Vegetation Management Plan
Elsey Station
Vegetation Management Plan
Elsey Station.

Report to the Northern Land Council and Greening Australia from Ecostudy, Flora and Fauna Consultants, Darwin

August 1993

Cover photograph: Harriet Daniels harvesting water lily fruits.
SUMMARY

This report presents the results of a vegetation survey undertaken on Elsey station in April/May 1993. Twenty-seven communities are described and each is assigned a range condition based on survey sites.

Six plant species of conservation significance are recorded. Two plant communities, Livistona rigida closed-forest and Typha orientalis closed-grassland are considered botanically significant and it is recommended that these communities be fenced and protected from fire.

Vegetation of significance to the Aboriginal owners is mapped on a 1:100,000 overlay. Plant communities associated with the course of the Roper River, its tributaries and floodplains are the richest and most utilized in terms of Aboriginal food resources and cultural significance. It is recommended that these areas be fenced and measures taken to control the feral pig population.

Twenty-four species of naturalized introduced plants are recorded for the station and control methods are detailed. Problem species should be eradicated, especially Parkinsonia and Calotropis. Priority should be given to small infestations in relatively controllable numbers but which have the potential for substantial increase. The riparian systems are identified as those most heavily invaded and it is recommended that major watercourses be fenced to enable long-term weed control to be successful.

Three plant communities are identified as badly degraded and these are mapped on a 1:100,000 overlay along with areas that have lost ground cover as identified from the Landsat Imagery. Removal of stock and rehabilitation of degraded land is a critical management requirement.

It is recommended that a network of monitoring points be established in consultation with the Pastoral Branch of the Department of Lands and Housing.
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Summary</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. INTRODUCTION</td>
<td>4</td>
</tr>
<tr>
<td>1.1 Background</td>
<td>4</td>
</tr>
<tr>
<td>1.2 Vegetation Information</td>
<td>4</td>
</tr>
<tr>
<td>2. METHODS</td>
<td>7</td>
</tr>
<tr>
<td>2.1 Mapping Techniques</td>
<td>7</td>
</tr>
<tr>
<td>2.2 Field Survey</td>
<td>7</td>
</tr>
<tr>
<td>2.3 Classification Scheme</td>
<td>7</td>
</tr>
<tr>
<td>3. VEGETATION DESCRIPTIONS</td>
<td>8</td>
</tr>
<tr>
<td>4. SIGNIFICANT PLANTS AND PLANT COMMUNITIES</td>
<td>21</td>
</tr>
<tr>
<td>4.1 Significant Plants</td>
<td>21</td>
</tr>
<tr>
<td>4.2 Botanically Significant Plant Communities</td>
<td>22</td>
</tr>
<tr>
<td>4.2.1 Management Guidelines</td>
<td>23</td>
</tr>
<tr>
<td>4.3 Aboriginal Significant Vegetation</td>
<td>24</td>
</tr>
<tr>
<td>5. WEEDS</td>
<td>26</td>
</tr>
<tr>
<td>5.1 Weed Species recorded on Elsey Station</td>
<td>26</td>
</tr>
<tr>
<td>5.2 Discussion</td>
<td>32</td>
</tr>
<tr>
<td>5.2.1 Ecosystems most at risk</td>
<td>33</td>
</tr>
<tr>
<td>5.2.2 Weed Management</td>
<td>34</td>
</tr>
<tr>
<td>6. MANAGEMENT GUIDELINES</td>
<td>35</td>
</tr>
<tr>
<td>6.1 Grazing Impact</td>
<td>35</td>
</tr>
<tr>
<td>6.2 Feral Animals</td>
<td>37</td>
</tr>
<tr>
<td>6.3 Fire</td>
<td>38</td>
</tr>
<tr>
<td>6.4 Erosion</td>
<td>39</td>
</tr>
<tr>
<td>6.5 Natural Waters</td>
<td>40</td>
</tr>
<tr>
<td>6.6 Tourism</td>
<td>41</td>
</tr>
<tr>
<td>7. MONITORING POINTS</td>
<td>42</td>
</tr>
<tr>
<td>8. REVeGETATION AND REHABILITATION PROGRAM</td>
<td>43</td>
</tr>
<tr>
<td>8.1 Rehabilitation</td>
<td>43</td>
</tr>
<tr>
<td>8.2 Amenity Plantings</td>
<td>44</td>
</tr>
<tr>
<td>Acknowledgements</td>
<td>45</td>
</tr>
<tr>
<td>References</td>
<td>46</td>
</tr>
<tr>
<td>Appendix A</td>
<td>49</td>
</tr>
</tbody>
</table>
1. INTRODUCTION

1.1 Background
Elsey Station covers an area of some 5,345 square kilometers to the south and east of Mataranka township. It includes part of the Roper River catchment and associated swamps. Elsey Station has a long history as a pastoral property. The property is owned by the Jilkminggan Community and supports a cattle enterprise managed by Banibi Pty Ltd as well as a small mining operation conducted by Northern Cement Limited. The station is currently under claim via the Land Rights Act.

The climate of the Elsey area is dry monsoonal, characterized by uniformly high temperatures and solar radiation. Average monthly minimum and maximum temperatures range from 22-38 C in October to 14-29 C in July (Plumb 1977). Rainfall is markedly seasonal, with the majority of the annual 650-800mm of rain falling between November and April. The cooler months of May to October are virtually rain-free (Plumb 1977). The dominant features of the climate are the annual period of aridity and uniformly high day temperatures (Wightman et al 1992).

The present study was undertaken to develop a workable strategy to determine the vegetation management, revegetation and rehabilitation needs of the station in relation to the traditional needs of the Aboriginal owners.

1.2 Vegetation Information

The vegetation of the Northern Territory was mapped at 1:1,000,000 scale by the Conservation Commission (CCNT), (Wilson et al 1990). Land Systems surveys undertaken by CCNT have also included vegetation descriptions, two of these include parts of Elsey Station - Roper River Catchment (Aldrick & Wilson 1992) and Sturt Plateau (Day et al 1985). Several sites were visited on the station during the CCNT Rainforest Flora survey.

In order to develop a Vegetation Management/Rehabilitation Plan for Elsey Station it was necessary to obtain more detailed vegetation information than was available through the above resources. The present study was developed by the Northern Land Council and Greening Australia NT to:
(a) make available a user friendly 1:100,000 vegetation map of the station.
(b) make recommendations for ecologically sustainable vegetation management requirements for the different land systems/vegetation types, including fire and grazing management.
(c) highlight degraded areas and recommend remedial actions.
(d) recommend a 5 year revegetation program for the station.
(e) highlight areas of weed infestation and feral animal damage and recommend management procedures.
(f) highlight significant plant populations and plant communities and determine conservation status and Aboriginal significance.
(g) recommend a training program for Aboriginal people in the areas of revegetation and vegetation management.
(h) suggest monitoring sites on the major land systems/vegetation types.

Some of these aims could not be addressed in the present study due to time and funding constraints. Consultancy fees were budgeted at 120 hours (or three weeks) for the entire project. In reality this time frame proved unrealistic with the current study requiring over 400 hours. Field work alone involved three weeks work, followed by two weeks of plant identification in the Herbarium before any report writing or the initial consultations with relevant government departments and delineating mapping boundaries.

Future vegetation management plans will need to be carefully designed to remain within budget. It is possible that field work and associated herbarium time could be substantially reduced by simplifying and refining the data collected to include only the dominant components of the vegetation needed to assess range condition.

The present study was essentially a trial run of using Landsat imagery and a detailed vegetation map as a basis for Property Management Plans. Satellite imagery has proved to be a relatively rapid and cost effective means of mapping the physical and biological resources of large areas. Satellite imagery has the advantage of being a non-static data set which can be constantly updated, Landsat V satellite covers the same area every 16 days (O'Neill & Eldridge 1990).
The present study provides baseline data on the vegetation of Elsey station. This data provides the foundation for more detailed investigations into areas vital to the sustainable management of the station such as stocking rates, fire and weed control. This information will prove invaluable to experts in these fields from government departments such as Department of Primary Industry and the Conservation Commission of the Northern Territory.
2. METHODS

2.1 Mapping Techniques

Mapping units were interpreted after recognition of vegetation patterns on Landsat (bands 3, 4 & 5) with reference to existing vegetation and land resource maps. All discernible patterns were delineated and, taking access into account, field inspection sites were proposed in each major mapping unit.

After field work and data analysis, re-interpretation and modification of the vegetation patterns comprising mapping units were carried out with further reference to geological, topographic and existing vegetation maps.

2.2 Field Survey

Field work was undertaken between 8 April and 6 May 1993. As many roads and tracks as possible were traversed by 4WD and mapping units sampled using the NT Vegetation Mapping Program proforma (Wilson et al 1990). A total of 134 20m x 20m plots were described. Plot locations were established in the field using topographic maps and satellite imagery. At one kilometer intervals along the roads brief descriptions of the canopy and ground layer were recorded along with formation and soil type.

Data from the CCNT Geographic Information System was made available and these sites were used to verify mapping units.

2.3 Classification Scheme

Mapping units were classified by analysis of the plot data and follow the scheme used by Wilson et al 1990.
3. VEGETATION DESCRIPTIONS

A total of 27 vegetation communities were mapped and described for Elsey Station. The landsat imagery available did not cover small areas on the borders of the property and no attempt was made to map these.

Taxonomy follows Dunlop (1992). The genera Eucalyptus and Acacia have been abbreviated to E. and A. where appropriate.

Range condition guides follow those of Payne et al 1974:

Good to excellent - desirable species (for forage and durability) predominate the stand. Vigor is high and seedlings are present. Intermediate species may be present. Undesirable species are rare. Ground cover optimal for pasture type and site. Nil to minor erosion.

Fair - Desirable, intermediate and undesirable species make up equal proportion of the stand. Vigor and reproduction of desirable species moderate. Density or frequency of occurrence of desirable species below potential. Intermediate species may predominate the stand. Desirable perennials alone may be present but frequency of occurrence is below optimum. Erosion nil to minor.

Poor to very poor - desirable species very sparse or absent with poor vigor and reproduction. Undesirable species predominate the stand, eg hummock grass with dense Aristida hygrometrica or black soil plain with dense Aristida latifolia. Nil to severe erosion.

