on CALM's Priority Flora list. The species is endemic to the Pilbara Biogeographical Region extending from the Burrup Peninsula through the Chichester Range and into the Hamersley Range. The species has been recorded from seven upland sites during this project.

Brachychiton gregorii

This taxon has an extensive distribution throughout arid central Australia from Shark Bay and Norseman in Western Australia through the Great Victoria and Gibson Desert into north-eastern South Australia and the central Northern Territory. During this project the species has been recorded on eight upland sites. These sites represent disjunct outlying populations from the species main distribution.

Cryptandra monticola

This Hamersley Range endemic, which until 1995 was listed on CALM's Priority Flora List is known from approximately 25 populations throughout the Hamersley Range. During this survey the species has been recorded from nine upland sites. The record for this species obtained from upland 5/96 extends the species distribution west by approximately 100 km.

Dampiera sp. Mt Bruce (M. E. Trudgen 1334)

This undescribed taxon is listed as Priority Two on CALM's Priority Flora List. The taxon is endemic to the Hamersley Range where it is known from eight populations, four recorded during the course of this project.

Dampiera sp. Mt Meharry (M. E. Trudgen 1178)

This undescribed taxon is listed as Priority Two on CALM's Priority Flora List. The taxon is endemic to the Hamersley Range where it is known from six populations, two recorded during the course of this project.

Daviesia eremaea

This species is on CALM's Priority Three flora list. The species has a distribution in the central deserts of Western Australia and the Northern

