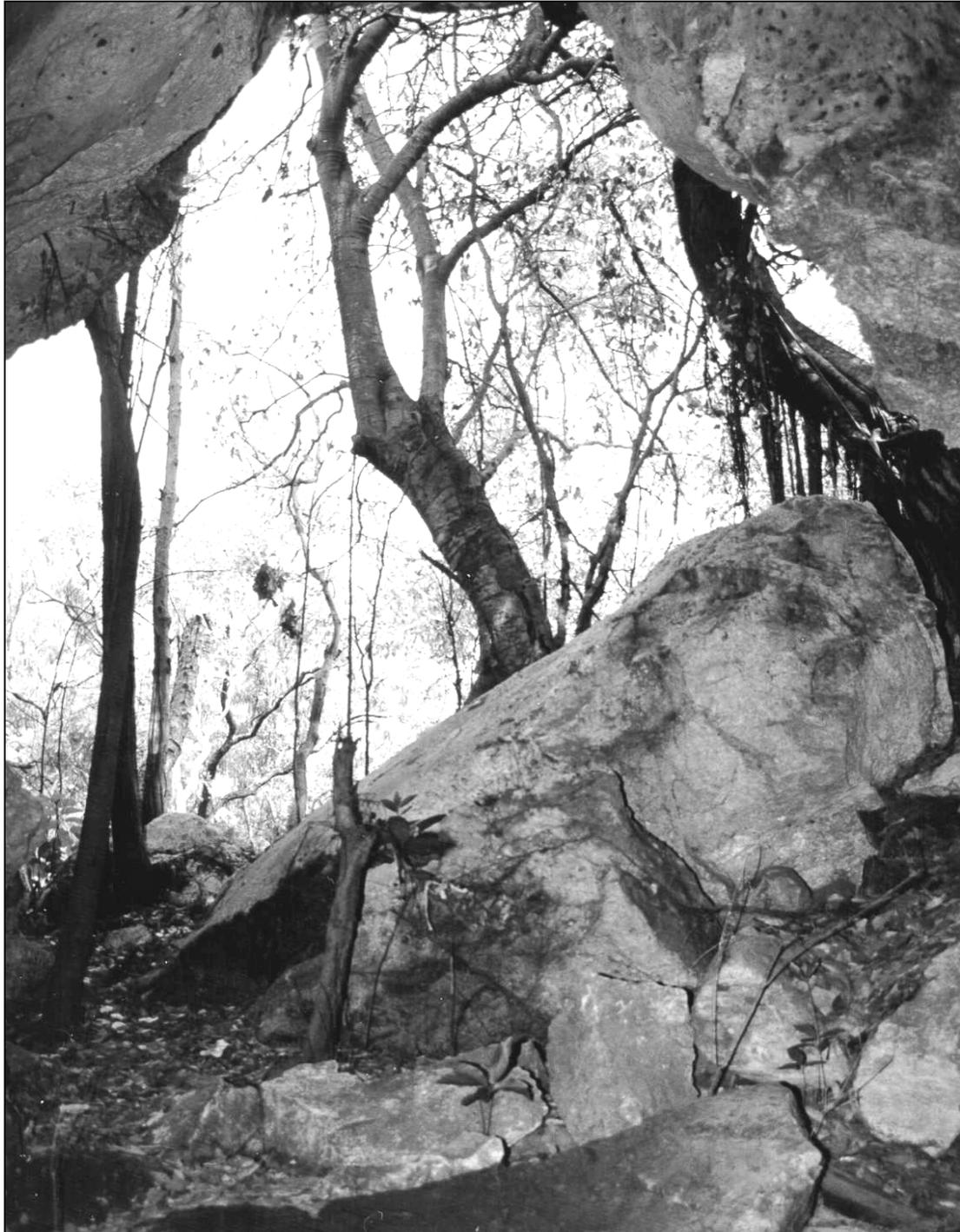
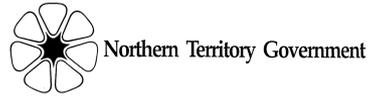


Parks and Wildlife Commission of the Northern Territory

KINTORE CAVES NATURE PARK



Plan of Management
November 2000



Northern Territory Government

Executive Summary

The Parks and Wildlife Commission of the Northern Territory is responsible for the management of Kintore Caves Nature Park, a small park of 423 hectares located twelve kilometres north-west of the township of Katherine.