CLOSED FOREST

1. Livistona rigida closed-forest.

Livistona rigida dominates the tree layer, sometimes in association with Melaleuca spp. The shrub layer is sparse except on disturbed sites (eg. recent fire) where canopy damage allows more light to enter and quick-growing shrubs such as Phyllanthus, Abutilon and Malvastrum may temporarily dominate. The ground layer is also sparse, comprising a mixture of tussock grass, forb and vine.
Restricted to loamy soils adjacent to major watercourses.

Condition: Fair, damage to streambanks from stock watering and high pig population evident from diggings.

1a. *Melaleuca cajuputi*, *M. leucadendra* closed-forest/open-forest.

The Melaleuca forests fringing permanent watercourses and seasonally inundated lowlands are generally dominated by *Melaleuca leucadendra* or *Melaleuca cajuputi*. Structure ranges from closed-forest to open-forest. *Melaleuca* spp. may co-occur with species such as the palm *Livistona rigidia* and *Timonius timons*. The shrub layer is sparse to absent including species such as *Physalis minima* and *Ficus* spp. Ground cover is variable with a mixture of tussock grasses, vines, sedges and forbs including the species *Brachiaria subquadripara*, *Paspalum scrobiculatum* and *Passiflora foetida*. Occurs on loamy soils adjacent to major watercourses.

Condition: Fair, damage to streambanks by stock watering.

WOODLAND

2. *Eucalyptus ferruginea*, *Erythrophleum chlorostachys* with *Sorghum*, *Chrysopogon*, *Plectrachne pungens* grassland understorey.

Mixed stands of *E. ferruginea* and *Erythrophleum chlorostachys* comprise the tree layer, although either species may dominate on specific sites. Common smaller trees include *Terminalis canescens*, *E. confertiflora* and *Petalostigma banksii*. The ground layer is dominated by *Sorghum* and *Chrysopogon* with the hummock grass *Plectrachne pungens* co-dominant on some sites. Commonly occurs on sandy soils.

Condition: Fair, dominance of increasers such as *Aristida hygrometrica*, *A. ingrata* and *Eriachne obtusa* on some sites may be a result of overgrazing or too frequent fires.
3. E. miniata woodland with Plectrachne pungens, Sorghum grassland understorey.

The upper layer is dominated by E. miniata, commonly occurring with E. ferruginea and Erythrophleum chlorostachys. The sparse shrub layer is dominated by a mixture of shrubs and tree regeneration, the most common species being Bossiaea bossiaeoides and Distichomen hispidula. The ground layer is typically dominated by the hummock grass Plectrachne pungens although on some sites tussock grasses (most commonly Sorghum) are dominant. This, and the development of an acacia midstorey appear to be fire related. Occurs on sandy soils.

Condition: Good to fair, too frequent firing appears to favor increasers such as Aristida hygrometrica.

4. E. tetrodonta, E. bleeseri woodland with Plectrachne pungens hummock grassland understorey.

E. tetrodonta and E. bleeseri are the dominant overstorey species, commonly in association with E. miniata and E. dicromophloia. A sparse shrub layer occurs with Planchnonia careya the dominant species. The ground layer is dominated by the hummock grass Plectrachne pungens. Occurs on sandy soils with a high gravel content.

Condition: Good to fair, Aristida hygrometrica makes up a variable proportion of ground cover.

5. E. tetrodonta, E. dicromophloia, E. ferruginea woodland with Sehima nervosum, Plectrachne pungens grassland understorey.

The composition of the overstorey is variable, usually co-dominated by a combination of E. tetrodonta, E. dicromophloia and E. ferruginea. Erythrophleum chlorostachys is often present. The sparse shrublayer is dominated by eucalypt regeneration and low shrubs such as Distichomen hispidula. Tall tussock grasses, most commonly Sehima nervosum and Chrysopogon and the hummock grass Plectrachne pungens co-dominate or dominate the ground layer. Occurs on flat to gently sloping plains with sandy soils.
Condition: Good to fair, increasers and intermediate species such as *Aristida hygrometrica* and *Eriachne obtusa* present in varying proportions.

6. *E. tetrodonta*, *Erythropheleum chlorostachys* woodland with *Chrysopogon, Sehima nervosum, Plectrachne pungens* grassland understorey.

*E. tetrodonta* and *Erythropheleum chlorostachys* dominate the overstorey. The sparse mid stratum is a mixture of tree regeneration and low shrubs. The ground layer is dominated or co-dominated by the tussock grasses *Chrysopogon* and *Sehima nervosum* and the hummock grass *Plectrachne pungens*. Occurs on flat to gently sloping plains with sandy soils.

Condition: Good to fair, cover values reasonable but *Aristida hygrometrica* dominates on some sites.

7. *E. dicromophloia* woodland/open-woodland with *Chrysopogon, Plectrachne pungens* open-grassland understorey.

*E. dicromophloia* predominates in the upper layer. The mid layer is generally a tall sparse-shrub layer, typically characterized by *Terminalia canescens*. The ground layer is dominated by *Chrysopogon* and *Plectrachne pungens* or a mixed stand of both species. Occurs on hills in sandy soil.

Condition: Fair, low cover values on some sites and the increasers and intermediate species such as *Aristida holathera* and *Eriachne obtusa* can make up 50% of the ground layer on some sites.

8. *E. microtheca* woodland/open-woodland with *Chrysopogon, Sehima nervosum, Eulalia aurea* grassland understorey.

*E. microtheca* dominates the upper stratum. The shrub layer, where present, is sparse and commonly includes *Flueggia virosa* and *Erythroxylum ellipticum*. The ground layer is dominated by the tall tussock grasses
Chrysopogon, Sehima nervosum and Eulalia aurea. Associated with heavy clay soils on plains.

Condition: Good to poor, ground layer varies from perennial grassland to a sparse grassland dominated by increaser species such as Aristida latifolia and Brachyachne convergens.


The tree layer is dominated by E. papuana. Gyrocarpus americanus and Lysiphyllum cunninghamii are common co-dominants. The shrub layer is variable, though often includes Fluegugia virosa, Grewia sp. and Lysiphyllum cunninghamii regeneration. The ground stratum is dominated by various tall tussock grasses such as Heteropogon contortus, Chrysopogon and Aristida. Common on sandy soils of plains adjacent to major watercourses.

Condition: Fair to poor, high proportion of intermediate and undesirable species occur in this community. Much evidence of disturbance by stock accessing river and high proportion of invasive weed species.

10. E. patellaris, Erythrophleum chlorostachys woodland/open-woodland with Chrysopogon, Sehima nervosum grassland understorey.

Predominately E. patellaris and Erythrophleum chlorostachys, the upper stratum of this woodland may also include E. foelscheana, E. terminalis, E. confertiflora, E. ferruginea, Lysiphyllum cunninghamii. The sparse shrub layer comprises various species including Fluegugia virosa and Grewia retusifolia. The grass layer is dominated by Chrysopogon, Sehima nervosum, Sorghum, Heteropogon contortus and Aristida hygrometrica.

Condition: Good to poor, variable in composition and cover.
11. *E. pruinosa* low woodland/low open-woodland with *Chrysopogon*, *Aristida* spp. open-grassland understorey.

The upper stratum is dominated by *E. pruinosa* with *Grevillea striata*, *Atalaya hemiglauca* and *Erythroxylum ellipticum* commonly subdominant. However, a wide range of subdominants relating to different habitats is included in this unit. The shrub layer is generally sparse with *Carissa lanceolata* and *Fluegga virosa* characteristic species. The ground layer is typically open-grassland although this unit spans a range from closed to sparse grassland. A wide variety of tussock grass species occur, the most characteristic being *Chrysopogon*, *Aristida* spp., *Eriachne obtusa*, *Sehima nervosum* and *Themeda triandra*.

Condition: Good to poor. Less than 10% of sites have a good cover of perennial grasses. Most are dominated by increaser species and the worst affected have less than 10% grass cover and active gully erosion.

12. *E. tectifica*, *Erythrophleum chlorostachys* woodland/open-woodland with *Heteropogon contortus*, *Sehima nervosum* open-grassland understorey.

*E. tectifica* and *Erythrophleum chlorostachys* co-dominant the upper layer with *E. confertiflora* a common component of the tree stratum. There is generally a sparse-shrub layer comprised of various species including *Fluegga virosa*, *Terminalia canescens* and *Atalaya hemiglauca*. The ground cover is characterized by a mixture of tall grasses, mainly *Heteropogon contortus*, *Sehima nervosum*, *Chrysopogon* and *Sorghum*.

Condition: Good to fair, *Aristida* spp. make up a varying proportion of the ground layer.
OPEN-WOODLAND

13. *E. leucophloia* open-woodland/low open-woodland with *Sorghum*, *Chrysopogon*, *Plectrachne pungens* open-grassland understorey.

*E. leucophloia* dominates the tree layer of this open-woodland. *Erythrophleum chlorostachys* and *E. pruinosa* are common sub-dominants. There is generally a sparse-shrub layer comprised mainly of *Terminalia canescens* and *Acacia* spp. The tussock grasses *Sorghum*, *Chrysopogon* and *Aristida* spp. dominate or co-dominate with the hummock grass *Plectrachne pungens*. Characteristic of low rocky hills.

Condition: Good to poor, low cover values on some sites and annual increasers make up to 50% of the grass cover.

14. *E. microtheca*, *E. camaldulensis* open-woodland with *Chrysopogon* open-grassland understorey.

*E. microtheca* and *E. camaldulensis* dominate the upper layer although the floristic composition and structure of the community varies with the size of the stream channel. *E. latifolia* and *E. papuana* are characteristic sub-dominants further away from stream banks. The shrub layer is generally very sparse with eucalypt regeneration and species such as *Grewia retusifolia*, *Atalaya hemiglauca* and *Acacia farnesiana*. The ground layer is generally characterized by an open cover of perennial tussock grasses such as *Chrysopogon*, *Heteropogon contortus*, *Themeda triandra* and *Sehima nervosum*. On plains adjacent to Chambers River and Cave Creek.

Condition: Fair, open grassland with high bare ground percentage subject to invasion by increaser species such as *Brachyachne convergens*.

