



APPENDIX E

A Management Program for Cycads in the Northern Territory of Australia



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Northern
Territory
Government

DEPARTMENT OF
NATURAL RESOURCES, ENVIRONMENT AND THE ARTS



Photo: C Wilson

draft

A Management Program for Cycads in the Northern Territory of Australia

2007-2012



Submissions

You are invited to comment on the draft Management Program for Cycads in the Northern Territory of Australia.

The draft Program is open for public comment until **Friday 3 August 2007**.

Written submissions can be sent to:

Cycad Management
Biodiversity Conservation
PO Box 496
Palmerston NT 0831

For further information:

- visit www.nt.gov.au/consult, or
- phone **08 8995 5000**

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1. Introduction

1.1 Species Subject to Management

Family:	Cycadaceae
Genus/Species:	All species, subspecies and hybrids of the Genus <i>Cycas</i> found in the wild in the Northern Territory
Family:	Zamiaceae
Genus/Species:	<i>Macrozamia macdonnellii</i>

Cultivated cycads of the above taxa are exempt from the provisions of this management program. Under the Commonwealth's *Environment Protection and Biodiversity Conservation Act 1999*, cycads, including artificially propagated plants, must be sourced from an approved program if they are to be exported commercially. During the life of this management program, the Supervisory Authority will consult with other government departments and industry stakeholders regarding the inclusion of artificially propagated cycads under this program.

1.2 Supervisory Authority

Parks and Wildlife Commission of the Northern Territory
PO Box 496
PALMERSTON NT 0831

Telephone: +61 08 8995 5000
Facsimile: +61 08 8984 4488

1.3 Legislation and International Obligations

1.3.1 Northern Territory

The Parks and Wildlife Commission may formulate and implement programs for the purposes of the protection, conservation, sustainable use, control and management of wildlife under section 32 of the *Territory Parks and Wildlife Conservation Act*. This cycad management program applies to the whole of the Northern Territory.

A permit is required to take *Cycas* plants or plant material, for commercial use. All *Cycas* that are listed as threatened wildlife in the Northern Territory are Protected Wildlife under section 3 of the *Territory Parks and Wildlife Conservation Regulations*. Threatened species require ministerial approval and permits to take for any purpose (commercial or otherwise).

In addition to the requirements for permits for taking of cycads, provision exists for support by the Parks and Wildlife Commission of the Northern Territory in the management of cycad populations 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. The management of cycad populations may be addressed through park plans of management.
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On Aboriginal Land: the Parks and Wildlife Commission may enter into an agreement with Aboriginal Land holders 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.

Under the *Pastoral Land Act* and *Crown Lands Act*, a licence may be required to take plants or plant products from Pastoral or Crown Lands.

Territory legislation is considered to be effective in regulating the management of cycad species found in the wild within the Northern Territory.

1.3.2 Other States and Territories

Only two of the 10 Northern Territory *Cycas* species have populations that occur in other states. Eight of the *Cycas* species are endemic to the Northern Territory. *Cycas angulata* is found in isolated stands in western Queensland and on Bountiful Island in the Gulf of Carpentaria. Cycad populations located in the Northern Territory near the Queensland border that were previously recognised as *Cycas brunnea* are no longer considered as distinct from *C. angulata* (Dixon, 2004). However, in regulations under Queensland's *Nature Conservation Act 1992*, *C. brunnea* is classified as a 'rare plant' in schedule 4 and *C. angulata* as a plant of 'least concern' in schedule 6. Both species are classified as 'protected' and are subject to the *Nature Conservation (Protected Plants) Conservation Plan 2000*. Under the plan, the taking of 'protected' plants is subject to control whether for commercial or recreational purposes.

Cycas pruinosa occurs in the eastern Kimberly Region of Western Australia and along with other cycads has been declared as 'protected flora' under the Western Australian *Wildlife Conservation Act 1950-1979*. As a result, a permit is required to harvest from crown land or to sell cycads from private property. Controls on harvest areas, quantities, period and products may be applied.

With the above exceptions, other states and territories are not involved in the management of wild populations of cycad species found in the Northern Territory. However, the Queensland regulations and the declaration of cycads as 'protected flora' in Western Australian demonstrate widespread legislative support for the conservation of cycads across northern Australia.

1.3.3 Commonwealth

All Northern Territory cycads are included under Section 303CA(1) of the *Environment Protection and Biodiversity Conservation Act 1999* that relates to the listing of species subject to the Convention on International Trade in Endangered Species of Wild Fauna and Flora. Section 303CC of the *Environment Protection and Biodiversity Conservation Act 1999* addresses the export of native flora listed under Section 303CA(1). Either wild harvested or artificially propagated plants must be sourced from an approved program or operation if they are to be exported commercially. *Macrozamia macdonnellii* is listed as Vulnerable under the *Environment Protection and Biodiversity Conservation Act 1999* and thus is an eligible listed threatened species. Eligible listed threatened species generally can not be exported unless they come from an approved artificial propagation program (Section 303FL), though there is limited provision for export in exceptional circumstances under Section 303GB. The import and export of cycad seed is

regulated by the Australian Quarantine and Inspection Service, under the *Quarantine Act 1908* and the *Export Control Act 1982*.

1.3.4 International

All Northern Territory cycads are listed under Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora. In recognition of this listing, unrestricted international trade in seed is allowed, but export of other cycad products such as whole plants or leaves requires an export permit issued by the Commonwealth Government under the *Environment Protection and Biodiversity Conservation Act 1999*. Importing countries may have stricter domestic measures. Export of whole plants requires a tag (see section 3.2.5).

1.4 Cycad Conservation Status and Management Issues

Macrozamia macdonnellii is listed as vulnerable to extinction under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*. Under the *Territory Parks and Wildlife Conservation Act*, *Cycas armstrongii* is listed as vulnerable in the Northern Territory. This status applies to the taxon as a whole. However, individual populations of some taxa that are not listed appear to be in decline from contemporary fire regimes, land clearing and previous uncontrolled harvesting. A description and distribution of each species is provided in the Background Information (Section 9). Those populations of cycads whose taxonomy is unclear appear to be locally abundant with no immediate threat to their survival.

Northern Territory cycads are slow growing and little is known about the ecology of many of the species, giving rise to concern about their sustainable management in the face of pressure from land clearance and contemporary fire regimes, along with a potential for an expansion of harvesting in some areas. Concern for the conservation of Northern Territory cycads in combination with the requirement for a management program to allow the export of wild harvested cycad products other than seed has led to this program. The management program has been developed in accordance with section 32 of the *Territory Parks and Wildlife Conservation Act*.

2. Aim and Objectives

The aim of this management program is to maintain viable wild populations of all cycad taxa across their range in the Northern Territory.

Objectives to achieve this aim are:

1. To promote the conservation of cycad populations through sustainable land management practices.
2. To develop and apply strategies for the ecologically sustainable use of cycads.
3. To provide for the wise use of cycads that will otherwise be destroyed through land use permitted under relevant legislation.
4. To facilitate essential research.
5. To promote public awareness and education.

This aim and objectives are consistent with the principles of management of Part IV, section 31, of the *Territory Parks and Wildlife Conservation Act* and objects of Part 13A, section 303BA, of the *Environment Protection and Biodiversity Conservation Act 1999*.

3. Management Measures

3.1 Land Management and Non-commercial Harvest

3.1.1 Agreements for Management of Populations

On private land, management agreements with landholders will be pursued where landholders are willing to participate and anticipated outcomes include a conservation benefit such as sustainable management of cycad habitat. Agreements may be made in association with commercial harvest of cycads.

3.1.2 Parks and Reserves

Six species of cycads (*C. armstrongii*, *C. calcicola*, *C. canalis*, *C. conferta*, *C. maconochiei* subsp. *maconochiei* and *M. macdonnellii*) are found on parks and reserves in the Northern Territory. The reservation of cycad populations will be considered in the declaration of parks and reserves.

All wildlife on parks and reserves is protected. Under clause 18 of the Territory Parks and Wildlife Conservation By-laws, plants and plant material may be taken from a park or reserve if such removal is part of an approved management plan under the *Territory Parks and Wildlife Conservation Act*. While provision exists for the removal of cycads or cycad products from parks or reserves, issue of the required permit will only be considered for scientific purposes or, in exceptional circumstances such as salvage from road construction. Where cycad populations occur on parks and reserves, specific management requirements will be addressed in plans of management.

