

**A TRIAL MANAGEMENT PROGRAM FOR  
*PTYCHOSPERMA BLEESERI* BURRET  
IN THE  
NORTHERN TERRITORY OF AUSTRALIA**

**PARKS AND WILDLIFE COMMISSION OF THE  
NORTHERN TERRITORY**

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# 1. INTRODUCTION

## 1.1 Species Subject to Management

Class: Liliopsida  
Order: Arecales  
Family: Arecaceae  
Genus/Species: *Ptychosperma bleeseri* Burret

## 1.2 Responsible Authority

Parks and Wildlife Commission of the Northern Territory  
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## 1.3 Overview

*Ptychosperma bleeseri* is a slender clumping palm endemic to rainforests in the Northern Territory of Australia and is listed as nationally endangered (EFN 1993). The species is known from eight rainforest patches all of which are wet, spring fed forests located on the margin of the Adelaide River floodplain or on the Howard River system to the east of Darwin (Barrow *et al.* 1993). The extent of the species range is 30km long by 20km wide and the total area of occupancy is 40ha. Information on individual populations is provided in the background (Section 9).

The recognized threats to *P. bleeseri* or its habitat include wildfire, introduced animals (buffalo *Bubalus bubalis*, cattle *Bos indicus*, pigs *Sus scrofa*), weeds (Duff *et al.* 1992) and hybridisation with ornamental *Ptychosperma* species introduced to gardens in the local area (Shapcott in press). Illegal harvesting is no longer a problem. Factors likely to be important in the long term, but less clearly understood, include: changes in the quality and quantity of groundwater through extractive mining, horticulture and rural residential subdivision (Liddle *et al.* 1996).

## 1.4 Legislation

### 1.4.1 Northern Territory

The palm *Ptychosperma bleeseri* is a specially protected plant under sections 45 and 47 of the *Territory Parks and Wildlife Conservation Act 1993*.

As with all specially protected plants, a licence or permit is required to take *P. bleeseri* plants or plant material, except for non-commercial use by the owner or lawful occupant of private land. Under section 51 the owner or person in occupation of private land shall not wilfully destroy a

specially protected plant, although it is a defence from prosecution if the defendant proves that the destruction resulted from the reasonable and efficient lawful use of the land.

Provision exists for support by the Parks and Wildlife Commission in the management of *P. bleeseri* on various types of land tenure. The legislative basis for such support under the *Territory Parks and Wildlife Conservation Act* is summarised below:

**On Reserved Land:** Parks and Reserves may be declared under section 12 and Plans of Management are prescribed under sections 18 and 19.

**On Aboriginal Land:** the Parks and Wildlife Commission may enter into an agreement with an Aboriginal Land Council relating to schemes for the protection and conservation of wildlife under section 73.

**On Private Land:** the Parks and Wildlife Commission may enter into an agreement with a land owner relating to schemes for the protection and conservation of wildlife under section 74.

The Parks and Wildlife Commission may formulate and implement programs for the purposes of the protection, conservation, management and control of wildlife under section 75.

The *Environmental Assessment Act 1982* provides a means of assessing the impact of proposed developments on *P. bleeseri* populations.

Declaration of specific sites under the *Heritage Conservation Act 1991* recognises their value as a part of the Territory's natural history.

#### **1.4.2 Commonwealth**

*Ptychosperma bleeseri* is listed as endangered on Schedule 1, Part I of the Commonwealth's *Endangered Species Protection Act 1992*. A recovery plan for the species was prepared by Liddle *et al.* (1992) and while the process of formal endorsement by the Federal Minister has not been completed, there has been substantial support from the Commonwealth for the management of the species and its habitat.

Within Black Jungle Conservation Reserve, the rainforest at Black Creek and portions of the rainforests at Crocodile Creek and BJ3 are listed in the Register of the National Estate under the *Australian Heritage Commission Act 1975*.

*Ptychosperma bleeseri* is listed under Schedule 1, Part IV of the Commonwealth's *Wildlife Protection (Regulation of Exports and Imports) Act 1982*. Under section 21 and Schedule 1, Part I, the export of a *P. bleeseri* plant or any part of a plant except seed is prohibited other than in accordance with a permit or an authority issued under the Act.

#### **1.4.3 International**

*Ptychosperma bleeseri* is not subject to any international agreements. The Commonwealth's *Wildlife Protection (Regulation of Exports and Imports) Act 1982* governs the export of native flora. Importing countries may have their own specific requirements.

## 2. OBJECTIVES

This management program aims at the long term conservation of *Ptychosperma blesseri* and its habitat, and seeks to:

1. Maintain stable populations or improve the size class and structure in wild populations of *P. blesseri*, specifically:
  - 1.1 maintain a stable population size and structure at Crocodile Creek Rainforest;
  - 1.2 increase the number of sub-adult or adult plants at Bankers Jungle, Black Creek, BJ3 and Whitewood Road Rainforests;
  - 1.3 increase the number of adult plants at Taminmin Rainforest;
  - 1.4 maintain the current population size at the 7km and 8km Rainforests.
2. Promote the conservation of *P. blesseri* populations and habitat through community participation by:
  - 2.1 consulting with landholders and, where appropriate, entering into agreements under the *Territory Parks and Wildlife Conservation Act* for the management of *P. blesseri* habitat;
  - 2.2 involving landholders and community groups through representation on a recovery team;
  - 2.3 encouraging community groups to adopt rainforests;
  - 2.4 promoting public awareness and education through public talks, print and electronic media.
3. Provide for the conservation of the species and its habitat through appropriate land use planning, including:
  - 3.1 ensuring that, where relevant, the potential impact on *P. blesseri* populations is included in advice provided by Parks and Wildlife Commission to other Government agencies and planning authorities on land use in the Howard and Adelaide River catchments;
  - 3.2 ensuring the conservation of *P. blesseri* populations and habitat is addressed in the Plan of Management for Black Jungle Conservation Reserve;
  - 3.3 investigate the potential for and desirability of establishing additional populations in National Parks and Reserves.
4. Allow the establishment and maintenance of *ex-situ* populations by:

- 4.1 maintaining a collection of *P. bleeseri* plants in the Darwin Botanic Gardens and the Territory Wildlife Park;
  - 4.2 providing for the harvest of plant material to establish *ex-situ* populations or other purposes that contribute to the conservation of the species.
5. Carry out essential monitoring and research, including:
  - 5.1 periodic monitoring of the size and demographic characteristics of wild populations, and the position of the boundaries of the rainforest patches;
  - 5.2 developing a population model that will allow prediction of the outcome of various management prescriptions;
  - 5.3 investigating potential threats to the genetic integrity of *P. bleeseri* populations and monitoring the impact of surrounding land use on ground water, and pollution of surface waters.