15. *E. terminalis* open-woodland/low open-woodland with *Sehima nervosum*, *Sorghum* open-grassland understorey.

*E. terminalis* dominates the upper stratum with *Terminalia arostrata* the most common subdominant. There is generally
a sparse-shrublayer with Carissa lanceolata and Hakea arborescens characteristic species. The grasslayer is dominated by tussock grasses, mainly Sehima nervosum and Sorghum.

Condition: Fair to poor, open-grassland with varying amounts of increaser species including Aristida spp., Heliotropium sp. and Abutilon sp.


The upper stratum is dominated by E. terminalis with a variety of subdominants including E. patellaris, E. confertiflora and Lysiphyllum cunninghamii. The shrublayer is generally comprised of Flueggia virosa, Hakea arborescens and Carissa lanceolata. The grasslayer is dominated by a mixture of tall tussock grasses, mainly Chrysopogon and Sehima nervosum.

Condition: Good to fair, perennial grasses dominate though cover is reduced on some sites.

17. E. terminalis, Hakea arborescens low open-woodland with Sorghum grassland understorey.

The upper stratum is dominated by E. terminalis which generally occurs as an open-woodland to scattered individuals. Typically there is an open-shrublayer comprising Hakea arborescens, Acacia ampliceps and Melaleuca acacioides, which varies in density and height depending on season and time since last fire. The ground layer is predominantly a Sorghum plumosum grassland.

Condition: Good to fair, grass cover and proportion of annual increasers varies.
MIXED SPECIES WOODLAND

18. *Erythrophleum chlorostachys, E. confertiflora* woodland/open-woodland with *Sorghum, Chrysopogon* grassland understorey.

The open-woodland to woodland upper stratum is generally dominated by *Erythrophleum chlorostachys* and *E. confertiflora* with *E.ferruginea, Brachychiton diversifolia* and *E. patellaris* common subdominants, although there is a wide range of subdominants relating to different habitats. There is generally a sparse shrublayer present with species such as *Grewia retusifolia* and *Flueggia virosa*. The ground layer is a tussock grassland, the common dominants including the tall grasses *Sorghum, Chrysopogon* and *Sehima nervosum*. *Aristida hygrometrica* is a characteristic though only occasional dominant component of the understorey. Occurs on flat to gently sloping plains with sandy soils.

Condition: Good to poor, most sites in fair condition with reasonable grass cover and a dominance of perennial species.

19. *Erythroxylum ellipticum* low woodland/low open-woodland with *Iseilema, Dicanthium* and *Aristida* spp. grassland understorey.

*Erythroxylum ellipticum* dominates the upper stratum of this unit with *Exoecaria parvifolia, Lysiphyllum cunninghamii* and *E. microtheca* common subdominants. The shrublayer is sparse, dominated by tree regeneration and species such as *Grewia retusifolia, Atalaya hemiglauca* and *Acacia farnesiana*. The ground layer is composed of mid-height to tall grasses such as *Eulalia aurea, Iseilema, Dicanthium* spp. and *Aristida*. Occurs on heavy clay soils.

Condition: Good to poor, grass cover is generally high but undesirable species such as *Aristida* spp. and *Heliotropium* sp. dominate in places.

*Exoecaria parvifolia* and *E. microtheca* occur as co-dominates at most sites, although *Exoecaria* may dominate in clumps along watercourses. Narrow bands of *Melaleuca leucadendra* and *Casuarina cunninghamii* are often present on stream banks. The shrub layer is very sparse to absent, with occasional *Erythroxylum ellipticum*, *Cathormion umbellatum* and *Lysiphyllum cunninghamii*. The ground layer is composed of mid-height to tall tussock grasses such as *Eulalia aurea*, *Astrebla squarrosa*, *Aristida* and *Iseilema*. A sparse-forbland is generally present, characterized by *Neptunia gracilis*. Occurs on heavy clay soils.

**Condition**: Good to poor, on good sites a variety of perennial grasses dominate with high cover values. In poor condition the ground layer is an open-grassland composed entirely of intermediate and undesirable species such as *Aristida* spp., *Brachyachne convergens* and *Neptunia gracilis*.


The upper layer is dominated by *Lysiphyllum cunninghamii* with *Erythroxylum ellipticum*, *Hakea arborescens* and *E. confertiflora* characteristic species. A variety of species dominate the sparse-shrub layer including *Flueggia virosa*, *Acacia farnesiana* and *Carissa lanceolata*. The ground layer is dominated by various tall grasses including *Sorghum*, *Chrysopogon*, *Eulalia aurea*, *Sehima nervosum* and *Panicum*. Localized areas with heavier clay soils are co-dominated by forbs such as *Galactia tenuiflora* and *Polymeria ambiguа*.

**Condition**: Good to fair, grass cover is variable and annual species such as *Aristida* spp. and *Polymeria ambiguа* dominate in localized areas.
22. Terminalia arostrata open-woodland/low open-woodland with Sorghum, Dicanthium fecundum grassland understory.

The open-woodland upper stratum is dominated by Terminalia arostrata with Lysiphyllum cunninghamii and E. terminalis common subdominants. There is generally a tall sparse-shrub layer present with species such as Carissa lanceolata, Cochlospermum fraseri and Hakea arborescens. The ground layer is a tussock grassland of variable composition, the common dominants including the tall grasses Sorghum, Dicanthium fecundum, Aristida and Heteropogon contortus.

Condition: Fair, grass cover is generally good but includes a variable amount of increasers such as Aristida spp.

MELALEUCA WOODLAND

23. Melaleuca viridiflora woodland/low woodland with grassland understory.

The upper layer of this low woodland is generally dominated by Melaleuca viridiflora with minor occurrences of other tree species such as E. polycarpa, E. microtheca and E. pruinosa. The tree layer merges into a sparse-shrubland comprising the above species and others such as Petalostigma banksii and Acacia spp. The ground layer of this community is complex, it includes the tussock grasses, Eriachne obtusa, Aristida hygrometrica, Chrysopogon and Schizachyrium fragile.

Condition: Fair, grass cover is generally low and annual species may dominate.

24. Melaleuca acacioides, E. pruinosa low woodland/low open-woodland with Chrysopogon, Aristida spp. open-grassland understory.

Melaleuca acacioides and E. pruinosa dominate the upper layer which generally a low woodland to low open-woodland. Erythroxylum ellipticum is commonly present. The open to sparse-shrub layer is dominated by various species, most commonly Carissa lanceolata, Flueggia
virosa and Dodonaea physocarpa. The ground layer is mainly composed of tall grasses such as Chrysopogon, Aristida spp., Themeda triandra and Sehima nervosum.

Condition: Good to poor, grass cover is usually low and increaser species may dominate.

ACACIA FOREST/WOODLAND

25. *A. shirleyi*, *E. leucophloia* forest/woodland with *Eriachne ciliata*, *Schizachyrium fragile* open-grassland understorey.

This unit varies from pure stands of *Acacia shirleyi* (most developed in the south-east of the station) to a mixed *Acacia shirleyi*, *E. leucophloia* woodland. The mid layer is often absent or comprised of scattered *A. shirleyi* regeneration and other shrubs. The ground layer is generally and open-grassland dominated by the tussock grasses *Eriachne ciliata* and *Schizachyrium fragile* and occasional *Plectrachne pungens*. Generally associated with rocky hills.

Condition: Good, little evidence of stock utilizing this community.

SPARSE-SHRUBLAND


The dominant stratum is generally a low sparse-shrubland of *Hibiscus panduriformis*, *Acacia farnesiana* and other shrubs including *Parkinsonia aculeata*, *Atalaya hemiglauca* and *Calotropis procera*. The ground layer is a tussock grassland including species such as *Heteropogon contortus*, *Iseilema*, *Pennisetum pedicellatum* and *Dicanthium sericeum*. Sedges may co-dominate and there is often a variety of forb species. Occurs on clay soils of Roper River plains.
Condition: Good to poor, ground cover generally high but increaser species may dominate. Invasive woody weeds are locally common.

GRASSLAND

27. *Typha orientalis* closed grassland.

*Typha orientalis* in stands almost forming a closed grassland community on cracking clay depressions. Occasional forbs and other sedges may be present. This grassland is often fringed by a low chenopod (*Halosarcia*) shrubland. On clay depressions.

Condition: Fair, evidence of pigs utilizing this community, margins subject to degradation and invasion by woody weeds.
4. SIGNIFICANT PLANTS AND PLANT COMMUNITIES.

4.1 Significant Plants

Six plant species of conservation significance (Leach et al 1992) are known from Elsey Station:

CARYOPHYLLACEAE
Polycarpaea staminodina
Range of greater than 100km but occurring in small populations which are mainly restricted to highly specific and localized habitats. Not known to occur within a reserve in the NT. Rare in Australia. Recorded during the present survey in *Eucalyptus tetrodonta* / *E. ferruginea* open-woodland with *Plectrachne pungens* understorey, Unit 5.

CUCURBITACEAE
Mukia micrantha
Annual herb occurring in sand or clay of streambanks or periodically inundated flats. Range of greater than 100km but occurring in small populations which are mainly restricted to highly specific and localized habitats. Not known to occur within a reserve in the NT. Rare in the NT, occurrence at Elsey Creek represents a disjunct distribution as all other NT collections are from central Australia. Also recorded from SA, Qld, NSW and Vic.

CYPERACEAE
Cladium mariscus
Perennial sedge growing in semi-saline sands and at edge of limestone creeks. Recorded from three localities in the NT, Roper River, Vanderlin Island and Cape Arnhem. Range of greater than 100km but occurring in small populations which are mainly restricted to highly specific and localized habitats. Not known to occur within a reserve in the NT. Rare in the NT, also recorded from SA.

POACEAE
Lepturus A51850
Annual grass known from one collection in 1947, type locality. Very restricted distribution in Australia, geographic range of less than 100km. Poorly known. Not known to occur within a reserve in the NT.
TILIACEAE
Corchorus fascicularis
Range of greater than 100km but occurring in small populations which are mainly restricted to highly specific and localized habitats. Not known to occur within a reserve in the NT. Rare in the NT, also occurs in WA and Qld. Recorded during this survey in Exocararia parvifolia woodland on cracking clay soil near Mt Sir James, Unit 20.