The area was first reserved in 1966 to protect and manage its main conservation values. These include the Park's karst (limestone) landscape and extensive system of underground caves which provide habitats for rare and interesting fauna. Archaeological values are also significant, confirmed by studies in the past disclosing evidence of a long history of human occupation. The significance of the Park has also been recognised by its declaration as a heritage place under the *Heritage Conservation Act 1991*.

The Park has never been developed in any way for public use. Consequently it is relatively undisturbed by human impact and offers excellent opportunities for continued geological, ecological and archaeological research.

Past management activities have focused on furthering knowledge of the Park's caves and cave fauna, control of weeds, maintenance of boundary fencing and reducing the impact of wildfire on vegetation.

This is the first Plan of Management for this Park. It identifies the key management issues and presents the guidelines by which the Park will be managed. The Plan proposes no drastic change to the way the Park has been managed to date. It focuses chiefly on continuing management for the protection of the Park's natural and archaeological values, and the encouragement of further research and monitoring.

For the period of this Plan significant management directions are:

- Improvement in the knowledge and understanding of the Park's karst and cave resources, the fauna utilising these habitats and the processes acting on these environments.
- Increasing cooperation with neighbouring landholders to facilitate effective management of fire, weeds, feral animals and activities which may impact on cave systems in the Park.
- The active encouragement of further archaeological research.
- Continuation of restrictions on public access to the Park and prohibition on recreational caving.
- Formalisation of agreements with adjoining landholders in respect of the existing fence alignment and functional Park boundary.
- The renaming of the Park to "Kintore Caves Conservation Reserve".

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1. INTRODUCTION

1.1 Purpose of this Plan

This plan states the intent of the Parks and Wildlife Commission with regard to the management of Kintore Caves Nature Park. It sets management objectives, identifies and addresses current issues and presents guidelines for effective management of the Park with regard to its values and resources.

This plan has been prepared and will become operational pursuant to sections 18 and 19 of the *Territory Parks and Wildlife Conservation Act*. It will remain in force for a minimum of 5 years and a maximum of 10 years unless revoked by a new plan or amended in accordance with the Act.

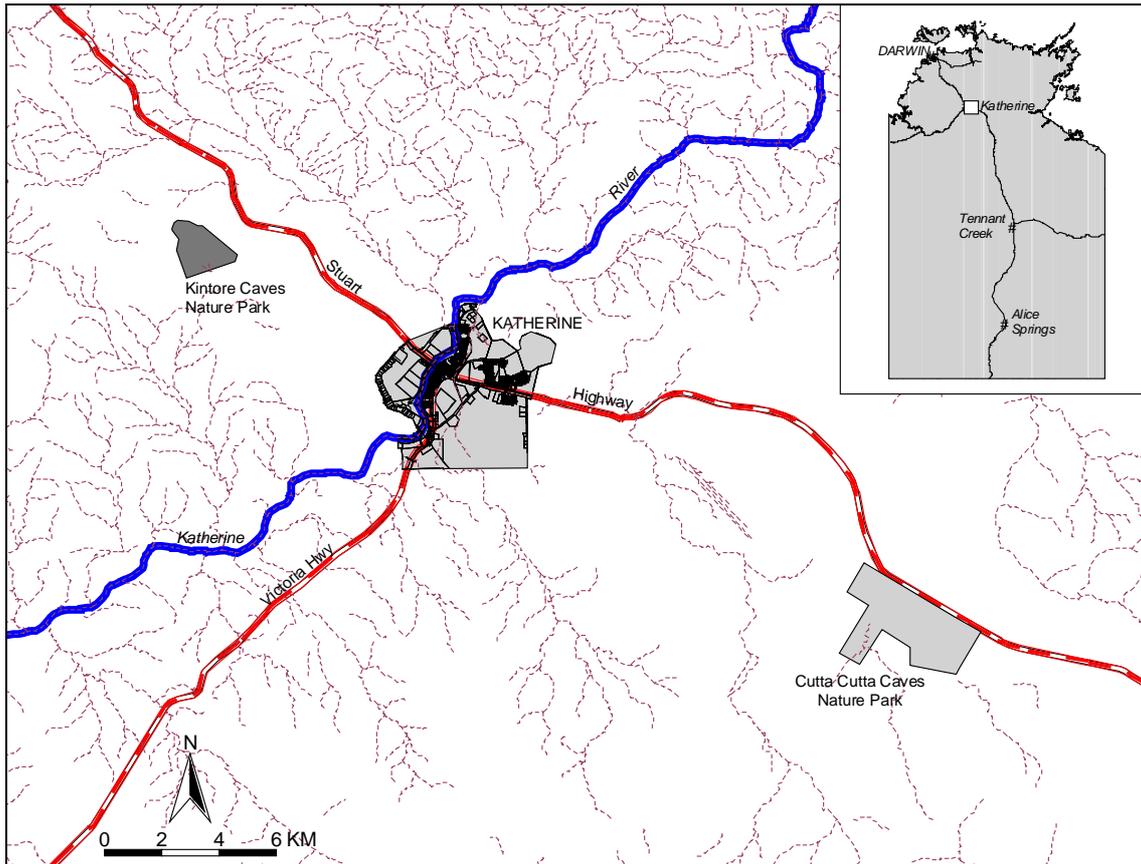
The plan will also be submitted for approval under section 39J(1) of the *Heritage Conservation Act* to ensure that actions outlined in this plan are approved in accordance with that Act.