3.1.3 Land Clearing and Bioregional Planning

The potential local and regional effects on the status of cycad populations will be taken into account in considering land clearing and other development

applications. The cumulative effects of land use decisions on cycad populations will be taken into account in preparing nature conservation plans for individual sites or bioregions.

3.1.4 Permits for Land Clearing Purposes

Under the *Territory Parks and Wildlife Conservation Act*, a permit is required by individuals to take Protected Wildlife or their parts for non-commercial purposes. In the case of cycads, *Cycas armstrongii* is protected due to its threatened status under the *Territory Parks and Wildlife Conservation Act*. Where land clearing has been approved under the formal procedures of the Northern Territory Government, no additional permit will be required to take cycads for non-commercial purposes on areas designated to be cleared. Cycads salvaged from such areas for commercial purposes will be subject to the commercial harvest provisions of this program (see section 3.2.5).

Non-commercial take of cycads requires the permission of the landholder. On Crown Land where responsibility for management of the resource rests with the Northern Territory Government, proposals for non-commercial harvest will be assessed on a case by case basis, however, harvest from Crown Land will generally be restricted to salvage only.

3.1.5 Traditional Harvest

Use of cycads for food, ceremonial or religious purposes by Aboriginals who have traditionally used an area may continue in accordance with section 122 of the *Territory Parks and Wildlife Conservation Act* and will not be controlled by this management program. However, any commercial utilisation by Aboriginals, or on Aboriginal Lands by non-Aboriginal people will be subject to the commercial use provisions of this program.

3.2 Commercial Harvest

3.2.1 Permits for Commercial Harvest

A permit is required to take a cycad for commercial purposes. Wild harvest operations may be either sustainable operations where the long-term maintenance of the cycad populations and their habitat is a primary objective of the activity; or salvage operations where cycads that would otherwise be destroyed under legitimate land use activities are taken. For sustainable harvests from private or leasehold land, preference will be given to the landholder, over non-landholder harvesters, for the issue of a permit for commercial use. The landholder is the person who has primary responsibility for management of the land and as such is viewed as the person who should take responsibility for the harvest and should gain a financial return if so desired. On Crown Land, a permit may be issued to a harvester but will normally be limited to salvage or scientific research. A permit for a salvage operation may be issued to a harvester on either private or Crown Land.

3.2.2 Harvest Areas

Areas for harvest will be negotiated with landholders upon request for a permit to harvest. Management areas for specific taxa will be delineated into harvest areas identified by either natural features or artificial markers. In extensive stands of cycads, some areas will be reserved from harvesting to prevent the imposition of a single treatment over the whole population.

3.2.3 Seed Harvesting

Sustainable commercial harvest of seed will be limited to all seeds from a set proportion of seeding females within each harvest area, up to a maximum number calculated as a percentage of the total seed production within that area. When selecting female stems from which seed will be taken, seed must not be removed from all reproductive plants in a local area. The maximum proportion of reproductive females harvested will be 50% in any one year, and the maximum number of seeds taken will be 50% of the total production within a harvest area.

Sustainable harvest of seed from threatened taxa, either Northern Territory or Commonwealth listed (currently *Macrozamia macdonnellii* and *Cycas armstrongii*), will only be considered in circumstances where the Director of Wildlife is satisfied there is likely to be a positive conservation outcome from the harvest. Such circumstances include use of the seed to establish *ex-situ* populations at registered botanical gardens, scientific or educational purposes, and management of wild populations whereby limited harvesting of selected populations will result in improved management of the species. Harvesting prescriptions for taxa from these categories of conservation concern will be set on a case by case basis and may be more restrictive than the regimes detailed above.

3.2.4 Leaf Harvesting

The market requires well-formed leaves with minimal defects, often resulting in the collection of only a small percentage of leaves from any individual stem. The maximum sustainable harvest will be 50% of leaves from any individual stem, with harvesting restricted to individuals that are not currently reproducing and that have an above ground stem at least 5 cm tall. This prescription purposefully excludes harvest from reproductively active individuals and juvenile plants that have not developed an obvious above ground stem. Permits for harvesting leaves from different species will be considered as requests are received. To minimise the risk of a cumulative effect on the health of cycad plants, leaf harvesting and seed harvesting will not be allowed from the same cycad stem in any one year. Sustainable harvest of leaves from threatened taxa will only be considered in circumstances where the Director of Wildlife is satisfied there is likely to be a positive conservation outcome from the harvest. Harvesting prescriptions for taxa from these categories of conservation concern will be set on a case by case basis and may be more restrictive than the regimes for taxa classified as being of least concern.

3.2.5 Whole Plant Harvesting

The taking of plants will be assessed on a case-by-case basis. The maximum annual off-take of any commercial sustainable harvesting prescription for whole plants, for any individual taxon, will not exceed 10% of the estimated population of that taxon on the area of harvest. In cases of salvage harvest all plants may be collected.

Harvesting of Commonwealth eligible listed threatened species (currently *M. macdonnellii*) will be limited to vouchered samples for registered botanical gardens, scientific research, educational purposes and exceptional circumstances where there is a clearly demonstrated conservation outcome from the harvest.

All permits for whole plant harvest will include the condition that all plants must be labelled with a Parks and Wildlife Commission approved tag prior to removal from the harvest site.

3.2.6 Wild Harvest Limit Determination

Wild harvest limits for individual permits will be determined by the Director of Wildlife, in line with the prescriptions specified in this plan. Harvest areas and harvest prescriptions will be prescribed as conditions of permits to take cycads. While recognising existing gaps in available information, harvest limits will be set after consideration of the following:

- trends in the size and structure of the cycad populations;
- year-to-year variation in reproduction and recruitment;
- management objectives for specific areas;
- proportion of total population subject to harvest;
- review of previous harvests;
- review of past and current research;
- the likely aesthetic impact of a harvest; and
- other relevant information.

In response to the paucity of information on the population dynamics of most Northern Territory cycads, an adaptive management approach will be used whereby prescriptions will be refined as more information becomes available.

3.2.7 Fees and Royalties

A permit fee may be introduced during the life of this plan. Royalties will be determined by the Minister by notice in the Government Gazette.

3.2.8 Harvesting Returns

Returns providing details of harvested flora are required as a condition of all permits. Information required includes, but is not limited to, the permit number, permittee's name, taxon, product, detailed information on harvest location, quantity from each area harvested in the period and list of the people or businesses the cycads were sold to. With plant harvest, for each numbered tag return information will include the length of the stem. With sustainable operations plant harvest tags must be matched with positional information for the harvest point obtained by a global positioning system while with salvage operations location by global position system or a detailed site plan of the harvest site will be required. Detailed information matching tags, plant size and harvest location will provide a tool to assist in auditing harvest operations and assist in monitoring compliance with permit requirements. Nil returns are required if no harvesting is undertaken in a period. Returns are to be submitted to the Parks and Wildlife Permits Section within the Department of Natural Resources, Environment and The Arts.

A summary report of permits issued and material harvested will be produced annually. Subject to this program being endorsed as a Wildlife Trade Management Plan under the *Environment Protection and Biodiversity Conservation Act 1999*, these reports will be provided to the Commonwealth Government. Data from harvesting returns will be summarised in the five yearly review of the plan that will detail the extent of cycad harvesting in the Northern Territory, and the type and quantity of material taken. Data from the harvesting returns will be used in the evaluation of harvesting impacts and to provide feedback on the administration of the program.

3.2.9 Overseas Export of Plants and Leaves

Plants and leaves destined for overseas export for commercial purposes will be limited to those harvested from approved sustainable operations. This emphasis on sustainable operations will facilitate approvals for export under Commonwealth

legislation. In addition, the promotion of wild harvested plants or leaves as derived only from sustainable operations will assist marketing Northern Territory cycads overseas as environmentally sound products. While overseas demand will provide an economic incentive for landholders to manage cycad populations and their habitat; this approach will minimise any incentive for landholders to clear land to obtain financial returns from the sale of salvaged cycads.

3.2.10 Artificially Propagated Cycads

The primary focus of this management program is on management of wild populations of cycads. Under the *Environment Protection and Biodiversity Conservation Act 1999* artificially propagated plants must be sourced from an approved program if they are to be exported commercially. Except in exceptional circumstances, eligible listed threatened species (currently *Macrozamia macdonnellii*) cannot be exported unless they come from an approved artificial propagation program. The Department of Natural Resources, Environment and The Arts will consult with other government departments and the Nursery and Garden Industry of the Northern Territory to explore options to manage artificially propagated plants and thus facilitate access to export markets.