TYPHACEAE
Typha orientalis
Tall perennial rush, common elsewhere in Australia but known from only five collections in the NT. Range of greater than 100km but occurring in small populations which are mainly restricted to highly specific and localized habitats. Represented in Elsey National Park but size of population within reserve is unknown. Occurs in all states, rarely in NT and not at all in northern WA.

4.2 Botanically Significant Plant Communities

The majority of Elsey station is vegetated by widespread plant communities, many of which are dominated by Eucalypt spp.

Two communities of significance occur within the area:

Unit 1 Livistona rigida closed-forest
Livistona rigida is a tall fan-leaved palm recorded from the Roper, Goyder and Flora Rivers in the NT, and from three localities in north-west Queensland. It occurs in dense stands beside lowland freshwater streams in limestone country and in associated monsoon forests.

Palms are characteristic of swamps and other areas of poor drainage. In dry climates they only occur in areas where their roots have access to permanent ground water. Thus, their habitat is restricted and they occur as relict populations with disjunct distributions.

Populations of Livistona rigida occurring on Elsey Station and immediately adjacent in Elsey National Park are the most significant in the NT. They are dependent on the spring waters which feed the Roper River, forming a lifeline through an otherwise
dry environment. This unit is classified as semi-deciduous rain forest, group no. 11 (Russell-Smith, 1991). Riparian rain forests are of special significance as they form discontinuous and elongate patches providing significant genetic interconnections for the regional vine forest vegetation which is characterized by its fragmentation (Russell-Smith & Dunlop, 1987). These active spring mound swamp systems are also of great geomorphic interest (Aldrick & Wilson, 1992).

Red Lily swamp area is listed on the CCNT Significant Conservation Site Register as being of high scientific value.

Unit 27 Typha orientalis closed-grassland. Typha orientalis has a range of greater than 100km but occurs in small populations which are mainly restricted to highly specific and localized habitats. While this species occurs in all mainland states it is rare in the NT, being recorded from only four localities. The swamps occurring on Elsey station are the most extensive in the Territory and are associated with the geomorphically significant active spring mound swamp systems.

The Typha swamps occurring on Elsey station are listed on the CCNT Significant Conservation Site Register as being of exceptionally high conservation value.

4.2.1 Management Guidelines

Livistona rigida closed-forest represents the southern riverine rainforest type group 11, associated with seasonally flooded inland river systems (Russell-Smith 1991). Rainforest vegetation in monsoonal northern Australia is considered vulnerable due to a variety of factors including small patch size, highly fragmented distribution and relatively fire-sensitive vegetation. As well in a region where water availability is seasonally restricted, rainforest patches associated with perennial surface water provide watering foci and resting habitat for a variety of native and introduced animals (Russell-Smith 1991).

Russell-Smith (1991) found that the impacts of fire, introduced animals and weeds on rainforest patches were highly intercorrelated, implying significant interaction between these factors.
It is widely accepted that relatively intense, late dry season fires are highly destructive of monsoon rainforest vegetation, particularly on patch margins and in areas of disturbance. Under a regime of frequent, late dry season fires patch margins may be rapidly eroded, while release from fire pressure results in the re-establishment of protective canopies over a period of decades. Fire management should include measures to protect the riparian vegetation from fire. Disturbance by cattle in these vulnerable communities has been found to be highly correlated to the impacts of weed invasion and fire.

It is recommended that a fire management strategy should involve fencing of these areas. Where protective fencing has been undertaken, release from livestock pressure has been shown to result in rapid floristic and structural regeneration (Russell-Smith 1991). Feral pig control also needs to be implemented.

Typha orientalis is associated with geomorphically significant active spring mound swamp systems. Aldrick and Wilson (1992) report these habitats to be very susceptible to damage by pigs and buffalo.

It is recommended that these areas be fenced to eliminate stock and a pig eradication program be implemented.

4.3 Aboriginal Significant Vegetation

The vegetation significant to the traditional owners of Elsey Station was considered in two different categories for the purposes of this report; vegetation of mythological or ceremonial significance and vegetation of economic significance.

Information on vegetation of mythological or ceremonial significance was obtained from custodians (primarily Jessie Roberts) during fieldwork, from the records held at the Aboriginal Areas Protection Authority and from the Northern Land Council. Little time was available to undertake an extensive investigation into this aspect of plant significance and indeed this work is better left to qualified anthropological consultants rather than botanists. From these preliminary investigations however it is clear the great majority of sites of mythological or ceremonial
significance occur along the course of the Roper River and Elsey Creek. These sites are associated with numerous dreamings including Kangaroo, Uninitiated Boys, Stormbird, Emu, Possum, Chicken Hawk, Willi Willi, Sugarbag, File Snake, Hare Wallaby, Water Rat, Rainbow and Rain.

Vegetation of economic significance includes those species of particular importance for food, medicine, timber etc. Wightman, Roberts & Williams (1992) present plant usage information for 139 species in the Elsey region. Of these, a total of 67 (32%) were food species, 33 (15%) were medicinal species, 58 (28%) were used for implements and 52 (25%) had various uses.

During the present study ethnobotanical information gathered again highlighted the importance of the river frontages, lagoons and swamps for vegetation of significance to the Aboriginal people.

Aquatic plants still form a significant part of the diet of the Mangarrayi people with the waterlillies *Nelumbo nucifera* (Gumgub), *Nymphaea macrosperma* (Gurryag) and *Nymphaea violacea* (Jadaburl) eagerly sought after for their seeds, stems and roots. The bullrush *Typha orientalis* (Danybayi) was an important food source in the past. Many plants with edible fruits occur along the river frontages; the most sought after being *Antidesma ghaesembilla* (Murrunggurn), *Ficus coronulata* (Garranba), *F. hispida* (Gularawarr), *F. racemosa* (Manarliyn), *Flueggia virosa* (Yurrulanyan) and *Terminalia erthrocarpa* (Girn.girnirr). Yams such as *Dioscorea transversa* (Yumdirrag/Jamburl) and *Ipomaea sp.* occur predominantly along the river frontages and black soil plains. The Cabbage Palm *Livistona rigida* (Miririb) is well regarded as a food for its sweet cabbage. It can only be collected from certain areas as it is considered sacred in some places.

The waterways are also of particular significance for other food resources, the most important of these being fish, turtle, shellfish and crocodile. The river frontages are apparently favored hunting areas for kangaroo and bush turkey.

It is recommended that the Roper River and major tributaries be fenced and water pumped to stock. Measures should be undertaken to reduce the feral pig population which is damaging much of the swamp system.
5. WEEDS

5.1 Weed species recorded on Elsey Station

A total of twenty-four species of naturalized introduced plants have been recorded for Elsey station and surrounding area. The following annotated species list is made up of species recorded during field reconnaissance work for this project (marked #) and species on the Conservation Commission Northern Territory Herbarium data base for the area bounded by 14.38 N, 15.20 S and 132.55 W, 133.55 E.

ACANTHACEAE

Barleria prionitis
Herb to 1m, spines, flowers yellow. Weed of disturbed areas.

AMARANTHACEAE

# Aerva javanica Kapok bush
Shrub to 1m, leaves glaucous, flowers cream, woolly. Common on disturbed sites around mine and homestead.

Gomphrena celosioides Gomphrena weed
Sprawling herb with long soft hairs, flowers white. Weed of disturbed areas.

ASCLEPIADACEAE

# Calotropis procera Rubber bush, Calotropis
Noxious weed Class B, spread to be controlled. Serious threat to NT native communities (Parsons & Cuthbertson 1992). Shrub or small tree to 4m; bark pale; large, rounded leaves; flowers white and purple; copious white sap. Common weed of disturbed sandy soils along roadsides, watercourses and in run-down pastures. Reproduces by seed and suckers. Native of the Afro-Asian region, spread along the Roper River during the 1950s. Seed is dispersed by wind, water and machinery. Individual colonies increase as a result of suckering and seedling growth. In northern Australia, Calotropis
forms dense thickets on alluvial flats and quickly spreads into adjacent run-down pastures. The quickest way to deal with small colonies, which provide a seed source, is by grubbing or spraying with herbicides. In the longer term grazing must be reduced to allow the development of a competitive pasture cover (Parsons & Cuthbertson 1992). Recorded during this survey on degraded plains and levees of major watercourses. Unit 8, 20, 21, 26, 27.

ASTERACEAE

# Acanthospermum hispidum  Starburr
Noxious weed Class B, spread to be controlled. Erect annual herb to 0.5m, fruit a burr. A weed of disturbed ground, on levee of Roper River. Unit 8, 9.

Parthenium hysterophorus
Noxious weed Class A, to be eradicated. Much branched annual plant to 2m; grey-green, deeply lobed, hairy leaves; flowers cream, in clusters at end of branch. Native to Central and South America, discovered in the Northern Territory along Elsey Creek in 1977. An intensive eradication program by the Department of Primary Industry and Fisheries has almost eradicated the plant from this area. No other infestations have been recorded in the Northern Territory. Parthenium weed is an aggressive colonizer of roadsides and overgrazed pastures. It is fast-growing, with each plant producing approx. 15,000 seeds, it can spread at alarming rate. Isolated plants should be removed by hand and burnt on site (note, do not hand pull unless wearing heavy gloves because of risk of allergic reaction). Larger infestations are best controlled by treating with herbicide (Parsons & Cuthbertson 1992). Over-grazed areas are particularly susceptible to invasion so correct grazing management will assist in its control (Pitt 1992). Not recorded during present survey, suspected sightings should be reported to the Department of Primary Industry and Fisheries immediately.

CAESALPINIACEAE

# Parkinsonia aculeata  Parkinsonia
Noxious weed Class B, spread to be controlled. Serious threat to NT native communities (Parsons & Cuthbertson 1992). Spreading thorny shrub or tree to 6m; bark green; leaves long, narrow with minute
leaflets on both edges; flowers yellow. Forms dense thickets along river frontages and adjacent blacksoil plains. Native of tropical America, it is now naturalized in many areas south of 14.30' latitude.

*Parkinsonia* has the potential to become troublesome over considerably larger areas than are already infested. Dispersal by seed. Main method of spread is by birds and animals eating seed and voiding it, often with enhanced germination capacity, away from source. Seed pods float and are spread by streams and floodwaters. This species is considered one of the most trouble some weeds of grazing in the NT (ANPWS 1991).