1.2 Park Location and Description

Kintore Caves Nature Park comprises NT Portion 782, an area of 423.3 hectares located approximately twelve kilometres west-north-west of the township of Katherine (Map 1). The Park is bounded along its northern portion by the Northern Territory Rural College and at its southern portion by private property zoned for rural use (Map 2). The area has had reserve status since 1966 when it was declared a Scenic Reserve under the *National Parks and Gardens Ordinance*. It was declared a Park under Section 12 of the *Territory Parks and Wildlife Conservation Act* on 1 March 1991 and was gazetted on 13 March 1991. Kintore Caves Nature Park is also a *Heritage Place* under Section 26 of the *Heritage Conservation Act*, declared 30 January 1995. In addition, the Park is listed on the Register of the National Estate under both natural and Aboriginal criteria.

The geology of the area and resultant landscape is of significant geological interest. Five hundred million year old limestone outcrops over a large portion of the Park. The weathering of this soluble limestone has produced a distinctive terrain known as *karst*. A range of interesting surface features are present, but of most interest is an extensive system of horizontal underground caves and associated subterranean features.

In addition to their geological interest, the caves have high archaeological value. Past research has uncovered evidence of Aboriginal occupation for thousands of years. Although traditional Aboriginal affiliations to the area appear to have been lost, the Aboriginal language group affiliated with the area was probably Dagoman. While traditional claim to the area is currently disputed between Jayown and Wardaman Aboriginal groups (personal communication, Jawoyn Association), a native title claim has been made over the Kintore Caves Nature Park on behalf of the Dagoman by the Northern Territory Land Corporation.