3.3 Salvage Operations

Areas where cycads are likely to be destroyed in the pursuit of other legitimate purposes such as construction of roads or fire breaks or under a clearing permit, will be eligible for the issue of permits for utilisation by salvage. Clearing applications lodged under the *Planning Act* are advertised in regional newspapers and copies are available for viewing by the public for 14 days at the Department of Natural Resources, Environment and The Arts, Darwin. Copies of current clearing permits are available from the Land Clearing Branch of the Department of Natural Resources, Environment and The Arts. All permits for the removal of cycads will include the condition that all plants must be labelled with a Parks and Wildlife Commission approved tag prior to removal from the salvage site.

3.4 Research

As part of the adaptive management approach adopted in this program, the Department of Natural Resources, Environment and The Arts will encourage research that assists in achieving the aim of this program. A high priority will be given to writing up the results of past research on the effects of harvest and fire on cycads. Priorities for future research include the response of wild cycad populations to various harvesting prescriptions and the impact of harvesting practices and associated land management on cycad habitat. Mechanisms for implementing research outcomes include harvesting prescriptions specified on permits to take cycads. For research purposes only, the restrictive prescriptions limiting the proportion of seeds, leaves or plants that may be harvested in a local population may be relaxed. The application of provisions will be assessed on a case by case basis and will only be considered in the framework of a clearly specified experimental design which is expected to lead to an increase in knowledge that will feed back into future management prescriptions.

3.5 Public Awareness and Education

The biology, ecological significance and economic value of cycads will be promoted in a variety of media and landholder extension activities conducted by the Department of Natural Resources, Environment and The Arts. The George Brown Darwin Botanical Gardens maintains a cycad collection which includes all species found in the Northern Territory. Media and extension activities will include promoting awareness of this program, along with the regulatory requirements pertinent to implementation of this plan. To complement web based information about plant harvesting and permits under the *Territory Parks and Wildlife Conservation Act*, a brochure providing guidelines to

harvesting cycads in the Northern Territory will be produced. Extension activities will include dissemination of research findings.

4. Monitoring and Assessment

4.1 Impact Monitoring

Under this management program monitoring will be implemented to record the impact of harvesting on plant populations. Harvesting returns will form an integral component of the impact monitoring by providing information on the type, extent and quantity of material harvested. Monitoring activities may be required of the harvester as part of the permit conditions. In the case of land clearing, the proportion of a species that is affected will be monitored.

Three tiers of assessment applying both qualitative and quantitative techniques will be undertaken to monitor population trends.

Qualitative Inspections

Qualitative inspections will be undertaken periodically at harvest and other sites, and information recorded on disturbance and population structure. The inspection will focus on evidence that may indicate population trends such as recruitment and fire effects on the target species. Observations will also be recorded on other components of the habitat, particularly any response that may be related to harvest activities, such as evidence of disturbance to other vegetation. The presence of exotic grasses that can result in increased fuel loads, an estimate of time since fire and evidence of fire impact will also be recorded.

Quantitative Impact Monitoring

Sampling transects will be set up at selected sites subject to harvest, and at comparable unharvested sites. Monitoring of cycads will be conducted on a regular basis with the period between assessment subject to apparent population trends, but is anticipated to be in the order of three to five years. Sampling will be targeted to provide feedback on the population response to potentially significant events such as harvest, intense wildfires or cyclones. Two levels of quantification will be implemented: rapid assessment transects where no attempt will be made to tag individual cycads; and detailed assessment sites where plants will be tagged. Building on population monitoring conducted over the last decade, a rapid assessment protocol will be developed. The protocol will focus on recording the trend of the adult component of the cycad population and provide an early warning system to avoid undesirable population changes.

At a subset of sites detailed quantitative assessment will be conducted using tagged plants to follow cycad population trends. Initial reassessment of cycads will be undertaken within 5 years, with subsequent periods between reassessment determined by the observed population response. At selected sites sampling will include non-cycad species with a focus on other woody species, as these taxa are likely to reflect change in the community in response to fire management. Floristic lists and woody abundance will be reassessed at least every decade to reveal long-term population trends.

Assessment

The data on population size and structure, and plant performance from sites subject to harvest will be compared against unharvested sites. Where differences in population or plant response are found, these differences will be evaluated and harvest levels adjusted accordingly.

5. Management Strategies

Should monitoring indicate that management aims and objectives are not being met, harvest prescriptions will be altered or other actions taken in accordance with this program. Cycad data from monitoring plots will be used to develop population models that will provide an early warning of population decline for these long-lived plants. Similarly, habitat data, floristic composition and abundance of non-cycad woody species collected at a selection of sites will be analysed for evidence of change arising from actions under this management program. Should there be a need to change harvest practices to avoid overharvesting or other unsustainable practices, the system of annual permits provides a mechanism to rapidly introduce changes into operational systems. Provision exists under section 59 of the *Territory Parks and Wildlife Conservation Act* to cancel permits should information become available that indicates a new threat or new circumstances in relation to the survival of cycads or their habitat.

6. Reports

A summary report of permits issued and material harvested will be produced annually and made available to the public. Monitoring results for the harvest and wild populations will be summarised into a report produced as part of the five year review of the management program.

7. Compliance

Wildlife regulations and permit conditions will be enforced by Conservation Officers appointed under the *Territory Parks and Wildlife Conservation Act*. Instruction on the requirements of this program and responsible harvesting practices will be included in the training of Conservation Officers undertaken by the Department of Natural Resources, Environment and The Arts. To ensure compliance with permit conditions and determine the extent, if any, of illegal harvesting, spot visits will be made to both harvested and unharvested areas and businesses on-selling the harvested cycads. Particular attention will be given to threatened populations and populations that have suffered from uncontrolled harvesting in the past. Field inspection of harvesting operations and harvest areas will be used to verify quarterly returns of material harvested. Substantial penalties apply under sections 66 and 67 of the *Territory Parks and Wildlife Conservation Act* for offences relating to protected and unprotected wildlife.

8. Review of Program

This management program will be reviewed as required under section 32(2) of the *Territory Parks and Wildlife Conservation Act* within five years of the date of commencement.

9. Background Information

9.1 Biology of Cycads

Cycads are long-lived, slow-growing, woody plants. They have male and female plants, develop cones and reproduce by seed. Sexual dimorphism is evident only in the cone of mature plants with male *Cycas* bearing a compact conical shaped reproductive structure and female *Cycas* bearing an open structure which encircles the stem. The age at maturity is unknown for most species and is probably influenced by environmental conditions. In cultivation many cycads reach maturity within 15 years, but it is likely that this time could be considerably longer in the wild. Any attempt to equate age with size is hampered by the fact that plants can regenerate from old bases or root stock.

Reproduction by individual plants can be annual, but may be sporadic or in intervals of up to or over 15 years depending on species and environmental conditions. Cycads are one of the few seed plants that produce motile sperm cells, a sign of their primitiveness. Pollination is believed to be primarily by insect vectors, especially beetles in the family *Boganiidae*. Cones produce an odour to attract the insects. Seeds are dispersed by gravity, water and animals. Germination may not occur at seed maturity because the embryo usually has an after-ripening period depending on the species. Seed predation by rats and humans can occur.

Cycads have various ways to cope with adverse conditions. Most cycads grow in impoverished soils. Additional nitrogen is acquired from cyanobacteria living in symbiosis on the cycad's coralloid roots at the soil surface. Seedlings are vulnerable to predation, fire and desiccation. Contraction of the primary root pulls the apical growing point underground providing protection. If the crown is destroyed, plants will produce new flushes of leaves; and if the apical growing shoots are damaged, branching can occur. In extreme circumstances when part or all of the above ground stem is destroyed, regeneration can occur from stem bases or old root stock.

9.2 Description and Status of Northern Territory Cycads

Northern Territory *Cycas* have a slender to stout emergent trunk with leaf bases typically retained on the trunk at senescence. New leaves emerge in a flush, and are erect with coiled leaflets that may be smooth or with hairs that are shed with age. Mature leaves are pinnate and oblong in outline and flat or keeled in cross-section. The petioles may or may not be spinescent and the leaflets have prominent midribs. Male cones are large and cylindrical; whereas female plants have loose and open reproductive structures. In addition to the 10 recognised Northern Territory *Cycas* species, there are populations that may constitute hybrids between recognised species.