### **3. MANAGEMENT**

#### **3.1 Maintenance of Wild Populations**

Management actions to date have focused on threats from wildfire, introduced animals and weeds (Liddle *et al.* 1996). While these disturbance factors impinge on all *P. bleeseri* rainforests, the pressure from individual factors varies from location to location.

##### **3.1.1 Crocodile Creek Rainforest**

The rainforest at Crocodile Creek retains the only large, stable population of *P. bleeseri* and management will be aimed at maintaining the current status of this population through an ongoing program of fire, feral animal and weed control.

##### **3.1.2 Bankers Jungle, Black Creek, BJ3 and Whitewood Road Rainforests**

These populations all exhibit a paucity of sub-adult plants or have been exposed to severe disturbance from fire within the last five years. Black Creek and BJ3 are located on the Black Jungle Conservation Reserve and will be subject to an ongoing program of fire management and feral animal control. Control of *Mimosa pigra* will continue on the floodplain adjacent to Black Creek.

Current land management for pastoral purposes has resulted in a reduced risk of fire at Bankers Jungle. In co-operation with the landholder, management activities will continue to focus on the exclusion of introduced animals (buffalo, cattle and pigs) from the rainforest.

Fire remains the primary threat to the Whitewood Road rainforest. In co-operation with the landholder, management will continue to focus on the control of wildfire. In an attempt to control the invasion of the exotic grasses, *Pennisetum polystachion* and *Pennisetum pedicellatum*, a weed control program will be continued over the first two years of this program. After two

years the effectiveness of the weed control program will be evaluated. Control of introduced animals will continue for the duration of this program.

### **3.1.3 Taminmin Rainforest**

Liaison will continue with the Aboriginal custodians with the objective of maintaining their current practice of early dry season control burning adjacent to the rainforest and preventing grazing stock entering the rainforest.

### **3.1.4 7km and 8km Rainforests**

In consultation with the landholder, a program of fire control will be implemented adjacent to the rainforests.

## **3.2 Community Participation**

Community involvement and support, particularly that of private landholders, is recognised as essential to the success of this program.

### **3.2.1 Landholder Consultation and Management Agreements**

Five wild populations occur on either freehold or pastoral leasehold land. Consultation will be maintained with individual landholders to facilitate the maintenance of the habitat patches. Where appropriate, voluntary agreements under sections 73 or 74 of the *Territory Parks and Wildlife Conservation Act* may be entered into with respective landholders.

### **3.2.2 Recovery Team**

A recovery team will be established to provide advice and support to the Parks and Wildlife Commission and other landholders on the management of the species. Membership of the recovery team may be flexible to reflect the changing need for advice but will include at least one landholder and one community group representative.

### **3.2.3 Adoption of Rainforests**

Community groups will be encouraged to become involved in management through the adoption of rainforest patches.

### **3.2.4 Public Awareness and Education**

The biology, ecological significance and management requirements of *P. bleeseri* and its habitat will be promoted in a variety of media and landholder extension activities conducted by the Parks and Wildlife Commission.

## **3.3 Land Use Planning**

The long term conservation of *P. bleeseri* habitat will require appropriate management on-site and sympathetic land use in the catchment. Off-site issues include: wildfire; feral animals; weed invasion; herbicide and fertiliser contamination from horticultural developments; siltation of

water courses and reduction in the volume and persistence of freshwater springs.

### **3.3.1 Off-Site Land Use**

Where relevant, the potential impact of land use in the Howard and Adelaide River catchments on *P. bleeseri* rainforest patches will be included in advice provided by the Parks and Wildlife Commission to other Government agencies and the Northern Territory Planning Authority.

### **3.3.2 Black Jungle Conservation Reserve**

Three wild populations occur in the Black Jungle Conservation Reserve. Specific management requirements to maintain these populations and their habitat will be addressed in the Plan of Management for the reserve.

### **3.3.3 Establishing Additional Populations**

The habitat requirements of *P. bleeseri* will be determined with a view to assessing the availability on National Parks and Reserves of habitats suitable for establishing additional populations. The possible impacts on these habitats will be assessed, and the desirability of establishing additional populations determined.

## **3.4 Ex-situ Populations**

### **3.4.1 Darwin Botanic Gardens and Territory Wildlife Park**

A collection of plants of known origin will be maintained at the Darwin Botanic Gardens and Territory Wildlife Park. The collection will be used as an educational resource to inform the public about the species and maintained as a potential source of propagating material should reintroduction to wild populations be required.

### **3.4.2 Wild Harvest of Plant Material**

As a specially protected plant under the *Territory Parks and Wildlife Conservation Act*, authorisation is required from the Minister of Parks and Wildlife before a permit or licence to take *P. bleeseri* is granted. Harvest will only be considered where there is a clearly demonstrated conservation outcome. These circumstances include: use to establish *ex-situ* populations as a seed source for the nursery trade or at registered botanical gardens; scientific investigations; or educational purposes. Harvesting prescriptions will be set on a case by case basis. Only in exceptional circumstances will the harvest of whole plants or seed be allowed from locations other than Crocodile Creek which contains the only large population that has remained stable from 1990 to 1995 (Liddle *et al.* 1996).

## **4. MONITORING AND RESEARCH**

An adaptive management approach has been adopted whereby prescriptions for the conservation of *P. bleeseri* and its habitat will be refined in the light of experience. Monitoring and research are key components of the process to allow evaluation of management actions and to develop future management prescriptions.