Once established the weed is difficult to eradicate. It is difficult to control chemically and the remote location of most infestations makes chemical control prohibitively expensive (Parsons & Cuthbertson 1992). Attempts at cutting, slashing and bulldozing infestations can lead to an increase in suckering, spread and erosion risk. Burning may result in massive seed germination, however this technique can be utilized to reduce the residual seed bank if follow up control using herbicides is practiced (Wilson & Miller 1987).

Good control of mature trees is possible with herbicides; basal bark or cut stump treatments usually give better results than overall spray. Alternately apply liquid or granular Hexazinone concentrate to soil surface close to base of stems. This washes into soil with rains and slowly kills shrub (Parsons & Cuthbertson 1992).

Present control methods are physical and chemical. To be cost effective these must be carried out when infestations are small. Isolated trees or small colonies are the nucleus for the commencement of large stands and these should be targeted (Miller & Dance, 1984). Biological control is still in the early stages. Unit 8, 9, 20, 21, 26.

*Senna occidentalis*. Coffee Senna
Noxious weed Class B, spread to be controlled. Annual or short-lived perennial shrub to 2m; flowers yellow; pods brown, cylindrical with pale margins. Native of tropical America, it has become a problem weed in other tropical areas but is not yet a major weed in the Territory. Weed of roadsides, degraded pastures
and waste places. The seeds of coffee senna are toxic to livestock. Essential to the control of this weed is the maintenance of a vigorous pasture cover by reduced grazing pressure (Parsons & Cuthbertson 1992). Reputed to be tolerant of many herbicides (Smith 1991). Recorded on disturbed sites along river frontages, homestead area and bores, Unit 8,9.

CUCURBITACEAE

# *Citrullus lanatus* Wild Melon
Annual climbing or trailing herb, leaves deeply lobed, globular fruit with paler markings. On degraded pastures. Unit 11.

EUPHORBIACEAE

*Jatropha gossypifolia* Bellyache bush
Noxious weed Class B, spread to be controlled. Shrub to 1.5m; leaves deeply lobed; flowers red to brown; fruit dry, splitting. Relict weed of abandoned homesteads, mine sites and degraded range lands. Spread by seed. Capsules split open when ripe, sometimes explosively, throwing seeds. Dig out and burn single plants especially seedlings, remove as much of tuberous root system as possible. In larger colonies slash close to soil surface and swab with herbicide. Slashing alone encourages regeneration from roots (Parsons & Cuthbertson 1992).

FABACEAE

*Clitoria ternatea* Butterfly Pea
Sprawling or climbing perennial herb, flowers blue, pods oblong. Naturalized in some disturbed places, often near rivers.

LAMIACEAE

# *Hyptis suaveolens* Hyptis
Noxious weed Class B, spread to be controlled. Erect annual herb to 2m, small mauve-blue flowers, whole plant has a strong minty smell. Native of South America, now widespread in Darwin, Katherine, Gulf and Victoria River Districts. Establishes readily on all disturbed
soils (Parsons & Cuthbertson 1992). Weed of roadsides and overgrazed pastures particularly around stock yards and watering places. Seed germinates after opening rains of wet, remains in spined burr which catches on fur, clothing etc, and floats on water. Overgrazing encourages Hyptis (unpalatable). Small infestations can be removed manually and all plant material burnt prior to seeding. Chemical control is available and investigations are continuing on the biological control of Hyptis (Miller & Schultz, 1991). Recorded on river frontage, Unit 8, 9.

MALVACEAE

# Gossypium hirsutum Upland Cotton
Shrub to 3m, leaves circular, flowers white, seeds surrounded by dense floss. On edge of dense riparian vegetation, Red Lily Lagoon. Unit 1.

# Malvastrum americanum Spiked Malvastrum
Sub-shrub to 1.3m, flowers yellow to orange in dense terminal spikes. On disturbed sites along river frontage. Unit 1.

# Sida acuta Spinyhead Sida
Noxious weed Class B, spread to be controlled. Perennial herb or sub-shrub to 0.6m, flowers yellow, fruit dry and splitting. Weed of disturbed areas, degraded pastures and roadsides. Native of Central America. Disseminated by seed, aided by 2 awns at apex, which adhere to fur, clothing etc. Seed ingested by stock and excreted. Seeds prolifically, deep root system extends life of plant. Seed viable for long period due to hard impermeable seed coat. Single plants or small groups should be grubbed out before flowering. Spread should be minimized by slashing or mowing established plants just before flowering to reduce number of seed set and keep stock off infested pastures during fruiting period (Parsons & Cuthbertson 1992). Common on disturbed sites around living areas, bores and river frontage. Unit 8, 9, 21.
PASSIFLORACEAE

# Passiflora foetida  Wild Passionfruit
Woody vine with unpleasant smell; fruit globular, green becoming yellow-orange when ripe. A common weed of disturbed areas, in riparian vegetation heavily disturbed by pigs. Unit 1,la.

PEDALIACEAE

# Martynia annua  Devil's Claw
Class A, to be eradicated. Erect annual herb to 2m, reproducing by seed, leaves large, pumpkin-like; flowers mauve; green fleshy fruit tapering into a longish beak. Occurs as a weed in disturbed soils along roadsides, extending into overgrazed areas. Native of Mexico, it occurs as isolated colonies along the Roper River. Dispersal of seed is assisted by spines and claws on the fruit, which catch on animals and vehicles. Devil's Claw is a fast-growing plant which is not readily eaten by livestock and therefore is not restricted by grazing pressure. The plant is easily controlled by hand pulling or grubbing before it flowers. Single plants that have flowered should be removed carefully and burnt, in order to destroy any fruit attached (Parsons & Cuthbertson 1992). This species was not recorded during the present survey but was reported to be present by Aboriginal informants. Every effort should be made to eradicate this weed when sighted.

*Sesamum indicum*
Annual herb to 1.5m. Weed of disturbed areas, roadsides, drains etc. May spread along creek lines in wet season.

POACEAE

# Brachiaria mutica  Para grass
Perennial stoloniferous tussock grass to 2m tall. Introduced pasture grass, mainly confined to damp situations. Unit 9.

# Cenchrus ciliaris  Buffel grass
Perennial tussock grass, widely used for pasture improvement and regeneration. Unit 9.
# Chloris inflata
Glabrous annual or short-lived perennial grass to 1m tall. Unit 26.

# Cynodon arcuatus
Perennial creeping grass, forming mats. Unit 8.

Digitaria bicornis  Finger grass
Annual tussock grass, colonizer of bare areas (Petheram & Kok 1986).

# Pennisetum pedicellatum
Annual tussock grass, sometimes used for pasture improvement. Unit 2, 26.

5.2 Discussion

Expansive natural areas combined with the extensive areas of invasion, rapid plant growth rates and small populations to deal with the problems make northern Australia a national priority area for dealing with introduced plants (ANPWS 1991).

The infestation of native pastures by undesirable species whether they be exotic or native species is a form of degradation that is becoming of increasing concern in the north of Australia. When over-grazing, mis-use of fire and physical disturbance of the soil destroys native plants weeds have an opportunity to become established.

Plants such as Calotropis procera, Hyptis suaveolens, Sida spinosa, Acacia farnesiana and Parkinsonia aculeata invade areas where the native vegetation is in a debilitated condition or where the soil surface has been disturbed (ANPWS 1991).

The role of grazing is a critical issue for the management of weeds generally because control measures on lands subject to continuous disturbance amount to treating the symptoms of disease with an expensive palliative rather than a cure. The effect of domestic stock has to be viewed in the context of the contributory effects of feral animals such as rabbits, goats, pigs and horses (ANPWS 1991).
Insufficient attention has been paid to regeneration of native species and rehabilitation of disturbed communities after control. Habitats occupied by monocultures of introduced species are vulnerable to degradation unless precautions are taken to rehabilitate the land and ensure that it is colonized by native species. It can be assumed that bare ground will again be colonized by the same species or another exotic (ANPWS 1991).

5.2.1 Ecosystems most at risk.

Riparian systems are most heavily invaded within any given environment and are therefore at greatest risk. The importance of these systems, particularly at times of drought, increases the ecological seriousness of this situation (ANPWS 1991). Watercourses are inherently vulnerable to colonization by weeds. The spread of weeds along rivers is assisted by the natural regime of disturbance by regular raising and lowering of water tables, by periodic flooding and by dispersal of seeds and propagules by the water. In pastoral country they are areas of concentration of stock and in times of drought become important refuges.

Descriptive information from northern Australia suggests that invading shrubs exclude native species and, along riverbanks or other areas of increased moisture, can form impenetrable monospecific thickets. These shrubs, however, are associated with grazing and increased fire frequency which may be an integral part of the process of depletion of native flora and promotion of invasion of the exotic species.

Grazing in riparian vegetation may exert considerable pressure in dry periods and can have an adverse effect on native species, leading to erosion of river banks or the invasion by introduced species.

Each of the broadscale invasive shrubs described for northern Australia proliferates along watercourses as exemplified by Parkinsonia aculeata (ANPWS 1991)

Whilst no aquatic invasive species have been recorded on Elsey station, most if not all introduced aquatic species are spread by human agency. Consequently, any waterbody visited by people in connection with their work or for recreation is at risk. A high
proportion of invading aquatic plants become serious economic and environmental weeds (ANPWS 1991).

5.2.2 Weed Management

All data collected during this study and from previously published sources highlights the susceptibility of riparian systems to weed invasion, especially when associated with disturbance from grazing. Control methods for individual species have been outlined in the annotated species list. However, disturbance to these communities must be eliminated if long-term control is to be successful. Fencing of major watercourses and piping water to stock is essential to an effective weed control program.
6. MANAGEMENT GUIDELINES

6.1 Grazing Impact

The primary aim in the management of pastoral lands should be to protect the surface of the landscape from physical destruction; secondly to minimize detrimental changes to the flora and thirdly to monitor the impact on native fauna with the aim of preventing pressure being placed on individual species (Ledgar 1987).