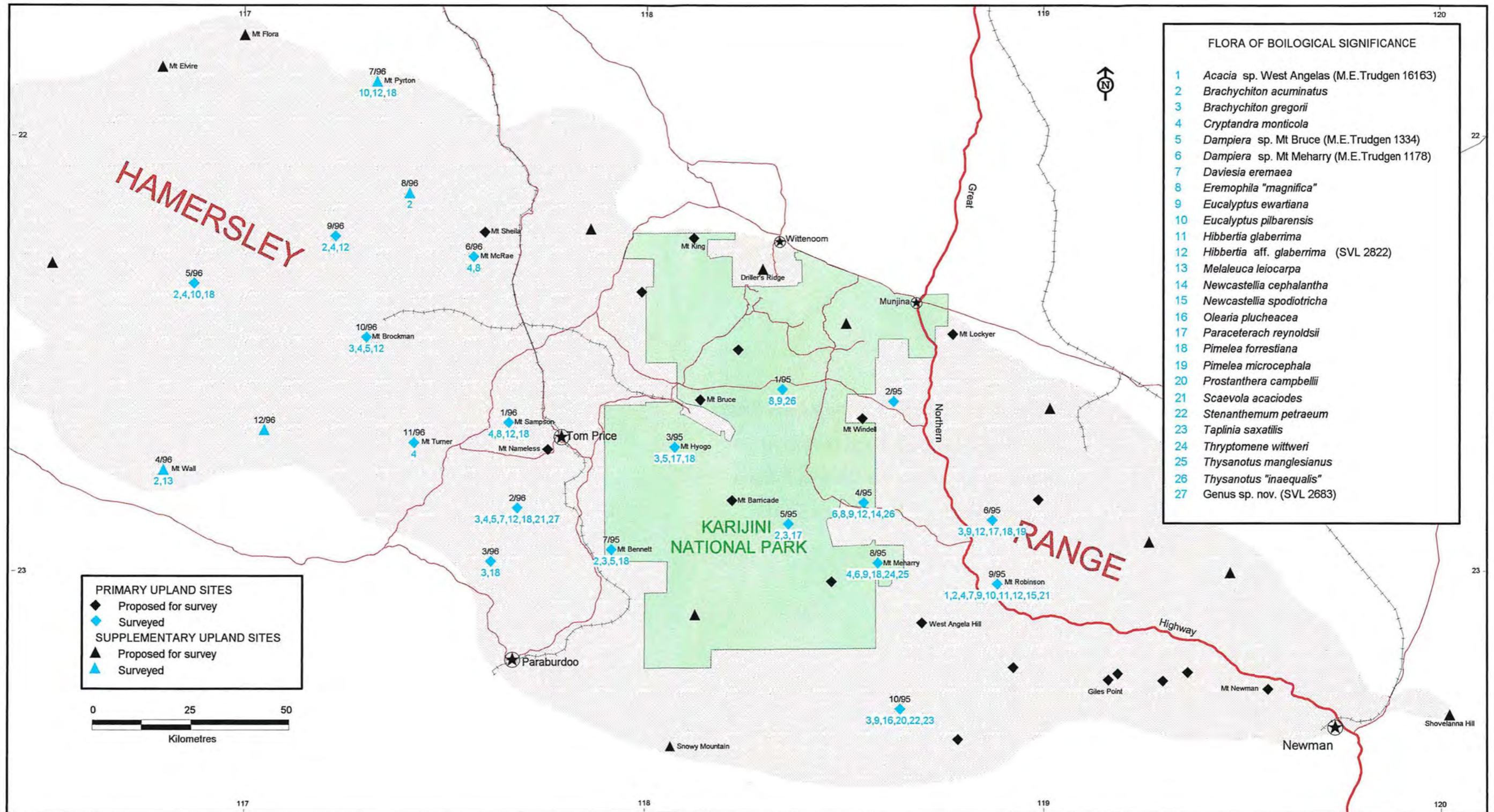


Figure 3 Population distribution for the 27 plant taxa of biological significance recorded on upland sites within the Central Pilbara project area during this project

Territory where it principally grows in the red sands of swales between dunes. Prior to the collection of this species from two uplands in the Hamersley Range as part of this project the most westerly known population was in the Little Sandy Desert^A east of Kumarina. The two Hamersley Range populations are over 230 km removed.

Eremophila "magnifica"

This undescribed taxon, which may consist of two distinct subspecies (R. J. Chinnock, personal communication) is endemic to the Hamersley Range. The taxon is listed on CALM's Priority Flora List as a Priority Three taxon. Prior to the commencement of this survey the taxon was known from 12 populations. An additional four populations have been documented during this project.

Eucalyptus ewartiana

This mallee has a distribution predominantly throughout the northern wheatbelt to Great Victoria Desert regions in southern Western Australia. Disjunct outlying populations are known from a few uplands within the Hamersley Range, namely Mt Newman, Mt Robinson and Mt Meharry. During this project the species has been recorded from six upland sites, four of which are new localities.

Eucalyptus pilbarensis

This species is endemic to the Pilbara Biogeographical Region being almost entirely restricted to the Hamersley Range. The species is listed on CALM's Priority Flora List as a Priority Four taxon. Prior to this project the species was known from 13 populations. During this project the species has been recorded from three new localities. Several of the undetermined *Eucalyptus* specimens may also represent this taxon.

Hibbertia glaberrima

This species is listed as a Priority Two taxon on CALM's Priority Flora list. The species was only known from Mt Bruce in Western Australia, although the species has also been recorded from numerous populations in the MacDonnell Ranges, Northern Territory. During this project a population of *H. glaberrima* was located on Mt Robinson.

Hibbertia aff. *glaberrima* (SVL 2822)

This taxon is closely allied to typical *H. glaberrima* from which it differs in floral morphology. Further investigations are required to ascertain if these differences are significantly pronounced to warrant recognition of the taxon as a distinct species. This taxon has been recorded from nine upland sites during this project.

Melaleuca leiocarpa

This species is common in spinifex and mallee communities of the Murchison and Coolgardie Biogeographical Regions in Western Australia. The record of this species on Mt Wall, obtained during this project, is the only collection from the Hamersley Range. This Mt Wall population is a disjunct outlier which is 180 km north of the next nearest population on Mt Augustus.

Newcastellia cephalantha

This species is distributed throughout the Eremaean Botanical Province of Western Australia extending from Telfer to south of Wiluna and from Kumarina east to the Northern Territory border. The species is also found

^A The populations of *Daviesia eremaea* located in the Little Sandy Desert east of Kumarina were recorded during the National Reserve System Program project N706 - Biological Survey of the Southern Little Sandy Desert.

in the Northern Territory, Queensland and South Australia. This species has been recorded from one upland site during this project which is the first record of the taxon in the Hamersley Range and Pilbara Biogeographical Region. This population is a disjunct outlier located 190 km north west of the next nearest population.

Newcastellia spodiotricha

This species is found in arid Western Australia, Northern Territory, Queensland and South Australia. Within Western Australia its distribution extends from the Edgar Range to Muggan Rockhole (Warburton Range) near the border with the Northern Territory. The species has been recorded from one upland site during this project which is the first record of the taxon in the Hamersley Range and Pilbara Biogeographical Region. This population is a disjunct outlier located approximately 250 km west of the next nearest population in the Little Sandy Desert.