### **4.1 Population Size, Demography and Rainforest Boundaries**

A total population count will be undertaken in 2000, being five years from the count in 1995. Periodic assessment of monitoring plots will be undertaken to provide data on the survivorship and growth of tagged individuals in all wild populations. To provide information on the stability of the habitat patches, a study will be undertaken to determine from aerial photographs if the rainforest boundaries have moved in recent years and to allow reassessment of boundary positions in the future.

### **4.2 Population Model**

A population model will be developed for the species based on the survivorship and growth of tagged individuals. The model will be used to predict the outcome of various management scenarios on *P. bleeseri* populations. Ongoing population monitoring will be used to refine the model.

### **4.3 Potential Threats**

#### **4.3.1 Genetic Integrity**

Hybridisation with ornamental *Ptychosperma* species introduced to gardens in the local area presents a potential threat to the genetic integrity of *P. bleeseri*. However the level of this threat is unclear due to a paucity of information on pollen transfer. The Parks and Wildlife Commission will seek support to conduct a study into pollination vectors, with an emphasis on identifying the most appropriate management to protect the wild populations.

#### **4.3.2 Ground Water**

A program of monitoring groundwater levels in the Black Jungle area will be continued by the Power and Water Authority to establish the impact of adjoining land uses on the water table.

## **5. MANAGEMENT STRATEGIES**

Should monitoring indicate that management aims and objectives are not being met, management prescriptions may be altered or other actions taken in accordance with this program.

In the event of further severe population decline or adverse change in population structure, potential exists for replanting into the wild populations from existing *ex-situ* stock or collection of seed, nursery propagation and subsequent replanting.

## **6. REPORTS**

Management actions and monitoring results will be summarised into a report produced annually and made available to the public.

## **7. COMPLIANCE**

Wildlife regulations and permit or licence conditions will be enforced by Conservation Officers appointed under the *Territory Parks and Wildlife Conservation Act* and officers of the Northern Territory Police Force.

## **8. REVIEW OF PROGRAM**

A review of the program, as required under section 75(2) of the *Territory Parks and Wildlife Conservation Act*, will be carried out within five years of the program being approved.

## 9. BACKGROUND

### 9.1 Description and Taxonomy

*Ptychosperma bleeseri* is a slender clumping palm endemic to rainforests in the Northern Territory of Australia. The species was described by Burret (1928) from material collected by F.A.K. Bleeser from Bankers Jungle on Koolpinyah Station on 27 August 1925. The collection was housed in the Berlin Herbarium which was destroyed by allied bombing during World War II (Wightman and Andrews 1989). The absence of a specimen led to confusion as to the validity of the species and it was incorrectly equated with *Carpentaria acuminata* by Essig in 1978. It was not until *P. bleeseri* was relocated on Koolpinyah Station in the early 1980's that existence of the species was again recognised by the scientific community.

*Ptychosperma bleeseri* is listed as nationally endangered (EFN 1993). The present distribution of *P. Bleeseri* is diminishing under sustained disturbance from wildfire and feral animals (Duff *et al.* 1992 and Barrow *et al.* 1993).

### 9.2 Habitats

All the rainforest patches containing *P. bleeseri* are of the one rainforest type ('Group 2') among the 16 floristic types classified by Russell-Smith (1991). They are wet spring fed rainforests in the northwest of the Northern Territory. Relative to Group 2 as a whole, *P. bleeseri* forests tend to occur on heavier textured soils prone to seasonal flooding and feral animal disturbance in high rainfall regions (Barrow *et al.* 1993).

The distribution of *P. bleeseri* within the rainforests is associated with soil texture, with a preference for relatively light textured soils. However, floristic, structural and edaphic (substrate and water availability) variables do not satisfactorily account for the distribution of *P. bleeseri* among rainforest patches. *Ptychosperma bleeseri* does not occupy all available suitable habitat on either a regional scale or within individual rainforest patches (Barrow *et al.* 1993).

A decline or expansion in the extent of *P. bleeseri* habitat is likely to be reflected in changes in the boundaries of rainforest patches. Mapping of rainforest boundaries from large scale aerial photography may provide a means of obtaining an historical perspective of boundary changes over the last decade or so, and provide a cost effective method of monitoring future changes. Overlaying of boundaries on a geographic information system is likely to provide an efficient tool for comparing a sequence of images.