Species in the genus *Cycas* appear to hybridise freely, assisted by a common number of chromosomes ($n=22$). In addition, there appears to be no pollinator specificity. Interspecific reproductive barriers appear to be either temporal or geographic in nature, ie

different cone development times and geographic separation, respectively. Neither of these are present between several species in the Daly River to Litchfield area. Considerable variability is evident in hybrids of *C. armstrongii*, *C. calcicola*, and *C. conferta*. Hybridism is a natural occurrence where species are within pollination range of each other. Although not a threat *per se*, it is necessary to be aware of hybrid occurrence when considering the distribution and genetic integrity of individual species. The increased use of cycads, both native and exotic, in landscaping may result in new hybrids in the future.

The sole representative of *Macrozamia* in the Northern Territory is a medium sized cycad with a stout trunk. Leaf bases are retained at senescence. Petioles are smooth and expanded at the base and leaflets lack a midrib. Cones are sexually dimorphic with female cones broad and large, and male cones smaller and narrow.

9.2.1 *Cycas angulata* R.Br.

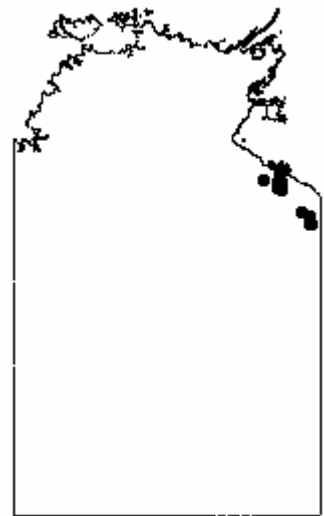
Species description: Large cycad up to 12 m, occasionally taller, with thick black trunk 30-60 cm in diameter, often swollen at the base. Leaves 100-160 cm have 170-360 leaflets attached to the rachis at 38-64° with the midrib raised below and only slightly raised above. For a detailed discussion see Dixon (2004). This taxon encompasses *Cycas angulata* R.Br. and *Cycas brunnea* K.D. Hill presented in Hill (1992, 1996), Hill and Osborne (2001), and Jones (2002).

Habitat: Sand to sandy loam in sparse grassy woodland with deep sands where cycads are the dominant vegetation.

Range: East of Borroloola along the Gulf of Carpentaria to the Robinson River with dense stands extending along the Wearyan River and east, inland of the salt flats, to the Robinson River. Also known from three populations on Wollogorang Station. Other populations are found around Lawn Hill in western Queensland and Bountiful Island in the Gulf of Carpentaria. Further examination of Wollogorang Station may reveal additional populations.

Land tenure: All stands are on leasehold or pastoral lease land. The majority are within four pastoral properties: Manangoora, Greenbank, Wollogorang, and Robinson River. The species does not occur in any parks or reserves.

Population dynamics: The majority of *C. angulata* populations are dominated by trunked plants most of which are greater than 1 m tall. The ratio of juveniles (non-seedlings without trunks) to trunked specimens varies among populations (1:20 to 3:2) and does not appear to be related to last fire. Evidence of seedlings is destroyed by fire, so primary recruitment can only be evaluated in unburnt areas where a ratio of seedlings per female can be greater than 10:1. The ratio of juveniles (non-seedlings without trunks) to trunked specimens from one of the Wollogorang populations studied is approximately 4:3. Plants as short as 1-2 m may be mature, and in the mid 1990s the ratio of seedlings per female was greater than 5:1. Evidence of adult mortality is minimal, so even minor recruitment would appear sufficient to maintain the population.



General status: With total numbers estimated at over 1 million plants, *C. angulata* is abundant over a large area. Fire appears to be well managed throughout the species range. The main damage to plants is from high winds often associated with cyclones. However mortality from wind damage appears to be minimal as the cycads respond by branching and regenerating from old bases and root stocks. Reproduction appears sporadic with a small percentage of females seeding in most years and a majority of females seeding only every 3 or 4 years. Cycads pose a problem for pastoralists because of their toxicity; however most station managers seem resigned to live with them.

Potential threats: At present the species is secure. Current controlled burning practices have minimised the impact of fire and should continue. No major clearing is anticipated in the area. However, development in the area, especially for tourism, could result in more clearing in the future.

9.2.2 *Cycas arenicola* K.D.Hill

Species description: Short cycad to 2 m, occasionally taller, with a stocky trunk 25-40 cm in diameter. Leaves 93-163 cm have 176-254 leaflets attached to the rachis at 48-58° with the midrib prominent below and only slightly, if at all, raised above. For a detailed description see Hill (1993) and Dixon (2004).

Habitat: Broken sandstone country on sandy soils on scree.

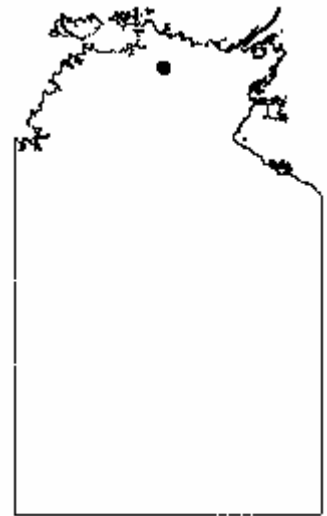
Range: Upper East Alligator River, along the eastern end of the Ranger fault line and along the upper Liverpool River. Because *C. arenicola* has been found in relatively inaccessible places, it is quite possible that other populations exist in the general area.

Land tenure: All stands are on Aboriginal land in Arnhem Land. It is not included in any parks or reserves.

Population dynamics: Unknown

General status: *Cycas arenicola* is locally abundant and because of its remoteness, not considered at risk from development such as land clearing.

Potential threats: Due to its remote locality, wildfire is a possible threat.



9.2.3 *Cycas armstrongii* Miq.

Species description: Medium cycad up to 6 m with a slender trunk 6-12 cm in diameter. Branching occurs along with occasional offsets and basal suckers. Leaves form an obliquely erect to spreading crown. Each has 84-156 leaflets attached to the rhachis at about 56-70° with a prominent midrib above. For a detailed description see Hill (1996), Hill and Osborne (2001), Jones (2002) and Dixon (2004).

Habitat: Mainly in open grassy woodland on yellow and red earths, limited in the area by drainage.

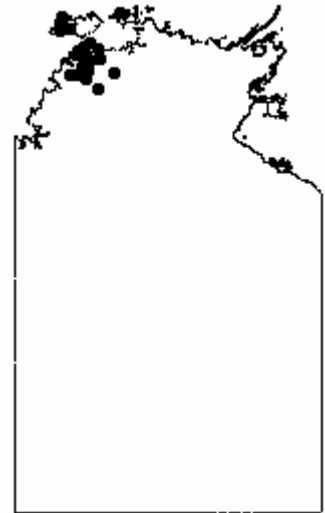
Range: Around the Darwin area south to near Hayes Creek, west to within 50 km of the coast and eastward past the Adelaide River floodplain to the north-western corner of Kakadu National Park. Also on the Tiwi Islands, Cobourg Peninsula, and Cox Peninsula.

Land tenure: *Cycas armstrongii* is found in multiple land tenures including private, government and leasehold. It is found on the following parks and reserves: Berry Springs Nature Park, Black Jungle Conservation Area, Blackmore River Conservation Reserve, Casuarina Coastal Reserve, Djukbinj National Park, Garig Gunak Barlu National Park, Holmes Jungle Nature Park, Howard Springs Hunting Reserve, Howard Springs Nature Park, Kakadu National Park, Litchfield National Park and Manton Dam Recreation Area.

Population dynamics: Population modelling based on experimental work near Darwin reveal resilience of the population to a wide range of frequency of low intensity fire but population decline when subject to frequent high intensity fire (Liddle 2004).

General status: This species is locally abundant but less than 1% of the population is included in conservation reserves. The species has been classified as Vulnerable, using the IUCN criteria, based on a predicted >30% reduction in population size over a 100 year period commencing a decade ago. Land clearing for urban, rural and horticulture in the greater Darwin area is reducing the available habitat. Such land clearing is expected to continue as Darwin expands. In particular, prime cycad habitat with deep loamy soil has been identified as land suitable for horticulture. It is anticipated that substantial areas of prime habitat on the Tiwi Islands will be cleared for forestry. The prevalence of high intensity fire events is expected to increase (Rossiter *et al.* 2003) as exotic grasses invade native vegetation in the Darwin Region (Kean and Price 2003).