Map 1. Park Location

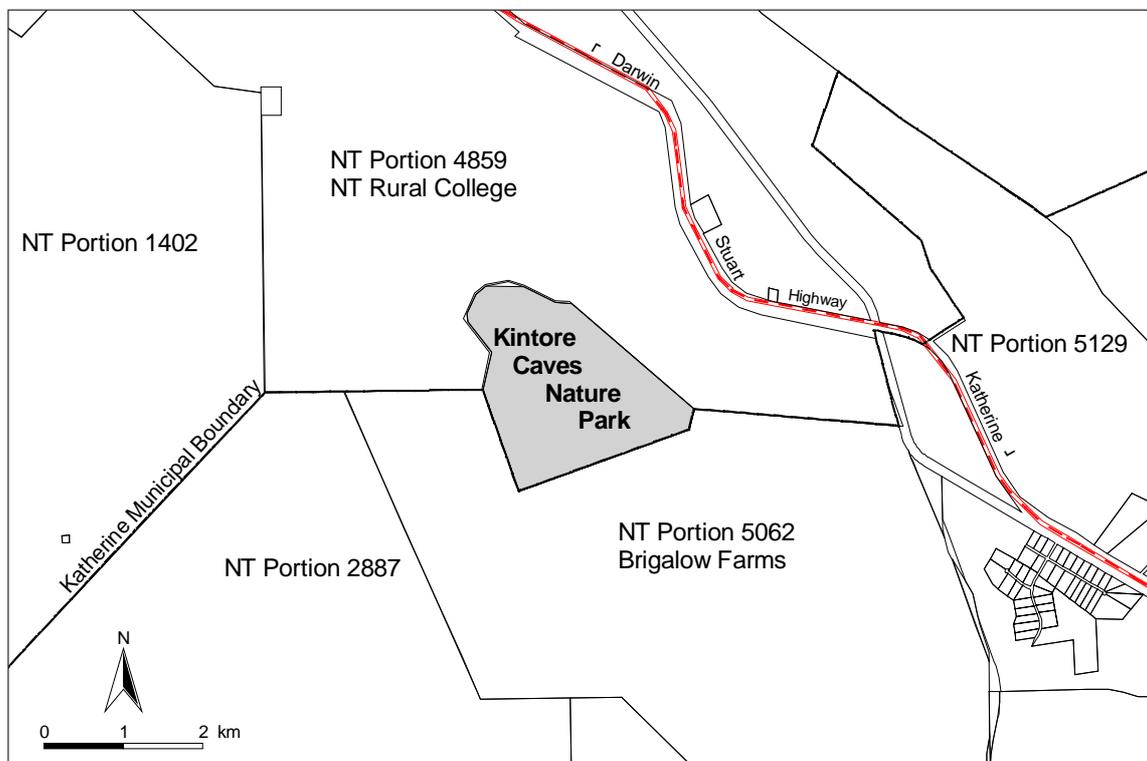
The landscape of the Park is varied. The central portion of the Park is very rocky and rugged with outcropping limestone, but the Park is generally of low relief. There are no creeks or standing waterbodies on the Park, although surface drainage funnelling into a number of caves and sinkholes is an obvious and interesting feature. The Park's vegetation consists mainly of Eucalyptus open woodland with minor shrub cover over a *Sorghum* and *Themeda* tall-grass understorey. Important populations of plants reserved on the Park include an uncommon cycad, *Cycas calcicola*, and a rare annual grass, *Sorghum macrospermum*. In addition, there are a number of small monsoon vineforest communities of conservation interest.

Opportunities to explore spectacular underground caves are available to the general public at Cutta Cutta Caves Nature Park about 40 kilometres south-east of Kintore Caves. Because of this alternative for the public to experience underground caves, and to protect the Park's primary values, this Park is neither developed nor managed for general public access. There are no facilities and access is four-wheel drive standard from the Stuart Highway for management purposes only.

1.3 Background

The European discovery of the caves dates back to 1879 when Alfred Giles, the manager of Springvale Station first visited the area. In 1891 Giles visited the main cave with the then Governor of South Australia, the Earl of Kintore, and named the cave after the Earl. The cave became, for a time, a popular picnic spot for white settlers around the turn of the century (Katherine Historical Society, 1972).

It appears that the location of the caves was then forgotten for some fifty years. In the 1950s a search to find the caves was initiated by the Administrator of the Northern Territory, Mr Marsh. The NT Speleological Society (NTSS) was established as a result of the widespread interest in relocating the caves. The NTSS rediscovered the caves and then successfully lobbied the Administrator to protect the area by awarding it reserve status (TESS, 1998). The caves of the Park have since been subject to quite extensive survey by the Katherine and Top End Speleological Societies.



Map 2. Neighbouring Land Tenure

In 1963, an archaeological excavation of the Kintore Cave system was conducted by Dr. DJ Mulvaney of the Australian National University. His excavation, near the entrance of the main cave, revealed a stone artefact sequence indicating some antiquity and temporal changes in stone tool technology. Artefacts in the upper layers consisted of points and other pieces with apparent relationships to other sites in this region. In the lower layers a few flaked tools were unearthed, which Mulvaney claimed probably belonged to an older culture. These findings suggest the area was used by Aboriginal people as a campsite and tool working area for many thousands of years.