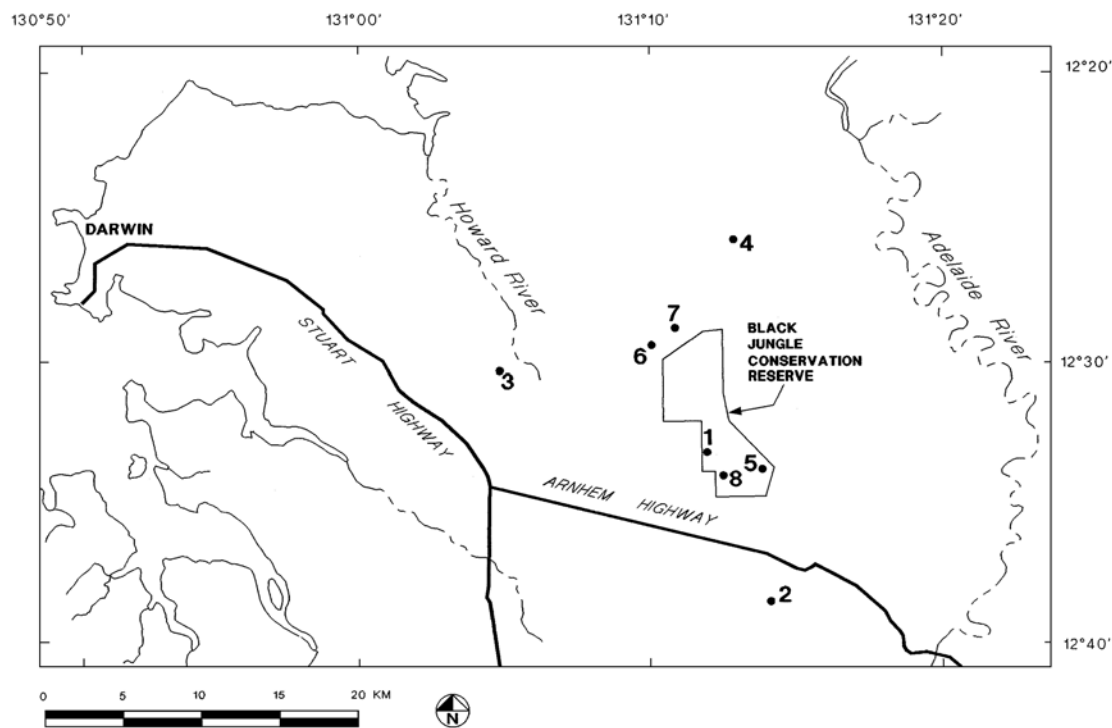


**Figure 1:** Map of *Ptychosperma bleeseri* Rainforests; 1 = Crocodile Creek, 2 = Taminmin, 3 = Whitewood Road, 4 = Bankers Jungle, 5 = Black Creek, 6 = 8km, 7 = 7km, 8 = BJ3.

### 9.3 Distribution, Abundance and Status

*Ptychosperma bleeseri* is known from eight rainforest patches within an area approximately 30km long by 20km wide to the east of Darwin in the Northern Territory of Australia (Figure 1). Seven patches occur on the upland margin of the Adelaide River floodplain and one occurs on the Howard River system.

A count of all known populations was conducted in 1990, with plants recorded in adult and juvenile classes. Where large numbers of juveniles were encountered, minimum population estimates were recorded (Liddle *et al.* 1992).

A follow up count was conducted in 1995 (Tables 1 and 2). Interpretation of population trends from the 1990 and 1995 counts alone must be undertaken with caution as the 1995 survey was more intensive than the 1990 survey. In addition, the boundary between juvenile and adult classes was a length of 2m from the base of the stem to the bottom of the leaves in the 1990 survey, whereas a stem length of 1.5m from the base to the point where the apical shoot emerges from the surrounding leaves was the class boundary used in 1995. Despite these limitations, the counts do provide a useful assessment of population trends when used in combination with data from permanent monitoring plots and site observations.

| Population                        | 1990     |          |                 | 1995  |          |              |
|-----------------------------------|----------|----------|-----------------|-------|----------|--------------|
|                                   | Adult    | Juvenile | Total           | Adult | Juvenile | Total        |
| <b>Crocodile Creek</b>            | 143      | 1500+    | <b>1643+</b>    | 345   | 4927     | <b>5272</b>  |
| <b>Taminmin</b>                   | 10       | 2000+    | <b>2010+</b>    | 25    | 5783     | <b>5808</b>  |
| <b>Whitewood Road</b>             | 137      | 358      | <b>495</b>      | 33    | 165      | <b>198</b>   |
| <b>Bankers Jungle</b>             | 24       | 25       | <b>49</b>       | 13    | 40       | <b>53</b>    |
| <b>Black Creek</b>                | 2        | 62       | <b>64</b>       | 2     | 60       | <b>62</b>    |
| <b>8km</b>                        | 11       | 19       | <b>30</b>       | 10    | 30       | <b>40</b>    |
| <b>7km</b>                        | 1        | 0        | <b>1</b>        | 1     | 2        | <b>3</b>     |
| <b>BJ3</b>                        | no count | no count | <b>no count</b> | 0     | 4        | <b>4</b>     |
| <b>Total (Species Population)</b> | 328      | 3964+    | <b>4292+</b>    | 429   | 11011    | <b>11440</b> |

**Table 1:** *Ptychosperma bleeseri* population counts for 1990 and 1995 (Liddle *et al.* 1992, Liddle *et al.* 1996)

| Populati<br>on      | Alive      |            |           |                  |                  |                 |            |                   |                   | Dead      |           |           |
|---------------------|------------|------------|-----------|------------------|------------------|-----------------|------------|-------------------|-------------------|-----------|-----------|-----------|
|                     | <0.2m      |            | 0.2 - 0.5 |                  | 0.5<br>-<br>1.5  | 1.5<br>-<br>5.0 | ><br>5.0   | Tota<br>l         | Ad.<br>Re-<br>duc | Juv       | Adult     |           |
|                     | Bil<br>o   | Pin        | Bilo      | Pin              |                  |                 |            |                   |                   |           | St        | Gr        |
| Crocodil<br>e Creek | 119        | 220        | 20        | 136<br>8         | 320<br>0         | 246             | 99         | <b>5272</b>       | 18                | 16        | 8         | 25        |
| Taminmi<br>n        | 29         | 317        | 3         | 227<br>4         | 316<br>0         | 20              | 5          | <b>5808</b>       | 4                 | 6         | 5         | 33        |
| Whitewo<br>od Road  | 7          | 10         | 0         | 73               | 75               | 25              | 8          | <b>198</b>        | 14                | 0         | 1         | 5         |
| Bankers<br>Jungle   | 12         | 7          | 0         | 12               | 9                | 0               | 13         | <b>53</b>         | 0                 | 0         | 5         | 4         |
| Black<br>Creek      | 1          | 1          | 0         | 14               | 44               | 1               | 1          | <b>62</b>         | 0                 | 0         | 1         | 4         |
| 8km                 | 17         | 1          | 0         | 4                | 8                | 1               | 9          | <b>40</b>         | 2                 | 0         | 1         | 1         |
| 7km                 | 2          | 0          | 0         | 0                | 0                | 0               | 1          | <b>3</b>          | 0                 | 0         | 0         | 0         |
| BJ3                 | 0          | 0          | 0         | 2                | 2                | 0               | 0          | <b>4</b>          | 0                 | 0         | 0         | 0         |
| <b>Total</b>        | <b>187</b> | <b>556</b> | <b>23</b> | <b>374<br/>7</b> | <b>649<br/>8</b> | <b>293</b>      | <b>136</b> | <b>1144<br/>0</b> | <b>38</b>         | <b>22</b> | <b>21</b> | <b>72</b> |

**Table 2:** *Ptychosperma bleeseri* population counts conducted between September and November 1995 (Liddle *et al.* 1996). The size classes, based on living material, are: total height less than 0.2m; total height equal to or greater than 0.2m and less than 0.5m; total height equal to or greater than 0.5m and stem length less than 1.5m; stem length equal to or greater than 1.5m and less than 5.0m; and stem length 5.0m or greater. The two smallest size classes have been subdivided into bilobed and pinnate leaved plants. All the larger classes are pinnate leaved plants. Plants with a stem length equal to or greater than 1.5m are classified as adults. Plants that were previously greater than 1.5m stem length but have been reduced to smaller size classes are recorded as Adult Reduced (Ad. Reduc). Dead plants have been classified as juvenile or adult, with the adults subdivided into standing and on the ground.