Olearia plucheacea

This species is endemic to Western Australia occurring in the Gascoyne and Murchison Biogeographical Regions. This species is known from approximately eight populations throughout the two regions. The collection of this species from one upland site during this project represents the first record of this taxon in the Hamersley Range and Pilbara Biogeographical Region. This disjunct outlying population is 220 km north east of the next nearest population on Mt Augustus.

Paraceterach reynoldsii

Three new populations of this species have been located during this project. Until the commencement of this project no specimens of this Central Australian taxon were housed in the W. A. Herbarium, although the species had previously been cited as occurring in Western Australia^B. It is understood that these records were based on specimens collected from Dales Gorge in the Hamersley Range.

Pimelea forrestiana

This species has a distribution which until recently was centred on the Gascoyne and Murchison Biogeographical Regions, although the Type collection was made from Mt Pyrton in the Hamersley Range by John Forrest in 1869. Recent collections have confirmed that the species does occur in the Hamersley Range, although these records are infrequent. During this project the species has been recorded from nine upland sites including the Type locality.

Pimelea microcephala

This species has a widespread distribution across Australia occurring in all mainland states. In Western Australia the species occurs from North West Cape to the Nullarbor where it is usually found growing in shrublands on sand. One population has previously been recorded in the Hamersley Range. During this project another population was located north of Mt Robinson.

Prostanthera campbelli

This species is endemic to Western Australia extending from the Ashburton to Avon-Wheatbelt Biogeographical Regions. The population recorded during this project is the first from the Hamersley Range and Pilbara Biogeographical Region. This population is a disjunct outlier

^B Hnatiuk, R. J. (1990). *Census of Australian Vascular Plants*, Bureau of Flora and Fauna, Australian Flora and Fauna Series, No 11.

located approximately 220 km north east of the next nearest population on Mt Augustus.

Scaevola acacioides

This species is listed as Priority Two on CALM's Priority Flora List. The species has a distribution centred on the Hamersley Range, although outlying populations occur in the Barlee Range. During this project an additional two populations have been located.

Stenanthemum petraeum

This recently described species has a distribution throughout central Western Australia from Mt Augustus eastwards to Warburton. The species is also known from the Peterrmann Range in the Northern Territory. It has previously been collected on only one occasion in the Hamersley Range at a location approximately 25 km north of the population located during this project.

Taplinia saxatilis

This woody herb is known from several populations throughout the Gascoyne and Murchison Biogeographical Regions. Prior to the collection of this species from one Hamersley Range upland site during this project the most northern population known for this species was on Mt Augustus. Recently the species has been recorded from another upland site in the Hamersley Range near West Angela Hill.

Thryptomene wittweri

This species is gazetted as Declared Rare Flora. The species has a peculiar distribution occurring on three hilltops throughout the Eremaean Botanical Province of Western Australia. The species is also known from Palm Valley in the Northern Territory. During this project the species was recorded on Mt Meharry, a previously known population.

Thysanotus manglesianus

This fringed lily is common in the transitional rainfall zone between the South-west and Eremaean Botanical Provinces. It has a range which extends from Meekatharra to Balladonia and is usually found growing in sandy soils. The population located on Mt Meharry during this project is the most north and is a disjunct outlier. The next nearest known population is on Mt Augustus, some 220 km further south.

Thysanotus "inaequalis"

This undescribed fringed lily is very poorly known but appears to have a distribution throughout the Murchison and Coolgardie Biogeographical Regions of Western Australia. The taxon has also been collected in South Australia. The nearest known population to the two located during this project is at Meekatharra, 400 km south of the Central Hamersley Range.

Genus sp. nov. (SVL 2683)

This taxon appears to be new to science and has not previously been recorded in the scientific literature. The taxon is closely allied to the genus *Olearia* from which it differs in the absence of ray florets. It is an attractive plant with large flowers. Only one population of this taxon has been located during this project.

Many of the undescribed taxa listed, and some of those which have been tentatively identified in Appendix One, may also be of conservation and taxonomic significance. This is particularly true for many of the unidentified specimens in the Goodeniaceae, Tiliaceae and Malvaceae and for taxa of

Eucalyptus and *Eremophila*. Many of these unidentified specimens may represent novel taxa which will require identification by specialist taxonomists before an assessment of conservation status can be made. Ongoing identification and specimen processing will clarify these problems.

One environmental weed, Ruby Dock (*Acetosa vesicaria*), was recorded on several of the upland sites visited. This species has unfortunately become more common in the Pilbara favouring disturbed sites associated with mining operations, particularly waste rock dumps and associated scree slopes and batters. The species appears to be invading some upland sites as a consequence of its inflated fruits which aid in wind dispersal and the inherent nature of many upland sites which comprise scree slopes.