Raising cattle and running a viable cattle enterprise are very important to the Aboriginal people living on Elsey station, however the sustainable management of the land must go hand in hand if there is to be a long term future for the industry. Northern savannas are more susceptible to the effects of grazing due to the extremes of seasonality and the consequent lower capacity of the grasses to regenerate (Tothill & Mott 1985).

Grazing lands in northern Australia are still semi-natural, the cattle industry being based on harvesting of native flora by domestic animals. The primary impact of these herbivores is to remove herbaceous biomass from plant community. The major effect of this is the long-term response of plant community which involves an overall decrease in perennial grasses and forbs and an increase in annual herbaceous and inedible woody plants and soil erosion (Wilson 1990). Few plant species have been lost entirely but there has been widespread local disappearance of mammals. Plant communities that have lost both cover and diversity are classed as degraded. An increase in bareground and erosion rate is common, particularly where animals congregate around water or along fences (Wilson 1990).

Generalist herbivores, such as cattle, prefer plants that are soft and green, choosing ephemerals while they are plentiful and softer perennial grasses or forbs that remain green during dry season. Browse shrubs are eaten mainly when other herbage has been consumed. Thus grazing pressure on browse shrubs is intermittent and only heavy during droughts. Pressure on ephemerals is also less than on perennials because brief periods of rapid growth exceed consumption and avoidance of grazing in Dry. In contrast, defoliation on perennial grasses, which provide nutritional forage
into the dry season, is prolonged and intense. These species have therefore suffered widespread decline in abundance in grazed communities. Unpalatable shrubs have been encouraged by release from competition (Wilson 1990).

Total community response to these various influences of grazing is a decrease in species both sensitive to defoliation and palatable (decreasers) and an increase in species resistant to grazing or unpalatable (increasers). Sustained high grazing pressure leads to subsequent decline in diversity, because of the combined effect of heavy defoliation pressure and loss of landscape variability through soil erosion (Wilson 1990).

The floristic shifts experienced presently by pastures is a move from perennials towards annual species. Christie (1984) identifies shifts in botanical composition or, the replacement of one type of plant cover with that of another, as one of the best means of detecting overgrazing. As perennials are vital for range stability (Payne et al 1974) these floristic shifts must be viewed as highly undesirable. Mott and Andrews (1985) have shown that for perennials such as Themeda australis and Dicanthium fecundum the maintenance of the community depends on the long-lived individual tussocks. All seedlings germinating in one wet season died in the following dry, with no recruitment into the mature sward.

Heavy grazing during the wet season can prevent seed set and species may be lost from the community (Mott & Andrew 1985). In perennial communities the poor natural recruitment also means that if plants are killed regeneration of a productive sward may be long and costly.

Pastoral activities will only become established as a sustainable landuse with further development of a conservation ethic among landholders, improved monitoring of vegetation change and further research into management (Wilson 1990).

By far the greatest problem Elsey station has faced historically is degradation of the environment caused by overgrazing by domestic and feral stock. Over the last century, high densities of cattle and feral stock have led to changes in composition of native grasslands, loss of vegetative cover, change in run-off and water-holding capacity of the soil, extensive and severe erosion and destruction of waterside vegetation.
Three communities on Elsey station were identified as badly degraded, having at least 50% of surveyed sites in poor condition (see Payne et al, 1974):

Unit 10 Eucalyptus patellaris, Erythrophleum chlorostachys woodland/open-woodland with Chrysopogon, Sehima nervosum grassland understorey. Poor sites were typified by low cover values in the ground layer and a dominance of Aristida spp.

Unit 11 Eucalyptus pruinosa low woodland/open-woodland with Chrysopogon, Aristida spp. open-grassland understorey. Poor sites had very low ground cover values dominated by intermediate and undesirable species, particularly Aristida spp. Active gully erosion was noted on many sites.

Unit 24 Melaleuca acacioides, Eucalyptus pruinosa low woodland/low open-woodland with Chrysopogon, Aristida spp. open-grassland understorey. Poor sites exhibited greatly reduced ground cover values and erosion.

These communities are mapped on a 1:100,000 overlay along with areas of bare soil visible on the Landsat Imagery.

Monitoring points need to be established in major vegetation communities to enable the long term analysis of pasture composition. Detecting changes in the composition of decreaser and increaser species is fundamental to sustainable pasture management and stocking rates should be adjusted accordingly.

From present data it is clear that Units 10, 11 and 24 have suffered significant degradation and these communities should be destocked and new paddocks positioned to avoid these communities. The shallow skeletal soils of Unit 11 in particular appear unable to sustain grazing animals without degradation.

6.2 Feral Animals

The removal of feral animals and rehabilitation of degraded land is a critical management requirement. The Brucellosis and Tuberculosis Eradication Campaign has done much to eradicate feral stock on Elsey station, however there is still a significant feral donkey population. Donkeys are extremely difficult to eradicate due to
very high reproductive rates and attainable densities and their ability to subsist on low quality food resources. These factors also determine a very rapid recovery following incomplete shoot-outs. It is recommended that shooting of feral donkeys by private contractors be undertaken on an annual basis.

Feral pigs are also present in significant numbers in the swamp systems of the Roper River where they pose a significant threat to native vegetation. Pigs are seen as detrimental to the traditional gathering grounds of the swamp systems by the Aboriginal owners. A control program should be implemented to reduce the number of feral pigs.

6.3 Fire

The effects of fire on the northern savannas is still little understood and indeed the object of much contention. In pastoral lands the four principal reasons for fire management are control of woody plants, stimulation of herbage growth, decrease of wildfire hazard or to exclude fire altogether from sensitive vegetation communities (Harrington et al 1984).

The current practice of burning to create a "green pick" for large numbers of hardhoofed animals is only a relatively recent innovation. The consequences of this practice include: damage to seedlings; destruction of micro-organisms in the litter layer; nutrient loss; damage to mature trees and an increase in the likelihood of soil erosion occurring (ANFWS 1991).

Bridge et al (1983) in a trial area at Katherine that was burnt annually and subjected to weekly clippings to simulate overgrazing, found that the perennial grass understorey almost totally died out by the second wet season.

Burning during dry intervals of the wet season can cause a change in the species composition of the sward. The early wet season germination of Sorghum spp. makes the sward susceptible to fire, with burning during the wet season killing seedlings without the possibility of further germination because of the exhausted soil seed store (Mott & Andrew 1985).
Within the annual community, dry season fires were found to have little effect on the yield of the sward, although absolute numbers in the burnt sward were reduced both by death of seed and a poorer establishment on the burnt ground (Mott & Andrew 1985).

While fire may be able to be used as a management tool to spell native pasture from grazing pressure, there is also evidence to suggest that grazing on fresh post-burn growth at the start of the rainy season is very injurious to the perennial grasses (Andrews 1986).

Despite vigorous, ongoing debate concerning the effects of different fire regimes on eucalypt dominated savannas, it is widely accepted that late dry season fires are highly destructive of monsoon rainforest vegetation. The riparian forests fringing the Roper River and associated swamps need to be protected from wildfires. This is most easily achieved by burning fire breaks.

A fire strategy needs to be established based on a variety of criteria including protection of fire-sensitive monsoon vine forest vegetation, paddocks, living areas and rehabilitation plots; avoidance of late dry season wildfires and legislation relating to burning. Optimum policy is most likely to be one which uses patchwork burning to maintain a wide range of vegetation ages and types. A detailed fire history map should be maintained for ongoing management purposes.

6.4 Erosion

Erosion is a natural process and an important factor in soil formation. Accelerated erosion, the loss of soil at a greater than natural rate, is however the major contributor to land degradation (Ledgar 1987).

Wind and water erosion are the two most common forms of erosion. Both result in a breakdown of the soil structure, wholesale movement of soil particles and the deposition of the material elsewhere (Ledgar 1987).

Aldrick and Wilson 1992 identified soil erosion as the most significant type of land degradation likely to occur in the area. They found that the marked climatic seasonality, high intensity wet
season rainfall and the susceptible nature of many of the soils, made even very low slopes susceptible to erosion if disturbed. Erosion was reported on disturbed sites around homesteads, cattle yards, areas subjected to high stock-watering pressures, fencelines, cattle "camp" areas, alluvial terrace edges and stream banks.

Areas identified as highly susceptible to erosion were: terraces and stream banks in McArthur land system, exposed soils of the Coolibah land system (clay plains), land unit 2 of Cliffdale land system and land unit 3 of Nutwood land system (which are very erodible and in most cases already quite seriously eroded), land units 2 and 3 in Strangways land system and sometimes land unit 2 in Patterson land system.

Areas of erosion visible on the Landsat Imagery have been mapped on a 1:100,000 overlay. Rehabilitation of degraded land is a critical management requirement. Long-term systematic and monitored experimentation should be undertaken using native species as pioneers. Rehabilitation measures could be documented such that Elsey station is capable of providing an example for restoration of degraded lands in the Top End.

6.5 Natural Waters

Availability of water also determines the grazing patterns of animals. Natural permanent waterholes and artificial waters receive extremely high grazing pressure towards the end of the dry season as intermittent water holes dry up thus restricting the animals ability to move. As cattle will not generally travel further than 5 km from water these areas become overgrazed (Ledgar 1987). Condon (1986) found that the most extensive areas of erosion in the Victoria River District occur in association with watercourses.

In the Top End where most of the rivers are perennial, damage to the river banks through trampling is a major cause for concern. These rivers during the wet season generally flow over the top of their banks. The high volume and velocity of the water scours the banks removing all loose soil. Cattle and horses grazing the river banks, especially in the late dry season remove grass cover and loosen the soil.
Frontage communities around permanent waterholes, along creeks and rivers and in gorges below springs are inherently fragile and susceptible to damage. These communities showed evidence of damage by cattle, pigs, fire and weed invasion. Destruction of this riparian vegetation can lead to erosion and rapid decline in water quality.

Swamp lands in particular are very susceptible to damage by foraging pigs and buffalo. Aldrick and Wilson 1992 reported a large feral pig population in the Red Lily land system. Pigs were observed feeding on water plants in shallow lagoons in this area. They considered that significant damage could be done to Red Lily land system if pig or buffalo populations were not controlled.

Grazing requires access to water but in the process does considerable damage to unique vegetation along waters edge. A simple solution is to fence off river edge and pipe water to stock (Wilson 1990).