Annual counts have been conducted by the Parks and Wildlife Commission and the Palm and Cycad Society of the Northern Territory at Bankers Jungle from 1992 to 1995, by walking line transects to assess the whole population within the fenced area (Figure 2). The plants were classified into five size classes and all plants labelled with stainless steel tags for future monitoring.

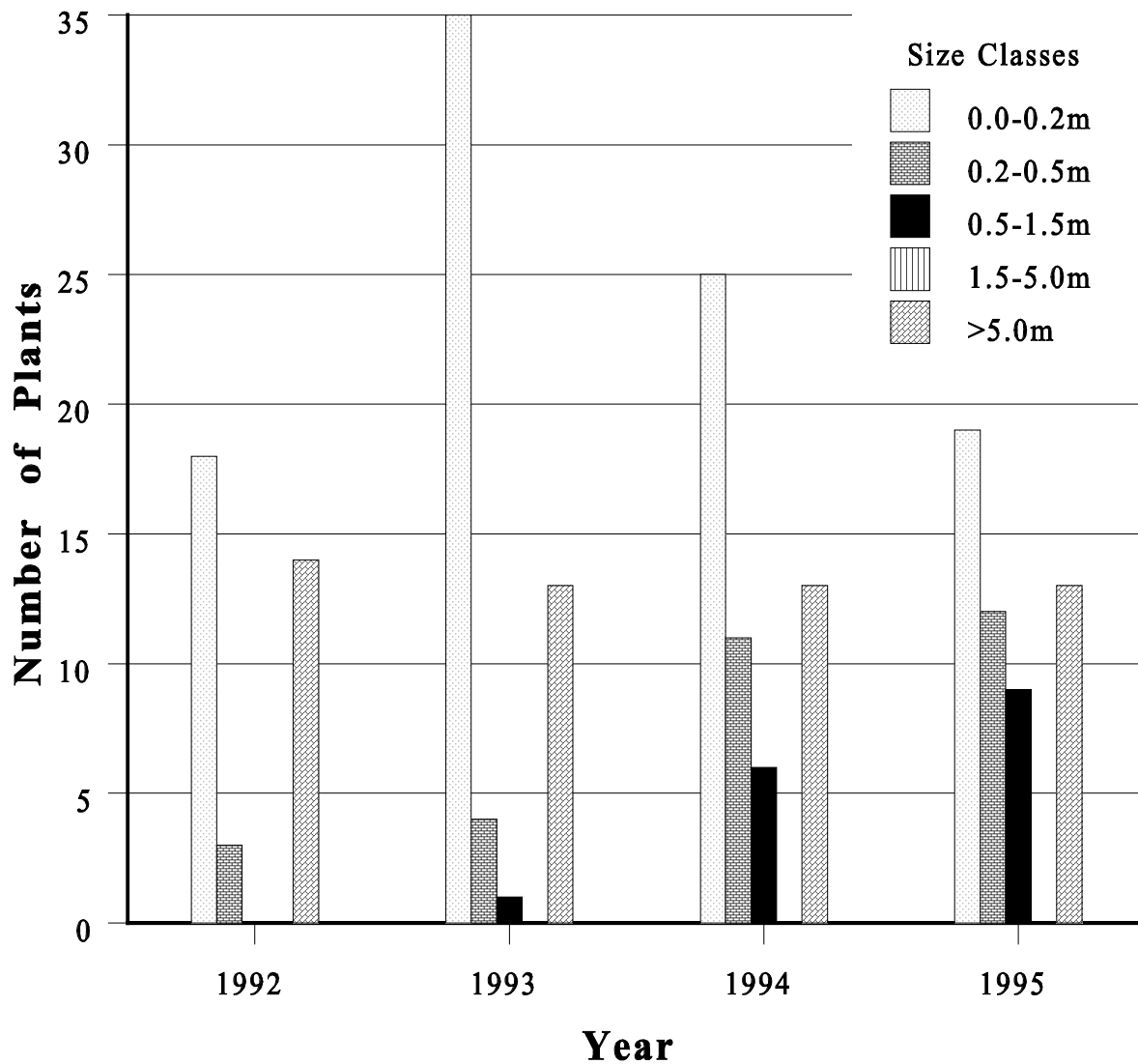


**Figure 2:** Size class structure of *Ptychosperma bleeseri* based on total population counts at Bankers Jungle (Liddle *et al.* 1996).

A total of ninety 10m x 10m monitoring plots have been established across the eight *P. bleeseri* populations. All adults and a selection of juvenile plants within these plots have been labelled with stainless steel tags to provide information on survivorship, growth rates and reproductive activity. Environmental data including disturbance from fire, buffalo or cattle and pigs have been recorded for each plot. The first plots were established in 1991 and have been reassessed annually or less frequently depending upon the level of disturbance and available resources. Sites with a high level of disturbance have been assessed most frequently to provide feedback on population trends. Data from tagged individuals will be used to develop a population model for the species that may be used to predict the outcome of various management scenarios.

A summary of past disturbance, threats, management actions and population trends for each rainforest is provided below.

## Crocodile Creek Rainforest

**Tenure:** Freehold, Conservation Land Corporation

**Rainforest Area:** 47ha

**Past Disturbance:** There has been a reduction in feral animals in recent years as a result of the Brucellosis and Tuberculosis Eradication Campaign (BTEC) and a feral animal control program conducted by the Parks and Wildlife Commission. There has been invasion of the weeds *Andropogon gayanus*, Gamba Grass, and *Pennisetum polystachion*, Perennial Mission Grass, onto land adjacent to the rainforest.