Potential threats: Land clearing and inappropriate fire regimes, particularly arising from increased fuel load due to invasion of exotic grasses, are major threats. Mortality in excess of 50% of adult stems per fire event has been recorded when subject to fuel loads of 20 tonnes per hectare (Liddle 2004). The exotic pasture species gamba grass *Andropogon gayanus* supports fuel loads up to 20 tonnes per hectare and the exotic perennial mission grass *Pennisetum polystachyon* supports fuel loads up to 27 tonnes per hectare. Both of these exotic species are spreading rapidly and have the potential to extend over the full range of *C. armstrongii*. Seed development occurs over a long period from October through September. Fires have varying effects on individual female reproduction, depending on stage of seed development, intensity of fire and height of female.



9.2.4 *Cycas arnhemica* K.D.Hill

Species description: Medium cycad 5 m tall, rarely to 7 m, with a slender trunk 12-20 cm in diameter. Leaves 52-116 cm long with 98-262 leaflets attached to the rachis at 48-80° with the midrib prominent below and only slightly, if at all, raised above. For a detailed description see Dixon (2004). This taxon encompasses the three subspecies previously recognised by Hill (1994, 1996).

Habitat: Found in savanna forests dominated by *Eucalyptus tetrodonta* and *E. miniata* on deep white to yellow sands over laterite, or on old beach dunes in near coastal sites on Groote Eylandt.

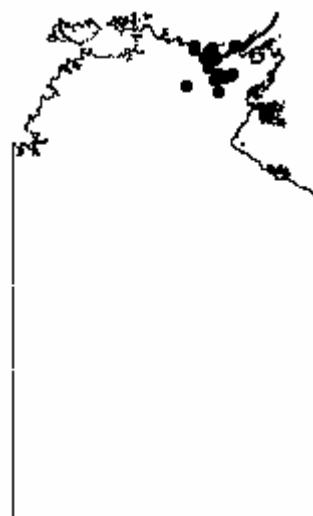
Range: Found around the Goyder River in central Arnhem Land. Groote Eylandt and the central north coast of Arnhem Land.

Land tenure: All stands are on Aboriginal land and the species is not included in any parks or reserves.

Population dynamics: Data from monitoring sites suggest a healthy balance of size classes within populations near Maningrida (Griffith *et al.*, 2005).

General status: Locally abundant.

Potential threats: Frequent fires are reported to have reduced the numbers of viable seed (Hill, 1994).

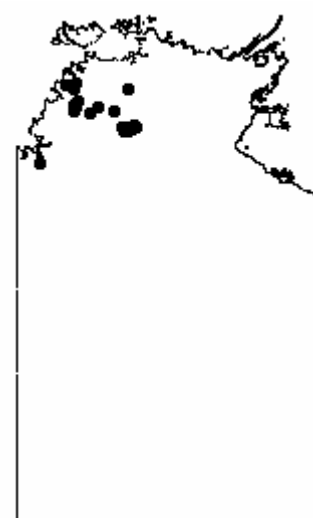
9.2.5 *Cycas calcicola* Maconochie

Species Description: Small to medium cycad up to 3 m in height and 30 cm in diameter having an obliquely erect crown with flat straight leaves. Each leaf contains 198-504 leaflets moderately spaced on the rachis at 48-80° with a raised midrib beneath. For a detailed description see Maconochie (1978), Hill (1996), Hill and Osborne (2001), Jones (2002) or Dixon (2004).

Habitat: Sparse, stunted woodland with limestone outcrops or sandy flats derived from sandstone with other vegetation varied, including *E. miniata*, *E. phoenicea*, *E. porrecta*, *E. confertiflora*, *Melaleuca* spp. and *Syzygium* spp. The soils are sandy over quartzite, shale and limestone.

Range: Three main areas are Litchfield Park, along the Daly River from the crossing southeast to Oolloo and northwest of Katherine. Smaller scattered stands may link these major groups. A population occurs on Bullo River Station and Spirit Hills in the Victoria River District.

Land tenure: Large numbers of *C. calcicola* are found in Litchfield National Park and a smaller population is at Kintore Caves Nature Park near Katherine. The remaining stands are on pastoral lease except for some small populations around



Katherine on private and government land, and populations in the proposed wilderness park in the Spirit Hills area.

Population dynamics: Only in unburnt areas are juveniles outnumbering trunked specimens. In 1994 the vast majority of adult plants were reproductive and the sex ratio appeared to be even. Primary recruitment can only be evaluated in unburnt areas where in 1994 few seedlings were present. Adult mortality is evident in areas of high intensity fire (Parks and Wildlife Commission unpublished data 1994).

General status: The populations around Katherine are in poor condition due to fire and past uncontrolled collection. However, the larger populations in the Daly River and Litchfield areas appear in better condition, though fire damage is widespread. Population estimates are: >7,000 for the Daly River; >5,000 for Litchfield Park; >1,500 for Katherine; and >5,000 individuals for Bullo River and Spirit Hills (Parks and Wildlife Commission unpublished data 1994, 1995 and 1996).

Potential threats: The main concern for these populations is fire. Evidence of fire damage has been widespread in the past, including stem loss or weakening and sap exudation in the severely burned populations. Illegal seed and plant collection in the past has contributed to the decline of populations adjacent to the Stuart Highway near Katherine.

9.2.6 *Cycas canalis* K.D.Hill

Species description: Medium cycad up to 3 m, and prominent below. For a detailed description see Dixon (2004). This taxon encompasses the two subspecies previously recognised by Hill (1994, 1996).

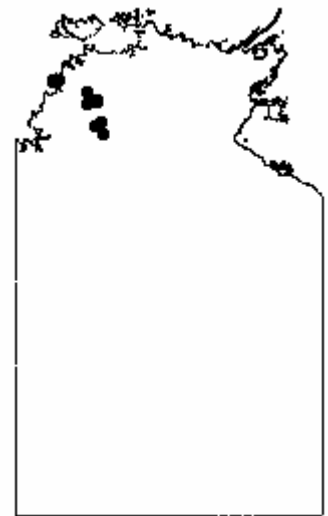
Habitat: *Cycas canalis* is found in Eucalypt forest woodland dominated by *E. miniata* on well-drained lateritic soils.

Range: *Cycas canalis* is found around Channel Point to Tjuwaliyn (Douglas) Hot Springs Park and south to the Flora River Nature Park.

Land tenure: *Cycas canalis* occurs on Aboriginal and pastoral leasehold land. Small populations occur on Tjuwaliyn (Douglas) Hot Springs Park and Flora River Nature Park.

Population dynamics: The Channel Point population of *C. canalis*, has a small proportion (<5%) of adults greater than 1 m tall. Seedlings are few and many apparently juvenile plants are regrowth from old bases or root stock. The remaining populations appear to have a more balanced population structure with a larger percentage of adults.

General status: *Cycas canalis* is locally very abundant,. The population at Channel Point is subject to heavy infestation by Chrysomelidae beetles which may limit the plants' resources, negatively impacting on reproduction.



Potential threats: Large areas of the Channel Point population have been cleared for agriculture and there is a potential that additional areas will be cleared for agriculture and tourist development. Frequent fire appears to be a threat to reproduction in the Channel Point population. In the remaining populations fire and land clearing are possible threats, with extensive clearing for agricultural proposed for the Daly Basin.

9.2.7 *Cycas conferta* Chirgwin

Species Description: Medium-sized cycad reaching 6 m in height and 15 cm in diameter. Petioles 24-34 cm long with 124-192 leaflets often overlapping with flush midrib. Lower petiole may be smooth or with a series of short thorns. For detailed description see Chirgwin and Wigston (1993) and Dixon (2004).

Habitat: Found mainly on rocky outcrops and stunted woodland overlying Cullen granite and sandstone and quartz of the Brocks Creek Group. The soils are grey gravelly loams. *Eucalyptus miniata* is the dominant tree species in the woodland whereas the cycads are dominant on the outcrops.

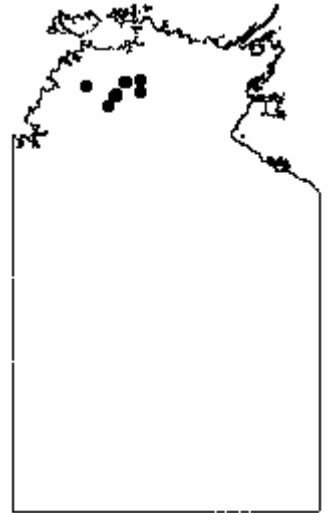
Range: From between Jim Jim Falls and Graveside Gorge in Kakadu, southwest through Goodparla and Mary River Station to Foelsche Headland, and north to Burrell Creek near Adelaide River. A large population of *C. conferta* has been reported near the headwaters of the Fergusson River, but as yet has not been confirmed.