Results from the chemical and physical analyses of the soil samples collected from the 20 sample sites are presented in Table 1. There is considerable variation between upland sites in many of the attributes assessed, in particular electrical conductivity (EC), total phosphorus (P total) and exchangeable cations, particularly calcium (Ca).

Scope 4:

Processing, incorporation and databasing of plant specimens into the Pilbara Regional Herbarium is progressing. Duplicate specimens are also being forwarded to the Western Australian Herbarium and, in the case of specimens of taxonomic interest, vouchers are being forwarded to appropriate taxonomists at Eastern States and overseas institutions.

A specimen database has been established and is continually being augmented as new specimen identifications become available. Development of the GIS database is progressing and currently contains themes related to vegetation (Beard's 1 : 000 000 map), land systems and geology. The latter two themes require accuracy verification and further development to ensure that they are useful products. A cadastral/tenure theme is also in the process of being developed and the relief theme is continually being refined as new data becomes available. Development of a fire history theme is not feasible as CALM and Local Government fire history records are not comprehensive enough to accurately delimit burnt area throughout the project area. The use of satellite imagery was investigated as an alternative to assist with the development of a fire history map for the project area, however, interpretation problems, principally associated with geological consideration, put the use of this tool and its development beyond the scope of this project.

Scope 5:

Preliminary work has commenced on the compilation of quantitative descriptions for the floristic composition and richness of the surveyed upland sites. Preliminary, exploratory analyses of the data support the notion that edaphic considerations have a marked impact on species distribution and the floristic composition of upland sites in the Hamersley Range. These edaphic considerations are intrinsically the product of the geological setting with the most

Table 1 Chemical and physical attributes of the soils from 12 upland sites in the Central Pilbara.

Burrup Quadrat No.	EC (1:5) mS/m	pH (H ₂ O)	pH (CaCl ₂)	Org C (W/B) %	N (total) %	P (total) mg/kg	P (HCO ₃) mg/kg	Ca ¹ (exch) me%	Mg (exch) me%	Na (exch) me%	K (exch) me%	Al (exch) me%	Mn (exch) me%	Sand %	Silt %	Clay %
1/96	2	6.3	5.1	1.06	0.071	437	6	4.46 ^b	1.08 ^b	0.04 ^b	0.32 ^b	0.75 ^b	0.19 ^b	65.5	18.5	16.0
2/96	1	5.6	4.4	1.22	0.079	365	6	1.73 ^b	0.44 ^b	0.02 ^b	0.24 ^b	0.03 ^b	0.13 ^b	60.0	24.0	16.0
3/96	2	6.3	5.2	0.60	0.037	297	9	4.42 ^b	2.64 ^b	0.02 ^b	0.49 ^b	0.02 ^b	0.24 ^b	65.0	17.5	17.5
4/96	12	6.0	5.3	1.73	0.103	442	7	8.06 ^b	1.93 ^b	0.17 ^b	0.34 ^b	0.04 ^b	0.15 ^b	63.5	22.0	14.5
5/96	2	6.4	5.3	2.50	0.149	458	6	8.80 ^b	1.81 ^b	0.03 ^b	0.25 ^b	1.26 ^b	0.12 ^b	55.5	28.0	16.5
6/96	1	5.4	4.2	2.17	0.123	385	4	1.15 ^b	0.46 ^b	<0.02	0.26 ^b	0.02 ^b	0.13 ^b	69.5	17.0	13.5
7/96	2	6.4	5.3	1.02	0.049	482	11	6.68 ^b	1.47 ^b	<0.02	0.29 ^b	0.10 ^b	0.19 ^b	57.0	22.0	21.0
8/96	2	6.0	4.7	1.47	0.083	788	20	5.21 ^b	1.89 ^b	0.03 ^b	0.48 ^b	0.03 ^b	0.15 ^b	65.5	20.5	14.0
9/96	1	6.3	5.1	0.84	0.041	458	7	4.78 ^b	0.96 ^b	<0.02	0.18 ^b	0.32 ^b	0.33 ^b	53.5	30.0	16.5
10/96	2	5.8	4.7	1.99	0.117	437	8	6.86 ^b	1.20 ^b	0.02 ^b	0.38 ^b	0.08 ^b	0.17 ^b	74.0	10.5	15.5
11/96	2	5.9	4.9	1.54	0.084	405	6	5.36 ^b	0.82 ^b	<0.02	0.22 ^b	<0.02	0.03 ^b	55.0	25.5	19.0
12/96	1	6.1	4.8	1.35	0.081	340	4	3.46 ^b	2.80 ^b	0.03 ^b	0.29 ^b	<0.02	0.03 ^b	55.0	25.5	19.0

Note: 1 Methods used in determination of exchangeable cations:

- a extracted in 1M NH₄Cl, pH 7.0
- b extracted in 0.1M BaCl₂
- c extracted in 1M NH₄Cl, pH 8.5

pronounced differences in floristic composition being apparent between Brockman Iron Formation (banded iron) and Mt Jope Volcanics (basalts).