**Potential threats:** Land subdivision for horticultural or rural living purposes is proposed within 0.5km of this rainforest and is likely to impact on ground and surface water supplies. If ornamental *Ptychosperma* are introduced into these subdivisions, they may threaten the genetic integrity of *P. bleeseri*.

**Management Actions:** Fenced in 1992, ongoing feral animal control, fire protection and weed control (*Andropogon gayanus*).

**Population Trends:** The only large population of *P. bleeseri* with a moderate number of plants in all size classes (Table 2) and which has remained stable between 1990 and 1995.

## Taminmin Rainforest

**Tenure:** Freehold, Limilngan-Wulna Corporation

**Rainforest Area:** 46ha

**Past Disturbance:** There has been a reduction in disturbance from introduced animals in recent years as a result of BTEC and a change in land use from pastoralism to an Aboriginal living area. The weeds *Andropogon gayanus* and *Calopogonium mucunoides*, Calopo, occur in the vicinity of the rainforest and have the potential to support fire late in the dry season.

**Potential Threats:** Any change in land use that removes the current practice of early dry season burning in adjacent country or which allows the reintroduction of stock into the rainforest.

**Management Actions:** Early dry season control burning of the country adjacent to the rainforest.

**Population Trends:** The presence of more dead than living adult plants in combination with a large number of juveniles and a paucity of intermediate size plants (large juveniles and small adults) indicates there has been a serious problem with survival at Taminmin (Duff *et al.* 1992, Table 2 this report). Under current management practices there has been a significant recruitment of juveniles into intermediate size class plants (Parks and Wildlife Commission unpublished data 1995).

## **Whitewood Road Rainforest**

**Tenure:** Freehold

**Rainforest Area:** 30ha

**Past Disturbance:** The forest was burnt by wildfires in 1990 and 1993. There has been a reduction in feral animals in recent years as a result of BTEC, intensification of land use in the catchment and fencing in 1993.

**Potential threats:** Intensification of land use in the catchment is likely to impact on ground water supplies. Sand mining in nearby areas has the potential to modify the groundwater supply. It is likely that a decreased groundwater supply will exacerbate the problem with fire. In turn, opening of the canopy by fire is likely to exacerbate drying out of the rainforest.

**Management Actions:** Fenced in 1993, an ongoing program of feral animal control, fire protection and weed control (*Pennisetum polystachion* and *Pennisetum pedicellatum*, Annual Mission Grass).

**Population Trends:** The population has declined dramatically between 1990 and 1995 as a result of two wildfires.

## **Bankers Jungle**

**Tenure:** Pastoral Leasehold

**Rainforest Area:** 28ha

**Past Disturbance:** Introduced animals have been active in the rainforest in the past.

**Potential threats:** Given existing land use, the rainforest is not under imminent threat from other sources.

**Management Actions:** Fenced to exclude cattle in 1990 and upgraded to exclude pigs in 1993. Fire has been excluded in recent years as a result of management practices implemented for pastoral purposes. *Mimosa pigra* control has been undertaken on the floodplain margin near the rainforest.

**Population Trends:** There was a substantial loss of adults between 1990 and 1995. Most of this loss occurred between 1990 and 1992. In some plants, death followed a history of disturbance by introduced animals which prevented the survival of basal shoots, in combination with damage to the apical shoot (apparently by Little Corellas, *Cacatua pastinator*). Between 1992 and 1995 there was an increase in survival and growth of intermediate sized plants (Figure 2). This increase has coincided with fencing to control introduced animals and while there have been frequent incursions by pigs and buffalo, there has been a dramatic increase in the density of the rainforest understory and much reduced evidence of damage to trees by trampling and rubbing (Liddle *et al.* 1996).

## **Black Creek Rainforest**

**Tenure:** Freehold, Conservation Land Corporation

**Rainforest Area:** 40ha

**Past Disturbance:** A wildfire burnt through the rainforest in 1992. There has been a reduction in feral animals in recent years as a result of BTEC and a feral animal control program conducted by the Parks and Wildlife Commission, followed by fencing in 1993.

**Potential Threats:** The Lambells Lagoon Horticultural Subdivision abuts the eastern boundary of Black Jungle Conservation Reserve and it is anticipated horticultural developments will extend to within 1km of the Black Creek Rainforest.

**Management Actions:** Fenced in 1993. Ongoing fire protection, feral animal and weed control (*Calopogonium mucunoides* and *Pennisetum pedicellatum*).

**Population Trends:** Although the total population recorded in 1990 is similar to 1995 (Table 1), there is evidence of a loss of plants from both fire (Parks and Wildlife Commission unpublished data 1994) and feral animals (pers. comm. S. Taylor 1993) during this period.

## **8km Rainforest**

**Tenure:** Pastoral Leasehold

**Rainforest Area:** 12ha

**Past Disturbance:** There has been a reduction in feral animals in recent years as a result of BTEC and the area is not currently stocked by the pastoral lessees. Wildfire has burnt a short distance into the rainforest in recent years, including an area with *P. bleeseri*. A small outbreak of *M. pigra* is located along a drainage line that flows into the rainforest.

**Potential threats:** If mining was to occur on the nearby sand sheet, groundwater supplies may be affected.

**Management Actions:** *Mimosa pigra* control has been undertaken along a drainage line that flows into the rainforest.

**Population Trends:** The number of adult plants has decreased slightly while the total number of recorded juveniles has increased (Table 1).

## **7km Rainforest**

**Tenure:** Pastoral Leasehold

**Rainforest Area:** 2ha

**Past Disturbance:** There has been a reduction in feral animals in recent years as a result of BTEC and the area is not currently stocked by the pastoral lessees. Wildfire has burnt up to the rainforest margin in recent years.

**Potential Threats:** Sand mining has been conducted within 0.5km of the rainforest and may be extended in the future.

**Management Actions:** No management has been undertaken.

**Population Trends:** The sole adult plant has survived from 1990 to 1995 and some juveniles have appeared. The survival rate of juvenile plants is low with a loss of two out of four tagged plants between 1994 and 1996.