Land tenure: The majority of plants occur on pastoral leases with small to medium size stands in Kakadu National Park.

Population dynamics: Reproduction rate is low and may be suppressed due to fire in areas such as Harriet Creek. Recruitment is hard to assess because of late season fires.

General status: Population estimates exceed 30,000 plants with a major concentration at Harriet Creek. In the past, the large population at Harriet Creek has been extensively harvested for seed. Some of the smaller populations along the Kakadu Highway have been severely impacted by past removal of plants. However, because of the large numbers over a substantial area, the species is not presently at risk.

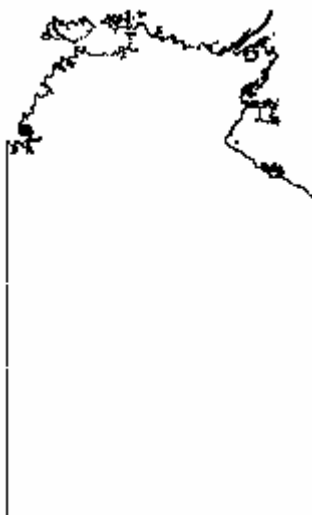
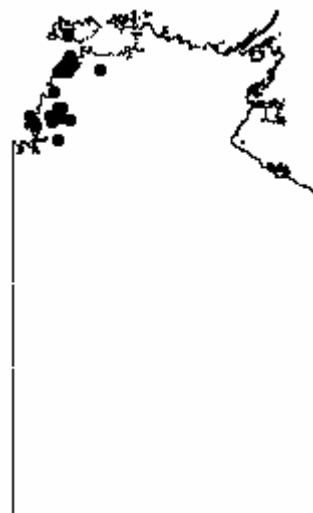
Potential threats: Contemporary fire regimes appear to be having a negative impact in some areas. There is a need to maintain controls on harvest as removal of plants from easily accessible sites could negatively impact on some populations.



9.2.8 *Cycas maconochiei* Chirgwin & K.D.Hill

Species description: Medium to tall cycad 3 m in height, rarely to 7 m, with a trunk 9 to 15 cm in diameter. Leaves 62-128 cm long with 152-288 leaflets attached to the rachis at 61-85°. Midrib slightly raised above and prominent below. Two subspecies occur: *Cycas maconochiei* subsp. *maconochiei* with dull bluish green leaflets that retain some hair; and *Cycas maconochiei* subsp. *viridus* K.D.Hill with glossy mid-green leaflets which become hairless with age. For a detailed description see Dixon (2004). *Cycas maconochiei* subsp. *maconochiei* encompasses two subspecies previously recognised by Hill (1996).

Habitat: Sparse woodland usually dominated by *E. miniata* on a variety of well-drained soils. Also found in swampy areas and coastal dunes.



Range: *Cycas maconochiei* subsp. *maconochiei* occurs in coastal areas west of Darwin from Cox Peninsula and Fog Bay extending south to the mouth of the Victoria River and inland toward Dorisvale. Populations also occur on the Tiwi Islands. *Cycas maconochiei* subsp. *viridis* is known only from Fossil Head.

Land tenure: The majority of the area is Aboriginal land with other private and leasehold land in the northern part. *Cycas maconochiei* subsp. *maconochiei* occurs on Indian Island Conservation Area.

Population dynamics: Unknown

General status: The two subspecies are locally abundant; however *C. maconochiei* subsp. *maconochiei* is under threat of substantial population decline through land clearing and inappropriate fire regimes. Insufficient data exists to adequately classify the status of *C. maconochiei* subsp. *viridis*.

Potential threats: Land clearing threatens populations in localised areas. The invasion of exotic grasses into areas of native vegetation and an increase in fire intensity due to increases in fuel load is likely to have a negative impact on this species.

9.2.9 *Cycas orientis* K.D.Hill

Species description: Medium cycad up to 4 m, occasionally taller, with a slender trunk 8-14 cm in diameter. Leaves 52-124 cm have 96-210 leaflets attached to the rhachis at 53-79° with midrib slightly to moderately raised above and prominent below. For a detailed description see Hill (1994, 1996) and Dixon (2004).

Habitat: Found in savanna forests dominated by *E. tetradonta* and *E. miniata* on deep white to yellow sands over laterite.

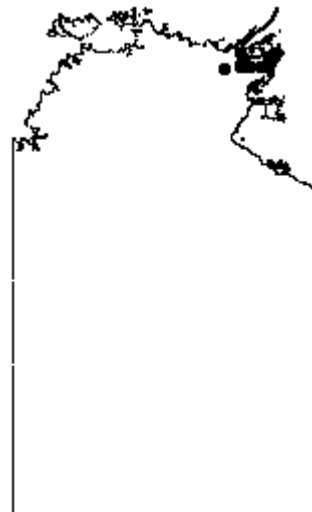
Range: Eastern Arnhem Land to Lake Evella.

Land tenure: All stands are on Aboriginal land. It is not known from any park or reserve.

Population dynamics: Unknown

General status: The species is locally abundant over a large area (Hill, 1994).

Potential threats: Little is known about the species. However, inappropriate fire regimes pose a threat to the species (Dixon pers. obs.)

9.2.10 *Cycas pruinosa* Maconochie

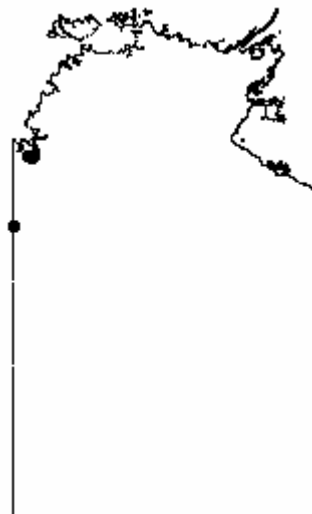
Species description: Medium cycad to 2 m, with a trunk 25-40 cm in diameter. Leaves grey green to bluish grey, 72-110 cm long bearing 158-420 leaflets with revolute margins, attached to the rachis at about 51-69° and obliquely erect with the basal portion of the leaf broadly U shaped and the distal 2/3^{rds} of the leaf forming a deep keel in or cross section. For a detailed description see Maconochie 1978, and Dixon (2004).

Habitat: In the Northern Territory *C. pruinosa* generally occurs in savanna woodland dominated by *E. miniata* and *E. tetradonta*, and open shrublands on sandstone. The population on Kirkimbie Station occurs on limestone.

Range: In the Northern Territory known from Bullo River and Kirkimbie Stations, and the Spirit Hills area (NT Herbarium database). In Western Australia it occurs in the ranges west and south of the Kununurra-Ord River area (Maconochie 1978).

Land tenure: In the Northern Territory *C. pruinosa* occurs on pastoral lease and in the proposed wilderness park in the Spirit Hills area.

Population dynamics: Preliminary data from monitoring sites established in the Spirit Hills area reveal little change in population structure over a nine year period (PWSNT unpublished data).



General status: Survey by the Department of Natural Resources, Environment and The Arts indicate in excess of ten thousand plants occur in the Northern Territory and the species is not considered to be at risk.

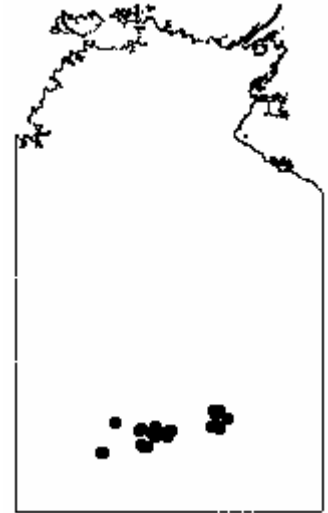
Potential threats: Fire is the main potential threat to the taxon in the Northern Territory.

9.2.11 *Macrozamia macdonnellii* (F.Muell. ex Miq.) A.DC.

Species description: A medium cycad to 3 m tall with a stout trunk to 1 m in diameter, often procumbent. Blue-green leaves 1.2-2 m have 120-170 crowded leaflets attached to the rachis at 40°. One or two cones are typically produced at one time per plant, but up to 5 cones have been recorded. The seeds are probably the largest of any cycad, weighing 50 g. For a more detailed description refer to Hill and Osborne (2001) or Jones (2002).

Habitat: Found in sheltered gorges and on hills of both metamorphic and sedimentary rock.

Range: It is restricted to the Krichauff, George Gill, Harts and MacDonnell Ranges in central Australia.