Scope 6:

A GIS database for plant species of conservation, taxonomic and biological significance has been developed. The distribution of populations for the 27 significant species detailed in Scope Item 3 is provided in Figure 3. Interrogation of the WA Herbarium database (WAHERB) and the databases of resources companies with interests in the project area are being examined to identify additional populations for the species of significance, especially in instances where they occur on upland sites. This data will be used to develop a detailed GIS database on the distribution of significant flora which will facilitate the assessment of floristic richness patterns throughout the project area. This data will also expedite assessments of the representativeness and adequacy of the existing reserve system in the project area.

Scope 7:

Some preliminary exploratory analyses have been undertaken on the flora databases in order to elucidate patterns of species distribution, turnover and richness. These results indicated that some upland sites are particularly rich in species (eg. Mt Robinson), especially those species which are represented by disjunct outlying populations. As previously reported, geological setting also appears to significantly influence the distribution of species. The position of the upland site with reference to the Hamersley Escarpment also appears to influence site floristics, although more detailed analysis and a large site database will be required to confirm this proposition.

Scope 8:

Distributional data for flora species of biological and conservation significance is already being utilised for routine management and operational procedures within the Karijini National Park. Species distributional data has been incorporated onto Wildfire Threat Analysis maps for the national park and areas immediately adjacent, especially in the proposed Mulgalands Natural Resources Management Area around Mt Robinson and Giles Point. The species distributional data has also been incorporated into operational plans, such as the Master Burn Plan for Karijini National Park which is associated with the development of strategic aerial buffers for the control and suppression of wildfires.

The flora database developed during this project has been used to help justify the case for incorporating significant parcels of vacant Crown land, adjacent to Karijini National Park, into the conservation estate. The data has been used to highlight some inadequacies, in terms of species representativeness, of upland sites within the national park and has also been used to illustrate how the inclusion of floristically rich uplands (eg. Mt Robinson) will significantly augment the comprehensiveness of the reserve system in the project area.

Data collected during this project has also been used to assist with the environmental assessments on a number of resource developments in the project area, namely the Environmental Review and Management Plan for Robe River Iron Associate's West Angelas project and the Public Environmental Review for BHP Iron Ore's Mining Area C proposal.

No formal proposals for reserve gazettal have been developed as part of this project, although the data has been used to strengthen the arguments for existing proposals, as outlined above.

PLANNED ACTIVITIES TOWARDS COMPLETION OF SCOPE ITEMS:

In 1998 it is planned to visit and sample the remaining 29 upland sites. Research will also continue on the identification of plant specimens collected, their databasing and ultimately incorporation into herbaria. Analytical work will also continue on the collected soil samples. Development of the GIS database will also proceed with the capture of additional themes and verification of geological and cadastral themes. Development of proposals for reserve acquisition and recommendations for management will also be initiated to ensure that uplands with significant biological value are represented on the conservation estate.

* * * * *

APPENDIX ONE

Appendix One

Vascular Plant Species

Botanical Survey of Central Pilbara Uplands

February 1998

This list of vascular plants includes all specimens collected during the 1995 and 1996 field programs and subsequently identified before 1 December 1997. Taxa are listed alphabetically in the order of genus and species in their respective families. The family sequence follows approximately the classification presented in Green (1985) "Census of the Vascular Plants of Western Australia". Nomenclature generally follows Green op. cit. and that employed by the Western Australian Herbarium, apart from a few exceptions where recent taxonomic revisions have suggested alternative classifications.