### **BJ3 Rainforest**

**Tenure:** Freehold, Conservation Land Corporation

**Rainforest Area:** 1.5ha

**Past Disturbance:** There has been a reduction in feral animals in recent years as a result of BTEC and a feral animal control program conducted by the Parks and Wildlife Commission.

**Potential Threats:** Horticultural developments that could affect the springs.

**Management Actions:** Ongoing fire protection and feral animal control.

**Population Trends:** This population was not counted in 1990 and consisted of four juveniles in 1995. Anecdotal evidence indicates this forest contained adult plants in the 1980's.

## **9.4 Parks and Reserves**

Three of the eight rainforest patches containing *P. bleeseri* occur within Black Jungle Conservation Reserve (Black Creek, BJ3 and Crocodile Creek Rainforests). The rainforest at Crocodile Creek contains the only large population that has remained stable from 1990 to 1995 (Liddle *et al.* 1996).

## **9.5 Biology and Ecology**

### **9.5.1 Life History**

Flowering primarily occurs in the dry season (April to August) and while ripe fruit has been observed throughout the year, the main fruiting period is the late dry to early wet season (August to December) (Wightman and Andrews 1989).

Juvenile plants are clustered around adult plants indicating gravity is the primary dispersal agent. Some juveniles are found outside the range of gravity dispersal and it is believed there is a

secondary, as yet unidentified dispersal agent (R. Belcher, K. Coombs and P. Horner pers. comm. 1991). Possible secondary dispersal agents include water and frugivorous birds. Plants have been readily propagated in the nursery by soaking in water for 24 to 36 hours to allow removal of the fleshy exocarp and sowing in a peat layer surrounded by a mixture of peat and coarse sand.

Germination has taken from three to six months and growth is relatively slow over the first year with heights of 0.13 to 0.19m attained after 15 months. Once established, plants grow more rapidly and can increase from 1.5m to 3.5m height in two years. In a shady suburban garden, a plant has grown to 6m tall and produced fruit in 8 years (P. Horner pers. comm. 1991). These growth rates are likely to exceed those in the wild as they have occurred in conditions of supplementary water and fertilizer (Liddle *et al.* 1992).

### 9.5.2 Response to Disturbance

There have been three occasions in the last six years where wildfire has burnt through *P. bleeseri* rainforests. These fires occurred at Whitewood Road in 1990 and 1993, and Black Creek in 1992. *Ptychosperma bleeseri* monitoring plots were established at Black Creek after the wildfire.

At Whitewood Road, Barrow *et al.* (1993) recorded a 22% mortality of reproductively mature stems (N=50) in the five months following the 1990 wildfire. Occurrence of a second fire within a three year period resulted in the loss of over 75% of adult plants and over 50% of juvenile plants (Table 1). Other impacts of two fires in close succession include the opening of many gaps in the canopy, and the invasion of weeds and pioneer rainforest species such as *Macaranga involucrata*, *Omalanthus novo-quineensis* and *Trema tomentosa* (Liddle *et al.* 1996). In addition to direct effects on *P. bleeseri* populations, wildfire may substantially alter the structure and composition of the habitat.

Introduced animals that impact on *P. bleeseri* include pigs, buffalo and cattle. Feral pigs pose a major threat by eating young plants and causing extensive disturbance to the soil and vegetation by rooting. In a survey of rainforests during 1987 to 1989, the impact of pigs ranged from severe at Bankers Jungle, Black Creek, 7km and 8km to nil at Whitewood Road (Parks and Wildlife Commission Rainforest Survey Data).

Buffalo and cattle, either feral or domesticated, pose a threat by trampling and rubbing. Some old *P. bleeseri* exhibit abrasion marks from stock rubbing on their stems and at Bankers Jungle many of the surviving individuals are growing in relatively protected positions near trees with buttress roots. In the rainforest survey during 1987 to 1989, the impact of buffalo and cattle at *P. bleeseri* rainforests ranged from severe at Bankers Jungle, Black Creek, 7km and 8km to nil at Whitewood Road (Parks and Wildlife Commission Rainforest Survey Data).

A combination of feral animal control under BTEC (Lehane 1996), changed land use patterns, fencing and a control program on Black Jungle Conservation Reserve has reduced animal impact, but animal numbers could rapidly build up again in the absence of appropriate management.

Exotic plants impact on *P. bleeseri* rainforest margins and in canopy gaps. *Mimosa pigra* is an aggressive weed of the floodplain and riparian habitats, and is well established on floodplains adjacent to several rainforests containing *P. bleeseri*. If left unchecked, *M. pigra* has the potential to develop into dense stands that may seriously impede access to these rainforests, harbor feral animals and invade canopy gaps. Control activities using herbicide and fire have been implemented so as to minimise impacts on the rainforests (Liddle *et al.* 1996).

Invasion by exotic grasses such as *Pennisetum polystachion*, *Pennisetum pedicellatum*, and *Andropogon gayanus*, pose a serious threat through their ability to modify the fire regime. *Pennisetum* species invaded the Whitewood Road rainforest margin and canopy gaps following wildfire. Fuel loads of 27 tonnes of dry matter per hectare have been recorded in a *Pennisetum polystachion* grassland occupying soils that formerly supported rainforest at Leanyer near Darwin (Panton 1993). In comparison, fuel loads of 6 to 8 tonne per hectare are present in non-weedy communities which would normally adjoin these rainforests (Bowman and Wilson 1988). The increased fuel loads can produce more intense fires, and if burnt early in the dry season (when moisture in the fuel may prevent complete combustion), sufficient material may remain to support a second wildfire within the one season. A cycle may establish whereby increased fire intensity and frequency produces or expands canopy gaps which allow more fuel to build up. Timely spraying prior to seed set is required to control these grasses. The invasion of these species is reflected in the increased use of herbicides at Whitewood Road where 75 litres of Glyphosate based spray was applied during the 1993/94 wet season, approximately 600 litres in 1994/95 and over 1,800 litres in 1995/96 (Liddle *et al.* 1996).