6.6 Tourism

The Aboriginal owners expressed strong opposition to the presence of tourists and with regards to their wishes no tourist facilities should be developed on the station. Tracks leading off the Roper Highway should be signposted limiting access and stating that no hunting or fishing is allowed on the property.
7. MONITORING POINTS

Current knowledge on the long-term effects of grazing, fire, climate variability and weed infestations is rudimentary. Monitoring points enable changes in range condition to be assessed, a vital component of rangeland research and integral to the goal of sustainable development.

In consultation with the Pastoral Branch of the Department of Lands and Housing, a network of monitoring points should be established.
8. REVEGETATION AND REHABILITATION PROGRAM

8.1 Rehabilitation

Symptoms of vegetation, soil and land abuse include water and wind erosion, vegetation decline, species loss, deterioration of land improvements (eg fences, roads) and a decline in economic production. Degraded land provides unfavorable environment for plant establishment and growth (Malcolm 1990).

The primary aim of rehabilitation is to stop problem getting worse, the secondary aim is to improve affected area. If rehabilitation is to be successful decisions need to be made as to what the objectives are. Is the purpose of the rehabilitation to provide palatable feed for cattle; or to stabilize eroded areas; or to restore the native vegetation? The objectives could be a combination of these goals.

For rehabilitation to be successful it must return the land to a condition where it is able to be self sustaining and not just provide vegetation for the resumption of grazing (Ledgar 1987).

Rehabilitation work has been aimed at the stabilization of the soil using introduced species such as Buffel Grass (*Cenchrus ciliaris*) and Kapok Bush (*Aerva javanica*). There is an obvious need for more research into the use of native grasses and shrub species if the ecological balance is to be maintained.

Regeneration programs have not even begun to make an impression on the huge areas of degraded land. They are expensive and time consuming. Management regimes that prevent the degradation from occurring in the first place must be implemented.

Degraded areas have been identified and mapped on a 1:100,000 overlay. The rehabilitation and revegetation requirements of these areas is still being assessed in conjunction with Mike Clark of Greening Australia and management guidelines will be presented as a separate document at a later date.
8.2 Amenity plantings

Aldrick and Wilson (1992) report that the sandy soils occurring in Blain, Elsey Creek and possibly Claravale, Langdon and Lindsay may be irrigable for tree crops such as cashews or mangoes. Discussions with traditional owners revealed a high level of interest in establishing orchards of edible fruit such as mangoes and citrus. This would provide a much appreciated supply of fresh fruit and possibly income through sales of excess crop.

Areas already degraded by past land clearing such as the airstrip to the East of the station homestead could be utilized. Water is accessible from the nearby Roper River, however further study needs to be done into the suitability of the water for long-term irrigation due to reported high levels of salts, and the suitability of the soil at this site.

Little or no interest was shown in the idea of a timber plantation for long-term financial return. Further discussion of this idea may however be beneficial.

There is a strong desire for more trees to be planted within the community housing area. Trees are seen as important components of the landscape for shade, dust control and fruit. Suggested species included mango, banana, pawpaw, tamarind and Eucalyptus camaldulensis. Interest was also expressed in the planting of "bush tucker" species, this could be done in conjunction with the community school which has received funding for a shade house from Greening Australia's Schools Grants Program.
ACKNOWLEDGEMENTS

The author is particularly grateful for the assistance and guidance provided by the Jilkminggan community, especially Jessie Roberts, Eileen Daylight and Harriet Daniels. Neville and Annette Trout provided invaluable local advice and unfailing interest in the project.

Ian Cowie, Clyde Dunlop and Greg Leach (N.T. Herbarium) provided assistance with plant identification.

Peter Brocklehurst generously provided access to the CCNT Vegetation Map database and to the Geographic Information System used to produce the final vegetation map. Duncan Rance digitized the vegetation map.

David Liddle (CCNT, Darwin) made available unpublished Rainforest Flora Survey data.

Mike Clark (GANT), Ross Coburn and Danny Collins (NLC) designed the initial project and provided guidance during the course of the work.

Funding was provided through a Greening Australia Community Grants Program and the Northern Land Council.

Finally, Nic Gambold must be gratefully acknowledged for his enthusiasm, guidance and long hours of childcare.
REFERENCES


Petheram, R.J. & Kok, B. 1986. *Plants of the Kimberley Region of Western Australia*. University of Western Australia Press, W.A.


APPENDIX A.

Plant species recorded on Elsey Station and adjacent area. List includes species recorded during field reconnaissance for this project plus records on the Conservation Commission Herbarium database for the area bounded by 14.38 N, 15.20 S and 132.55 W, 133.55 E. * denotes naturalised introduced species.

<table>
<thead>
<tr>
<th>PTERIDOPHYTA (Ferns)</th>
<th>AMARANTHACEAE</th>
</tr>
</thead>
<tbody>
<tr>
<td>HEMIONITIDACEAE</td>
<td>Achyranthes aspera</td>
</tr>
<tr>
<td>Platyzoma microphyllum</td>
<td>* Aerva javanica</td>
</tr>
<tr>
<td>MARSILEACEAE</td>
<td>Alternanthera angustifolia</td>
</tr>
<tr>
<td>Marsilea hirsuta</td>
<td>Alternanthera nodiflora</td>
</tr>
<tr>
<td>OLEANDRACEAE</td>
<td>Gomphrena affinis</td>
</tr>
<tr>
<td>Nephrolepis biserrata</td>
<td>Gomphrena canescens</td>
</tr>
<tr>
<td>Nephrolepis hirsutula</td>
<td>* Gomphrena celosoiides</td>
</tr>
<tr>
<td>PARKERIACEAE</td>
<td>Ptliotus corymbosus</td>
</tr>
<tr>
<td>Ceratopteris thalictroides</td>
<td>Ptliotus exaltatus</td>
</tr>
<tr>
<td>PTERIDACEAE</td>
<td>Ptliotus fusiformis</td>
</tr>
<tr>
<td>Acrostichum speciosum</td>
<td>Ptliotus spicatus</td>
</tr>
<tr>
<td>SCHIZAEEACEAE</td>
<td>Pupalia lappacea</td>
</tr>
<tr>
<td>Lygodium flexuosum</td>
<td>ANACARDIACEAE</td>
</tr>
<tr>
<td>SINOPTERIDACEAE</td>
<td>Buchanania obovata</td>
</tr>
<tr>
<td>Cheilanthes ?hirsuta</td>
<td>ANNONACEAE</td>
</tr>
<tr>
<td>ANGIOSPERMAE (Flowering Plants)</td>
<td>Polyalthia australis</td>
</tr>
<tr>
<td>ACANTHACEAE</td>
<td>APOCYNACEAE</td>
</tr>
<tr>
<td>* Barleria prionitis</td>
<td>Alstonia actinophylla</td>
</tr>
<tr>
<td>Dicliptera arnhemica</td>
<td>Carissa lanceolata</td>
</tr>
<tr>
<td>Dicliptera armata</td>
<td>Tabernaemontana pandacaqui</td>
</tr>
<tr>
<td>Hygrophi/a angustifolia</td>
<td>Wrightia saligna</td>
</tr>
<tr>
<td>Hypoestes floribunda</td>
<td>APONOGETONACEAE</td>
</tr>
<tr>
<td>Nelsonia campestris</td>
<td>Aponogeton elongatus</td>
</tr>
<tr>
<td>Rostellularia adscendens</td>
<td>ARECACEAE</td>
</tr>
<tr>
<td>AIZOACEAE</td>
<td>Livistona rigida</td>
</tr>
<tr>
<td>Trianthema pilosa</td>
<td>Livistona humilis</td>
</tr>
<tr>
<td>Trianthema rhynchoalyptra</td>
<td>ASCLEPIADACEAE</td>
</tr>
<tr>
<td>Trianthema triquetra</td>
<td>* Calotropis procera</td>
</tr>
<tr>
<td>ALIZMATAECEAE</td>
<td>Gymnanthera oblonga</td>
</tr>
<tr>
<td>Caldesia oligococca</td>
<td>Marsdenia viridiflora</td>
</tr>
<tr>
<td></td>
<td>Tylophora cinerascens</td>
</tr>
</tbody>
</table>
ASTERACEAE
* Acanthospermum hispidum
Blumea axillaris
Eclipta platyglossa
Epaltes australis
Flavera australisica
* Parthenium hysterophorus
Pterocaulon serrulatum
Pterocaulon verbascifolium
Streptoglossa bubakkii
Streptoglossa odorata
Wedelia verbesinoides

BIGNONIACEAE
Dolichandrone filiformis
Dolichandrone heterophylla

BIXACEAE
Cochlospermum fraseri

BORAGINACEAE
Ehretia saligna
Heliotropium bracteatum
Heliotropium crispatum
Heliotropium ovalifolium
Heliotropium tenuifolium
Trichodesma zeylanicum

BURSERACEAE
Canarium australianum

CAESALPINIACEAE
Chamaectista absus
Erythrophleum chlorostachys
Lysiphyllum cunninghamii
* Parkinsonia aculeata
Senna costata
Senna notabilis
* Senna occidentalis
Senna oligocladia
Senna planitiicola
Senna venusta

CAPPARACEAE
Capparis lasiantha
Capparis umbonata
Cleome cleomoides
Cleome tetrandra
Cleome viscosa

CARYOPHYLLACEAE
Polycarpaea breviflora
Polycarpaea longiflora
Polycarpaea spirostylis
Polycarpaea staminodina

CASUARINACEAE
Casuarina cunninghamiana

CELASTRACEAE
Denhamia obscura
Maytenus cunninghamii

CHENOPODIACEAE
Halosarcia sp.