* *Introduced species.*

APPENDIX ONE

ADIANTACEAE

Cheilanthes brownii
Cheilanthes sieberi
Cheilanthes sp. nov. (SVL 2812)
Paraceterach reynoldsii

CUPRESSACEAE

Callitris glaucophylla

POACEAE

Amphipogon caricinus
Aristida contorta
Cymbopogon obfectus
Cymbopogon sp. nov.
Eriachne dominii
Eriachne mucronata
Iseilema vaginiflorum
Paraneurachne muelleri
Themeda triandra
Triodia epactia
Triodia pungens
Triodia wiseana

CYPERACEAE

Cyperus cunninghamii

ANTHERICACEAE

Thysanotus manglesianus
Thysanotus "inaequalis"
Tricoryne "trudgeniana"

MORACEAE

Ficus platypoda var. *lachnocaulon*
Ficus platypoda var. *minor*

PROTEACEAE

Grevillea berryana
Grevillea leucodendron
Grevillea stenobotrya
Grevillea striata
Grevillea wickhamii subsp. *aprica*
Hakea suberea
Hakea sp. nov. (SVL 2720)

SANTALACEAE

Exocarpos sparteus
Santalum lanceolatum

LORANTHACEAE

Amyema miquelii
Diplatia aff. *grandibracteata*
 (SVL 2825)

POLYGONACEAE

* *Acetosa vesicaria*

CHENOPODIACEAE

Dysphania rhadinostachya
Rhagodia eremaea
Salsola kali

AMARANTHACEAE

Ptilotus aevroides
Ptilotus auriculifolius
Ptilotus calostachyus
Ptilotus carinatus
Ptilotus exaltatus
Ptilotus gomphrenoides
Ptilotus heliapteroides
Ptilotus macrocephalus
Ptilotus obovatus
Ptilotus polystachyus
Ptilotus rotundifolius

GYROSTEMONACEAE

Codonocarpus cotinifolius

PORTULACACEAE

Calandrinia aff. *tepperiana*
 (SVL 2043)

CARYOPHYLLACEAE

Polycarpaea holtzei
Polycarpaea longiflora

APPENDIX ONE

MENISPERMACEAE

Tinospora smilacina

LAURACEAE

Cassytha capillaris

CAPPARACEAE

Capparis lasiantha
Capparis spinosa
Capparis umbonata
Cleome viscosa

BRASSICACEAE

Lepidium oxytrichum

PITTOSPORACEAE

Pittosporum phylliraeoides var.
microcarpa

SURIANACEAE

Stylobasium spathulatum

MIMOSACEAE

Acacia adoxa
Acacia aneura
Acacia arida
Acacia atkinsiana
Acacia ayersiana
Acacia bivenosa
Acacia coriacea subsp. *seriophylla*
Acacia coriacea subsp. *pendens*
Acacia cowleana
Acacia dictyophleba
Acacia hamersleyensis
Acacia sp. West Angela (M. E. Trudgen 16163)
Acacia inaequilatera
Acacia kempeana
Acacia maitlandii
Acacia marramamba
Acacia monticola
Acacia pachyacra
Acacia pruinocarpa
Acacia pyrifolia

Acacia rhodophloia
Acacia spondylophylla
Acacia stowardii
Acacia aff. *subtessarogona* (SVL 2738)
Acacia synchronicia
Acacia tenuissima
Acacia tetragonophylla
Acacia validinervia

CAESALPINIACEAE

Petalostylis labicheoides
Senna artemisioides subsp. *x artemisioides*
Senna artemisioides subsp. *helmsii*
Senna artemisioides subsp. *oligophylla*
Senna artemisioides subsp. *sturtii*
Senna artemisioides subsp. sp. nov. (SVL 2063)
Senna cardiosperma subsp. *cardiosperma*
Senna sp. "cardiosperma group" (SVL 2706)
Senna glutinosa subsp. *ferraria*
Senna glutinosa subsp. *glutinosa*
Senna glutinosa subsp. *luerssenii*
Senna glutinosa subsp. *pruinosa*
Senna notabilis
Senna pleurocarpa var. *augustifolia*
Senna sp. nov. (SVL 1946)

PAPILIONACEAE

Daviesia eremaea
Gastrolobium grandiflorum
 Genus sp. nov. (SVL 2015)
Glycine tabacina
Gompholobium polyzygum
Indigofera "fractiflexa"
Indigofera monophylla
Indigofera sp. nov. (SVL 2011)
Indigofera sp. nov. (SVL 2023)
Indigofera sp. nov. (SVL 2794)
Isotropis atropurpurea
Mirbelia viminalis
Rhynchosia minima
Rhynchosia aff. *minima* (SVL 2050)
Rhynchosia sp. Bungaroo Creek (M. E. Trudgen 12402)

APPENDIX ONE

Swainsona maccullochiana
Swainsona sp. Hamersley Station
 (A. A. Mitchell 196)