Other factors likely to impact on *P. bleeseri* habitat include changes in the quantity and quality of ground and surface water through extractive mining, horticulture and rural subdivision.

The rainforests that contain *P. bleeseri* are a discharge zone for aquifers in the local area. Rural development and the supply of water to Darwin threatens to intercept aquifer through-flow which will affect the moisture regime of the rainforests.

The area of most immediate concern is Black Creek Rainforest which is located adjacent to a horticultural subdivision. Studies performed by the Power and Water Authority in 1988 (Jolly and Yin Foo) found two major aquifer systems in the area. The northern system is susceptible to saline intrusion and any sustainable yield is highly dependent on boreline configuration. The southern aquifer system has an estimated annual recharge of 12.5 million cubic metres with a through-flow from the area of an estimated 10.3 million cubic metres annually. Black Jungle Conservation Reserve is a major discharge zone for the through-flow. A simulation model using an extraction rate of 30 ML/d for 316 days is considered to develop an acceptable drawdown regime for the subdivision. However, the Power and Water Authority caution that 'flows into Black Jungle Swamp and the lagoons in the vicinity of the rural subdivision will be affected and the environmental impact of this should be examined if extraction at this rate is to proceed' (Appendix B, Jolly and Yin Foo 1988).

The following calculations of through-flow diversion for this horticultural development have been based on figures from the Power and Water Authority, Department of Lands, Planning and Environment, and the Department of Primary Industry and Fisheries. They are based on 160ha under banana production and a further 340ha under production of bananas or other less water-hungry crops. It is estimated that bananas use 15-20 ML/ha/yr; while other crops use 10 ML/ha/yr. Combined, this gives a range of 5.8 to 10.0 million cubic metres of water extracted annually. If the annual recharge is 12.5 million cubic metres and the through-flow is 10.3 million cubic metres, the surplus is 2.2 million cubic metres of water. The interception of through-flow would be the total annual extraction less the surplus, i.e., 3.6 to 7.8 million cubic metres of water. These are approximate figures, however, they equate to 35% to 75.7% of total through-flow being diverted away from Black Jungle and surrounding lagoons.

Monitoring bores have been established by the Power and Water Authority to assess the impact of horticulture on groundwater flows into Black Jungle Conservation Reserve. It is likely that

any decrease in soil moisture due to water diversion will exacerbate the problem with wildfire in rainforest patches on the Conservation Reserve.

In the long term other rainforests are likely to be affected by groundwater diversion. This may already be occurring at Whitewood Road where in recent years, springs have stopped flowing earlier in the dry season than previously observed. All eight populations of *P. bleeseri* are within or adjacent to Benham's Water Region, between the Howard and Adelaide Rivers. It was reported in 1986 that the increasing demand for water from the public system, rural residents and agriculture/aquaculture would exceed the yield of the Benham's aquifer system without proper management controls (Bragger 1986). With ongoing rural subdivision, bores are being constructed and additional water extracted from the aquifers. The increasing demand for ground water highlights the need for regulation of water use in the area. The Power and Water Authority is investigating the potential use of bore water from the area west of Black Jungle Conservation Reserve to augment supplies to Darwin and is undertaking a long-term study of the water resources in the rural area. The study will include evaluation of the existing requirements of the plant communities, through-flow characteristics, effect of climate, interaction of shallow and deep aquifer systems and the impact of changed land use on the environment.

In areas where agricultural or horticultural development occurs, the potential exists for pollution of ground or surface waters from extensive use of fertilisers, herbicides and pesticides. For the long term maintenance of *P. bleeseri* and its habitat, best practice cultivation techniques and the proper use of low impact chemicals is desirable.

### **9.5.3 Genetic Integrity**

There is a potential threat to *P. bleeseri* through hybridisation with ornamental *Ptychosperma* species such as *P. macarthurii*, which is a common garden plant in the Darwin area. While hybridisation occurs with *P. bleeseri* (Shapcott in press) the pollination vectors for the species are unknown so the distance at which other members of the genus might pose a threat is also unknown. The minimum distance from a natural population to a low density rural development is currently 0.5km. As Darwin expands and further subdivision occurs the threat of hybridisation will increase.

### **9.5.4 Harvesting**

In the past humans posed a threat to *P. bleeseri* by collecting plants for garden planting or food. Plant collectors removed seedlings, sub-adult and occasionally adult palms from wild populations. In recent years this practice has reduced to a low level. Education of the public that *P. bleeseri* is an endangered species and its availability at commercial outlets should negate this practice in the future.

The "cabbage" or growth cortex at the leaf base of *P. bleeseri* is edible (Wightman and Andrews 1989) and has been eaten in the past by Aboriginal people living at Humpty Doo Station near the Taminmin rainforest. If harvesting recurs, a low profile education campaign aimed at the people of Humpty Doo is likely to be the most effective countermeasure.

## 9.6 Glossary

The following definitions are taken from the *Territory Parks and Wildlife Conservation Act*.

**"Crown land"** means land -

- (a) held by the Territory for an estate in fee simple; or
- (b) in respect of which neither a lease granted by the Territory or the Commonwealth is in force nor an estate in fee simple has been granted by the Territory;

**"plant"** means any member, alive or dead, of the plant kingdom or of the fungus kingdom, and includes seeds and parts of plants and things produced from plants;

**"private land"** means any land which is not Crown land;

**"protected plant"** means a plant declared by or under section 45 or the Regulations to be a protected plant, and includes a specially protected plant;

**"specially protected plant"** means a plant declared by or under section 45 or the Regulations to be a specially protected plant;

**"take"** means to sever, remove, damage or destroy, or assist to sever, remove, damage or destroy, the plant;

**"wildlife"** means -

- (a) animals and plants that are indigenous to Australia;
- (b) animals and plants that are indigenous to the Australian coastal sea or the sea-bed and subsoil beneath that sea;
- (c) migratory animals that periodically or occasionally visit Australia or the Australian coastal sea;
- (d) animals and plants of a kind introduced into Australia, directly or indirectly, by Aborigines before the year 1788; and
- (e) such other animals and plants as are prescribed.

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