COMBRETACEAE
Terminalia arostrata
Terminalia bursarina
Terminalia canescens
Terminalia erythracarpa
Terminalia grandiflora
Terminalia platypylla
Terminalia platyptera
Terminalia pterocarya
Terminalia savannicola
Terminalia volucris

COMMELINACEAE
Commelina ensifolia
Commelina lanceolata
Cyanotis axillaris
Murdannia gigantea
Murdannia graminea

CONVOLVULACEAE
Bonamia media
Bonamia pannosa
Cressa cretica
Evolvulus alsinoides
Ipomoea diamantinensis
Ipomoea diversifolia
Ipomoea eriocarpa
Ipomoea nil
Ipomoea polymorpha
Jacquemontia browniana
Merremia gemella
Operculina brownii
Polymeria ambigua
Xenostegia tridentata
CUCURBITACEAE
* Citrullus lanatus
Cucumis melo
Mukia maderaspatana
Mukia micrantha
Trichosanthes cucumerina

CYPERACEAE
Bulbostylis barbata
Cladium mariscus
Crosslandia setifolia
Cyperus aquatilis
Cyperus breviculmis
Cyperus carinatus
Cyperus castaneus
Cyperus conicus
Cyperus cunninghamii
Cyperus eleusinoides
Cyperus flavicomus
Cyperus javanicus
Cyperus portae-tartari
Cyperus pygmaeus
Cyperus victoriensis
Eleocharis atropurpurea.
Eleocharis dulcis
Eleocharis geniculata
Eleocharis nuda
Eleocharis sundaica
Fimbristylis densa
Fimbristylis dichotoma
Fimbristylis dolera
Fimbristylis ferruginea
Fimbristylis littoralis
Fimbristylis nuda
Fimbristylis pachyptera
Fimbristylis rupestris
Fimbristylis schultzii
Fimbristylis sieberana
Fimbristylis signata
Isolepis humillima
Rhynchospora sp.
Schoenoplectus lateriflorus
Schoenoplectus litoralis
Schoenoplectus praelongatus
Schoenus falcatus
Scleria ?lithosperma
Scleria novae-hollandiae
Scleria rugosa

DIOSCOREACEAE
Dioscorea bulbifera

EBENACEAE
Diospyros cordifolia
Diospyros humilis

ERIOCAULACEAE
Eriocaulon cinereum

ERETHROXYLACEAE
Erythroxylum ellipticum

EUPHORBIACEAE
Adriana glabrata
Antidesma ghaesemballa
Breynia cernua
Breynia rhyynchocarpa
Bridelia tomentosa
Croton arnhemicus
Croton habropetalus
Euphorbia comans
Euphorbia mitchelliana
Euphorbia schultzii
Euphorbia vachellii
Euphorbia sp. C
Exoecaria parvifolia
Flueggea virosa
Glochidion disparipes
* Jatropha gossypifolia
Leptopus decaisnei
Mallotus nesophilus
Margaritaria dubium-traceyi
Petalostigma banksii
Petalostigma pubescens
Petalostigma quadriloculare
Phyllanthus coccoides
Phyllanthus fuernrohrri
Phyllanthus maderaspatensis
Phyllanthus reticulatus
Phyllanthus simplex
Phyllanthus trachygynne
Sauropus trachyspermus
Sebastiania chamaelea

FABACEAE
Abrus precatorius
Aeschynomene indica
Alysicarpus rugosus
Bossiaea bossiaeoides
Cajan marmoratus
Chamaectista absus
* Clitoria ternatea
Crotalaria crispata
Crotalaria medicaginea
FABACEAE
Crotalaria novae-hollandiae
Desmodium filiforme
Desmodium Muelleri
Desmodium A25477
Erythrina vespertilio
Flemingia pauciflora
Galactia muelleri
Galactia tenuiflora
Indigofera colutea
Indigofera hirsuta
Indigofera linifolia
Indigofera trita
Jacksonia dilatata
Psoralea balsamica
Rhyncosia minima
Sesbania cannabina
Sesbania chippendalei
Sesbania simplificuscula
Tephrosia brachyodon
Tephrosia leptoclada
Tephrosia oblongata
Tephrosia phaeosperma
Tephrosia remotiflora
Tephrosia reticulata
Tephrosia spechtii
Tephrosia D1883
Uralia lagopodoide
Vigna lanceolata
Vigna vexillata
Zornia muriculata

FLAGELLARIACEAE
Flagellaria indica

GENTIANACEAE
Centaurium spicatum
GOODENIACEAE
Goodenia hispida
Scaevola amblyanthera
Scaevola ovalifolia

HERNANDIACEAE
Gyrocarpus americanus

HYDROCHARITACEAE
Hydrilla verticillata
Maidenia rubra
Ottelia alismoides
Ottelia ovalifolia
Vallisneria spiralis

HYDROPHYLLACEAE
Hydrolea zeylanica

JUNCAGINACEAE
Triglochin procerum

LAMIACEAE
Basilicum polystachyon
Epimeredi salviifolius
*Hyptis suaveolens
Ocimum tenuiflorum

LAURACEAE
Cassytha filiformis

LECITHIDACEAE
Barringtonia acutangula
Planchonia careya

LEMNACEAE
Spirodela polyrhiza

LENTIBULARIACEAE
Utricularia aurea
Utricularia chrysantha
Utricularia muelleri

LILIACEAE
Crinum angustifolium
Protastrapus racemosus

LOGANIACEAE
Mitrasacme connata
Strychnos lucida

LORANTHACEAE
Amyema benthamii
Amyema bifurcatum
Amyema miquelii
Amyema sanguineum
Amyema villiflora
Decaisnina signata
Dendrophthoe acacioides
Dendrophthoe odontocalyx
Lysiana spathulata
MALVACEAE
Abelmoschus ficulneus
Abutilon andrewsianum
Abutilon leucopetalum
Abutilon otocarpum
Gossypium australe
Gossypium hirsutum
Hibiscus leptocladus
Hibiscus merauakensis
Hibiscus microchlaenus
Hibiscus panduriformis
Hibiscus pentaphyllus
* Malvastrum americanum
* Sida acuta
Sida fibulifera
Sida macropoda
Sida rohlenae
Sida spinosa
Urena australiensis

MELIACEAE
Owenia vernicosa

MENISPERMACEAE
Tinospora smilacina

MIMOSACEAE
Acacia ampliceps
Acacia aulacocarpa
Acacia "calcigera"
Acacia difficultis
Acacia dimidiata
Acacia ditricha
Acacia dunnii
Acacia farnesiana
Acacia galioides
Acacia gonooclada
Acacia hammondii
Acacia hemignosta
Acacia holosericea
Acacia humifusa
Acacia megalantha
Acacia neurocarpa
Acacia pachyphloia
Acacia pallidifolia
Acacia platycarpa
Acacia shirleyi
Acacia torulosa
Acacia umbellata
Acacia victoriae
Albizia canescens
Cathormion umbellatum

Dichrostachya spicata
Neptunia dimorphantha
Neptunia gracilis
Neptunia major
Neptunia monosperma
Prospis limensis

MORACEAE
Ficus coronulata
Ficus hispida
Ficus leucotricha
Ficus opposita
Ficus platypoda
Ficus racemosa
Ficus virens
Ficus D17207

MYOPORACEAE
Myoporum acuminatum

MYRTACEAE
Calytrix brownii
Calytrix exstipulata
Eucalyptus alba
Eucalyptus aspera
Eucalyptus bigalerita
Eucalyptus bleeseri
Eucalyptus camaldulensis
Eucalyptus chlorophylla
Eucalyptus clavigera
Eucalyptus confertiflora
Eucalyptus cyanoclada
Eucalyptus dicromophloia
Eucalyptus distans
Eucalyptus ferruginea
Eucalyptus foelscheana
Eucalyptus grandiflora
Eucalyptus latifolia
Eucalyptus leucophloia
Eucalyptus microtheca
Eucalyptus miniata
Eucalyptus ollaris
Eucalyptus papuana
Eucalyptus patellaris
Eucalyptus phoenicea
Eucalyptus polycarpa
Eucalyptus pruinosa
Eucalyptus setosa
Eucalyptus tectifica
Eucalyptus terminalis
Eucalyptus tetradoanta
Eucalyptus tintinnans
MYRTACEAE (cont)
Eucalyptus tokwa
Eucalyptus umbrarwarrensis
Lophostemon grandiflorus
Melaleuca acacioides
Melaleuca cajuputi
Melaleuca citrorensis
Melaleuca dealbata
Melaleuca leucadendra
Melaleuca nervosa
Melaleuca stenostachya
Melaleuca viridiflora
Syzygium forte
Verticordia cunninghamii

NAJADACEAE
Najas graminea
Naua tenuifolia

NELUMBONACEAE
Nelumbo nucifera

NYCTAGINACEAE
Boerhavia coccinea
Boerhavia paludosas
Boerhavia schomburgkiana

NYMPHAEACEAE
Nymphaea gigantea
Nymphaea macroserperma
Nymphaea violacea

OLEACEAE
Jasminum molle

ONAGRACEAE
Ludwigia octovalvis
Ludwigia perennis

ORCHIDACEAE
Cymbidium canaliculatum

PANDANACEAE
Pandanus spiralis
Pandanus aquaticus

PASSIFLORACEAE
* Passiflora foetida

PEDALIACEAE
* Martynia annua
* Sesamum indicum

POACEAE
Aristida holathera
Aristida hygrometrica
Aristida inaequiglumis
Aristida ingrata
Aristida latifolia
Aristida queenslandica
Aristida schultzii
Astrebla elymoides
Astrebla pectinata
Astrebla squarrosa
Bothriochloa bladhii
Bothriochloa ?ewartiana
* Brachiaria mutica
Brachiaria polyphylla
Brachiaria pubigera
Brachiaria reptans
Brachiaria subsquarrosa
Brachyachne convergens
* Cenchrus ciliaris
Cenchrus elymoides
Chamaeraphis hordeacea
Chionachne cyathopoda
Chionachne hubbardiana
* Chloris inflata
Chloris pumilio
Chrysopogon fallax
Chrysopogon pallidus
Cymbopogon procerus
* Cynodon arcutus
Dactyloctenium radulans
Dichanthium fecum Demonstrates
Dichanthium sericeum
* Digitaria bicornis
Diplachne parviflora
Echinochloa colona
Echinochloa elliptica
Echinochloa turneriana
Ectrosia leporina
Ectrosia schultzii
Elytraphorus spicatus
Enneapogon pallidus
Enneapogon polyphyllus
Enneapogon purpurascens
Eragrostis cunningii
Eragrostis tenellula
Eriachne armittii
Eriachne ciliata
Eriachne glauca
Eriachne obtusa
Eriachne sulcata
Eriochloa procera