ZYGOPHYLLACEAE

Tribulus platypterus
Tribulus astrocarpus
Tribulus suberosus

POLYGALACEAE

Polygala chinensis

EUPHORBIACEAE

Euphorbia boophthona
Phyllanthus maderspatensis

CELASTRACEAE

Maytenus aff. *cunninghamii*

STACKHOUSIACEAE

Stackhousia sp. nov. (SVL 1961)

SAPINDACEAE

Alectryon oleifolius
Atalaya hemiglauca
Dodonaea coriacea
Dodonaea lanceolata
Dodonaea peteolaris
Dodonaea viscosa subsp.
angustissima
Dodonaea viscosa subsp. *mucronata*
Dodonaea viscosa subsp. *spatulata*

RHAMNACEAE

Cryptandra monticola
Stenanthemum petraeum
Ventilago viminalis

TILIACEAE

Corchorus sp. nov. (SVL 1956)
Corchorus sp. nov. (SVL 2064)
Corchorus sp. nov. (SVL 2080)
Corchorus sp. nov. (SVL 2705)
Corchorus sp. nov. (SVL 2750)

Corchorus sp. nov. (SVL 2808)
Triumfetta sp. nov. (SVL 1717)
Triumfetta sp. nov. (SVL 2800)
Triumfetta sp. nov. (SVL 2806)

MALVACEAE

Abutilon lepidum
Abutilon sp. nov. (SVL 1949)
Gossypium robinsonii
Hibiscus coati
Hibiscus goldsworthii
Hibiscus aff. *haynaldii* (SVL 1998)
Hibiscus aff. *haynaldii* (SVL 2813)
Hibiscus leptocladus
Malvastrum americanum
Sida fibulifera
Sida "golden calys"
Sida sp. nov. (SVL 1951)
Sida sp. nov. (SVL 1966)
Sida sp. nov. (SVL 1978)
Sida sp. nov. (SVL 1995)
Sida sp. nov. (SVL 1997)
Sida sp. nov. (SVL 2046)
Sida sp. nov. (SVL 2066)
Sida sp. nov. (SVL 2694)
Sida sp. nov. (SVL 2707)
Sida sp. nov. (SVL 2735)
Sida sp. nov. (SVL 2746)

STERCULIACEAE

Brachychiton acuminatus
Brachychiton gregorii
Brachychiton sp. nov. (SVL 2702)
Keraudrenia integrifolia
Rulingia rotundifolia
Waltheria indica
Waltheria virgata

DILLENIACEAE

Hibbertia glaberrima
Hibbertia aff. *glaberrima* (SVL 2822)

VIOLACEAE

Hybanthus aurantiacus

APPENDIX ONE

THYMELAEACEAE

Pimelea forrestiana
Pimelea microcephala

MYRTACEAE

Calytrix carinata
Corymbia deserticola
Corymbia ferriticola
Corymbia terminalis
Corymbia aff. *terminalis*
Corymbia sp. nov. (SVL 2737)
Corymbia sp. nov. (SVL 2765)
Eucalyptus ewartiana
Eucalyptus gamophylla
Eucalyptus kingsmillii
Eucalyptus leucophloia
Eucalyptus pilbarensis
Eucalyptus aff. *pilbarensis*
 (SVL 2823)
Eucalyptus rupullulans
Eucalyptus trivalvis
Eucalyptus "xerothermica"
Eucalyptus aff. *"xerothermica"*
Eucalyptus sp. nov. (SVL 2085)
Eucalyptus sp. nov. (SVL 2086)
Eucalyptus sp. nov. (SVL 2671)
Eucalyptus sp. nov. (SVL 2679)
Eucalyptus sp. nov. (SVL 2680)
Eucalyptus sp. nov. (SVL 2696)
Eucalyptus sp. nov. (SVL 2697)
Eucalyptus sp. nov. (SVL 2699)
Eucalyptus sp. nov. (SVL 2713)
Eucalyptus sp. nov. (SVL 2732)
Eucalyptus sp. nov. (SVL 2754)
Eucalyptus sp. nov. (SVL 2768)
Eucalyptus sp. nov. (SVL 2785)
Eucalyptus sp. nov. (SVL 2789)
Eucalyptus sp. nov. (SVL 2795)
Eucalyptus sp. nov. (SVL 2803)
Melaleuca leiocarpa
Thryptomene wittweri