Land tenure: Between 60% and 70% occur on parks and reserves with the remainder on Aboriginal land and pastoral lease. The parks and reserves containing cycads are Finke Gorge National Park, Ruby Gap Nature Park, Watarrka National Park and West MacDonnell National Park.

Population dynamics: Females cone very sporadically and recruitment is dependent on rains which are unpredictable. Based on work done at Pimelea Valley in Finke Gorge less than 20% of plants are adults and over 50% of plants have an above ground stem under 5 cm high. Preece (2005) found that less than 5% of individuals were seedlings and evidence indicates that plants are very long-lived.

General status: *Macrozamia macdonnellii* is thought to be a relict species surviving in a narrow ecological niche in an otherwise hostile environment. Many small populations ($n < 1000$) exist; however, larger populations are limited to Kings Canyon and Palm Valley. Little recruitment occurs and growth in the wild appears to be the slowest of Northern Territory cycads. The species is classified as vulnerable under the *Environment Protection and Biodiversity Conservation Act 1999* due to its restricted occurrence in severely fragmented populations, in combination with a projected decline due to fire and illegal harvesting. In a recent review of plants listed as threatened under the *Territory Parks and Wildlife Conservation Act*, the species was downlisted to near threatened. This reclassification was due to the reasonably large and extensive population in combination with a lack of evidence of a mechanism of decline. The species displayed a strong ability to resprout following intense fires in 2002 and a study by Preece (2005) indicated that fire was not a significant factor in the distribution of the species.

Potential threats: Illegal seed collection is a potential threat to populations at accessible sites. There is concern about an apparent decline in the Black-Footed Rock-wallaby, *Petrogale lateralis*, populations. If Rock-wallabies undergo a decline this may have an adverse effect on seed dispersal.

9.3 Historical Use of Cycads

Cycads have long been used by Aboriginal people in the Northern Territory (Thieret 1958). The seed is rich in starch and is treated by heat and leaching to remove toxins before being eaten. Exudates from the leaves and sporophylls are used for medicinal purposes, as is the ground seed. This usage is thought unlikely to create problems for wild cycad populations or require management.

The toxins that cycads contain may cause paralysis in cattle. Although not a preferred feed, cycad leaves are eaten by cattle, especially during dry conditions when more palatable food is scarce. In the past cycad eradication was promoted by the Department of Primary Industry and Fisheries (Wesley-Smith 1973). While such eradication is no longer actively promoted by government agencies, many pastoralists view cycads as a threat to cattle and seek ways to reduce or eliminate them. An intention of this management program is to raise the profile of cycads and their habitat through the return of royalties to landholders from sustainable harvesting and a public awareness campaign.

Cycad plants and seed are in demand from cycad enthusiasts and from the nursery trade. While traditionally the primary demand has been from specialist collectors, cycads are increasingly popular in landscaping and as pot plants. There is demand from the ornamental leaf trade due to their attractive shape and long shelf-life. The leaves are commonly used to complement orchid stems and in dried flower arrangements. To date, collection has posed little threat to the survival of species. However, in the past some small populations have been decimated by uncontrolled removal of plants and seed. It is a thrust of the management program to promote public awareness of cycads and allow for legal collection from the wild to help meet the demand with minimal impact on any wild population.

9.4 Conservation

The recurrence of intense late dry season fires threaten some cycad populations. Field observation of *C. armstrongii* indicate a reduction in the production of seed within the same year following fire. Fire destroys existing seed (Wesley-Smith 1973) and seedling mortality appears to be increased by fire (Chirgwin 1990). These observations support the proposal that frequent burning inhibits regeneration. On the other hand fire appears to promote seed production in other situations (Jones 2002). Intense fires may damage plants and increase their susceptibility to insect damage, especially termites, and disease (Parks and Wildlife Commission unpublished data). Under the auspices of a previous management program for cycads, research has been undertaken to examine the impact of various fire regimes on *C. armstrongii* (Liddle 2004). Modelled population response under various frequencies of low intensity fire reveal resilience of cycad populations to a broad range of fire frequency. In contrast, high intensity fire more frequently than one in five years resulted in population decline. Given the prominence of fire in many Top End landscapes (Williams *et al.* 2001) and the rapid spread of exotic grasses (Kean and Price 2003) which give rise to intense fires (Rossiter *et al.* 2003), there is a significant evolving threat to cycads and their habitat. The evidence provides weight to the argument that landscapes supporting cycads will require active management to avoid long-term population decline. Obtaining an economic return from the sustainable harvest of cycads provides one of few incentives available to landholders to conserve cycads and their habitat. The impact of fire on populations will continue to be evaluated in the cycad monitoring program and the results incorporated into cycad management prescriptions.

With the expansion of rural development and agriculture, especially in the Darwin and Katherine Regions, cycads such as *C. armstrongii*, *C. canalis* and *C. maconochiei* subsp. *maconochiei* are especially vulnerable to clearing. The projected rate of clearing within the range of *C. armstrongii*, in combination with the invasion of exotic grasses, has been sufficient to warrant this species being classified as vulnerable to extinction under Red List criteria (IUCN 2001). Clearing on pastoral land is regulated under the provisions of the *Pastoral Land Act* and the implementation of regulations needs to reflect flora conservation priorities. Under the provisions of the *Planning Act*, clearing controls are in place on all freehold and Crown land of two hectares or more outside of existing towns and current plan areas such as Darwin, Katherine and Alice Springs. These also need to take flora conservation provisions into account. As part of this management program, the Department of Natural Resources, Environment and The Arts will provide advice to other sections of Government involved in approving land clearing proposals for areas with cycads. To assist in providing advice, the extent of clearing of cycads will be monitored using data from the Land Clearing Branch of the Department of Natural Resources, Environment and The Arts.

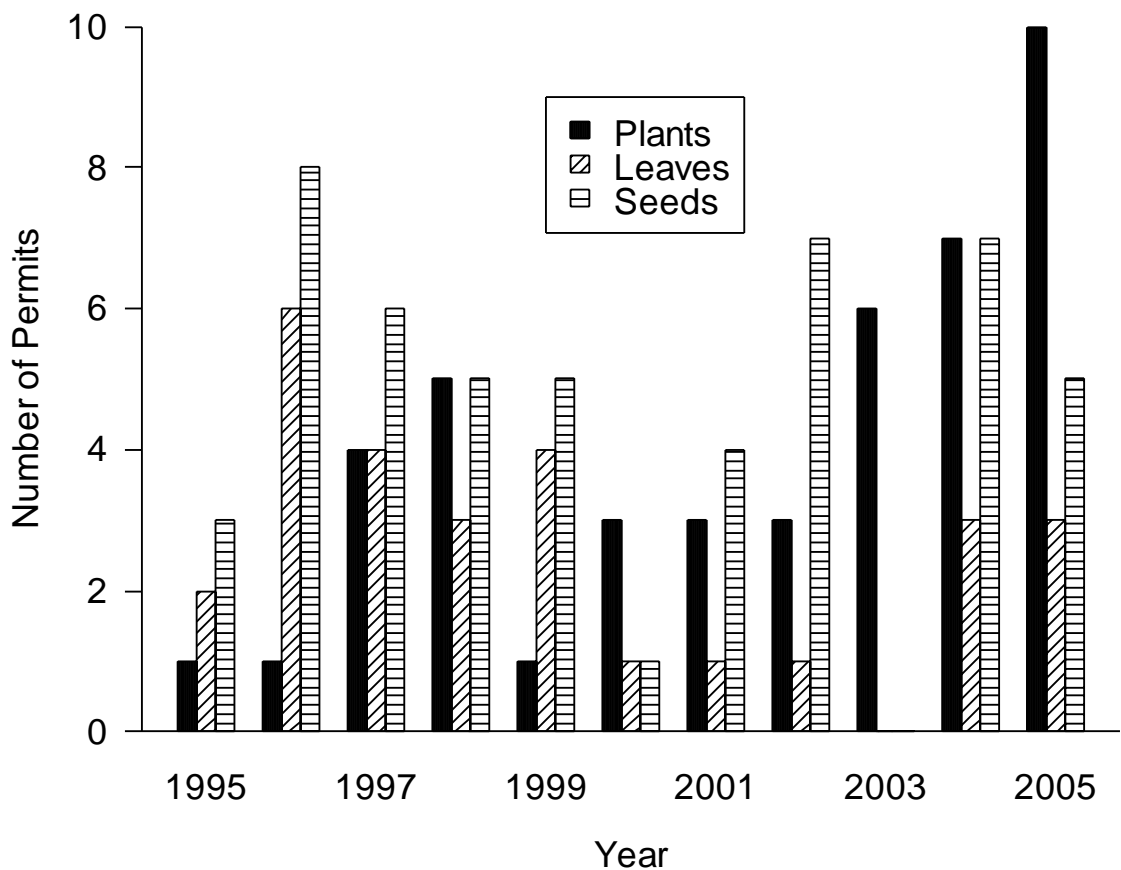


Figure 1: The number of permits issued for cycad harvesting from 1995 to 2005.