HALORAGACEAE

Haloragis gossei

ARALIACEAE

Astrotricha hamptonii

APIACEAE

Daucus glochidiatus
Trachymene oleracea
Trachymene aff. *oleracea*

OLEACEAE

Jasminum didymum subsp. *lineare*

LOGANIACEAE

Mitrasacme sp. nov. (SVL 1983)

ASCLEPIADACEAE

Gymnema sp. nov. (SVL 2820)
Gymnema sp. nov. (SVL 2824)
 Genus sp. nov. (SVL 2027)
Rhyncharrhea linearis
Sarcostemma viminale subsp. *australe*

CONVOLVULACEAE

Evolvulus alsinoides
Ipomoea aff. *pes-caprae*
Porana commixta

BORAGINACEAE

Halgania aff. *solanacea*
Heliotropium heteranthum
Trichodesma zeylanicum

VERBENACEAE

Clerodendrum sp. nov. (SVL 1959)

CHLOANTHACEAE

Newcastelia cephalantha
Newcastelia spodiotricha
Spartothamnella teucriiflora

LAMIACEAE

Plectranthus intraterraneus
Plectranthus aff. *intraterraneus*
 (SVL 2809)

APPENDIX ONE

Prostanthera albiflora
Prostanthera campbellii
Prostanthera sp. nov. (SVL 1969)

SOLANACEAE

Nicotiana benthamii
Nicotiana occidentalis
Solanum ferosissimum
Solanum horridum
Solanum lanceolatum
Solanum lasiophyllum
Solanum sturtianum
Solanum aff. *sturtianum* (SVL 2718)
Solanum sp. nov. (SVL 1974)
Solanum sp. nov. (SVL 1988)
Solanum sp. nov. (SVL 1994)
Solanum sp. nov. (SVL 2028)
Solanum sp. nov. (SVL 2718)
Solanum sp. nov. (SVL 2753)
Solanum sp. nov. (SVL 2815)

ACANTHACEAE

Rostellularia adscendens subsp.
adscendens
Rostellularia adscendens subsp.
clementii

MYOPORACEAE

Eremophila cuneifolia
Eremophila exilifolia
Eremophila forrestii
Eremophila fraseri
Eremophila latrobei
Eremophila longifolia
Eremophila "magnifica" subsp.
"magifica"
Eremophila "magnifica" subsp.
"velutina"
Eremophila sp. nov. (SVL 1968)
Eremophila sp. nov. (SVL 2036)
Eremophila sp. nov. (SVL 2041)
Eremophila sp. nov. (SVL 2677)
Eremophila sp. nov. (SVL 2681)
Eremophila sp. nov. (SVL 2693)
Eremophila sp. nov. (SVL 2743)

RUBIACEAE

Canthium latifolium
Canthium lineare
Hedyotis crouchiana
Pomax umbellata
Pomax aff. *umbellata* (SVL 2012)

CUCURBITACEAE

Mukia maderaspatana

LOBELIACEAE

Lobelia heterophylla

BRUNONIACEAE

Brunonia australis

GOODENIACEAE

Dampiera candicans
Dampiera sp. Mt Bruce
(M. E. Trudgen 1334)
Dampiera sp. Mt Meharry
(M. E. Trudgen 1178)
Dampiera sp. nov. (SVL 2714)
Goodenia cusackiana
Goodenia heterochila
Goodenia prostrata
Goodenia stobbsiana
Goodenia trichophylla
Goodenia triodiophylla
Goodenia sp. nov. (SVL 1947)
Goodenia sp. nov. (SVL 1980)
Goodenia sp. nov. (SVL 2013)
Goodenia sp. nov. (SVL 2797)
Scaevola acaciodes
Scaevola browniana
Scaevola parvifolia subsp. *pilbarae*
Scaevola sp. nov. (SVL 2722)
Velleia connata

ASTERACEAE

Bidens pilosa
Calocephalus sp. Wittenoom
(A. S. George 1082)
Calotis eremaea
Calotis hispidula

APPENDIX ONE

Calotis multicalus
Chrysocephalum pterochaetum
Chrysocephalum semicalvum
Chrysogonum trichodesmoides
Genus sp. nov. (SVL 2683)
Olearia plucheacea
Olearia sturtii
Olearia xerophila
Pterocaulon serrulatum var. *velutinum*
Pterocaulon sphaeranthoides
Rhodanthe helichysoides
Senecio magnificus
Sigesbeckia orientalis
Streptoglossa bubakii
Taplinia saxatilis
Vittadinia virgata
Wedelia sp. Hamersley
(A. S. Western 8444)

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