9.5 Harvesting History

Prior to 1992 there was provision under the *Forestry Act 1980* for regulation of cycad harvesting through Forest Products Licences and under the *Crown Lands Act* through Miscellaneous Licences. Few licences were issued and limited information is available to indicate the scale of harvesting. The number of permits and licences issued for the taking of cycads under the *Territory Parks and Wildlife Conservation Act* since 1995 is provided in Figure 1. Early in the period leaf harvesting predominated while in the later years seed and whole plant harvesting have become more prominent (Figure 2). Based on harvesting returns, the majority of plant harvest has been of *C. maconochiei* subsp. *maconochiei* (45%) and *C. armstrongii* (29%); followed by *C. angulata* (13%) *C. arnhemica* (10%) and *C. canalis* (2%). Leaf harvest has been primarily from *C. armstrongii* (98%), with a small proportion of *C. maconochiei* subsp. *maconochiei* (2%). Seed harvest has been spread across *C. angulata* (41%), *C. armstrongii* (38%), *C. maconochiei* subsp. *maconochiei* (14%), *C. calcicola* (3%), *C. canalis* (3%) and *C. arnhemica* (1%).

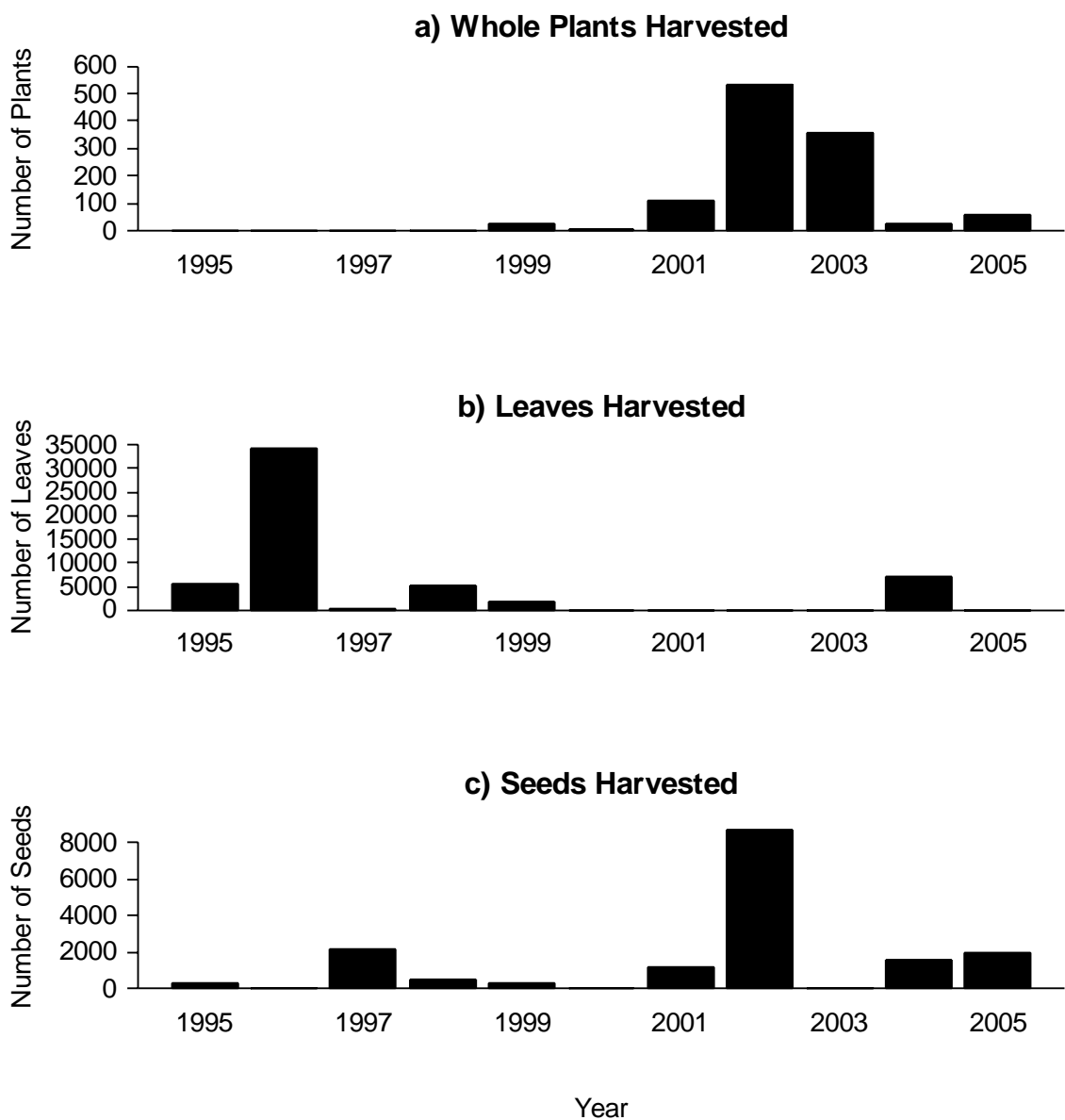


Figure 2: Quantity of (a) cycad plants, (b) leaves and (c) seeds harvested from 1995 to 2005 based on permit return data.

Appendixes

Appendix 1 - Milestone Matrix for Cycad Management Program

Section & Milestones	Action Officer	Year					
		2007	2008	2009	2010	2011	2012
3.2.6. Issue of permits for cycad harvest	Director of Wildlife	Sept 07 Summary report of permits issued and material harvested	Sept 08 Summary report of permits issued and material harvested	Sept 09 Summary report of permits issued and material harvested	Sept 10 Summary report of permits issued and material harvested	Sept 11 Summary report of permits issued and material harvested	Sept 12 Summary report of permits issued and material harvested
3.2.8, 4.1, 7 Harvest compliance monitoring	Director of Wildlife	Dec 07 Site inspections undertaken	Dec 08 Site inspections undertaken	Dec 09 Site inspections undertaken	Dec 10 Site inspections undertaken	Dec 11 Site inspections undertaken	Dec 12 Site inspections undertaken
3.4. 4.1 Impact monitoring and assessment	Director of Wildlife	Sept 07 Develop rapid impact assessment protocol	Dec 08 Assessment of selected sites including floristics	Dec 09 Assessment of selected sites	Dec 10 Assessment of selected sites	Dec 11 Assessment of selected sites	Dec 12 Assessment of selected sites
3.2.10 Artificial propagation	Director of Wildlife	Dec 07 Consultation with stakeholders commenced	Dec 08 Position on artificial propagation developed				
3.4 Report on past research	Director of Wildlife	Dec 07 Report on C. armstrongii fire impact and population model of fire and harvest	June 08 Report on C. armstrongii leaf and stem harvest	June 09 Report on C. calcicola population model including fire impact			
3.5 Media and landholder extension	Director of Wildlife	Dec07 Brochure on guidelines to cycad harvest	Ongoing	Ongoing	Ongoing	Ongoing	Ongoing
3.2.8, 6 & 8 Review program	Director of Wildlife					Dec 11 Review program and report on monitoring	Mar 12 Revised program ready for adoption process

Appendix 2 - 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 is in force nor an estate in fee simple has been granted by the Territory;

"interfere with", in relation to an animal or a plant, means to –

- (a) harm, disturb, alter the behaviour of or otherwise affect the capacity of the animal or plant to perform its natural processes; or
- (b) damage or destroy the habitat of the animal or plant:

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

"protected wildlife" means a species of wildlife or an animal or plant of a species of wildlife that is protected under section 43;

"sustainable use", in relation to wildlife, means the taking or using of wildlife at a level that is capable of being continued without endangering the capacity of the wildlife to maintain itself and sustain its natural processes;

"take" means – (b) in relation to a plant - to sever, remove, damage or destroy, or assist to sever, remove, damage or destroy, the plant;

"unprotected wildlife" means a species of wildlife or an animal or plant of a species of wildlife that is not protected wildlife;

"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 Aboriginals before the year 1788; and
- (e) such other animals and plants as are prescribed.

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