1.4 The Values of the Park

The primary values of the Park are scientific and archaeological, relating to the cave systems and the associated evidence of past human use. The Park is a declared *Heritage Place* under the Section 26 of the *Heritage Conservation Act*. Kintore Cave Nature Park is also listed on the Australian Heritage Commission's Register of the National Estate as a significant scientific and archaeological site.

Scientific Values

- The Park's karst features, in particular the extensive underground caves are relatively undisturbed by human impact and represent an excellent opportunity for study into tropical caves and karst processes.
- The cave system represents an important opportunity for continued research into cave ecology. There is much still to be learned about cave fauna and flora. The cave system is regarded as a very important roosting habitat for several species of bat including the Ghost Bat, *Macroderma gigas* and the Orange Leaf-nosed Bat, *Rhinonictus aurantius*, both of which are sensitive to environmental disturbance.
- The Park's populations of *Cycas calcicola* and *Sorghum macrospermum* are of conservation interest, in addition to its monsoon vineforest communities.

Archaeological / Cultural Values

- The main cave is of high archaeological significance. The site contains a deep stratified cultural deposit incorporating a stone artefact sequence, which shows the transition in use and type of tools used by early inhabitants over time. There has been relatively little advance on this work and the opportunity for further archaeological research is one of the main values of the Park.
- A number of cave entrances contain Aboriginal paintings and engravings. Cultural links with motifs elsewhere have been established and there are important opportunities for further documentation and study.
- Evidence provided by recent flood events presents opportunities for research into the effects of various taphonomic processes, particularly those associated with flooding, on sites.
- The caves' historical associations with key figures of early Territory history, namely, the Earl of Kintore and Alfred Giles, first manager of Springvale Station, is also considered important.

1.5 The Purpose of the Park

The purpose of the Park is to provide for continued research and conservation of its scientific and archaeological resources. The Park will not be developed or managed for tourism or recreation and visitor access will be restricted. The Park will be managed in accordance with the following objectives:

- To protect and conserve the Park's natural features and processes.
- To protect and conserve the Park's biodiversity.
- To record and protect the Park's cultural resources.
- To advance scientific understanding of the Park's tropical karst and cave features and processes by providing the opportunity for research.
- To advance understanding of the Park's archaeological values by providing the opportunity for further research.

2. MANAGEMENT OF THE PARK'S NATURAL RESOURCES

2.1 Objectives

- To protect and conserve the Park's natural features and processes.
- To manage the Park for the maintenance and protection of its biodiversity through appropriate fire, weed and feral animal management programs.
- To utilise opportunities for ongoing scientific survey, research and monitoring to enhance understanding of the Park's natural resources.

2.2 Karst, Caves and Hydrology

Information Summary

The Park overlies a geological sequence known as Tindall Limestone, a member of the Daly River Group formed on the eastern rim of the Daly Basin (Twidale, 1984). This sequence formed in the middle Cambrian period some 500 million years ago and consists mainly of grey limestone, most of which is porous and permeable. The tropical climate, the passage of time and the Park's geology have produced an ancient tropical karst landscape – a terrain with distinctive landforms and hydrology developed from high solubility and porosity of the limestone (DPLE, 1993). Tropical karst and cave systems such as those represented in Kintore Caves Nature Park are of limited extent in Australia. They are therefore of considerable scientific interest.

Karst and caves develop from the chemical weathering of limestone. Carbonic acid formed from the absorption of atmospheric carbon dioxide into rainwater slowly dissolves limestone. This chemical activity is enhanced over the wet season, while the processes slow markedly during the dry season (Hamilton -Smith, 1989).

Caves are a measure of the intensity and persistence of karst processes. Caves are influenced by both surface and underground processes, and in this regard are unusual ecosystems. Caves are highly sensitive to surface disturbance, in particular, any change in the surface hydrology or water flow may alter underground hydrology, increasing or reducing natural flooding and sedimentation patterns. Some parts of some caves on the Park are subject to regular wet season flooding. Many of the Park's caves were subjected to extreme flooding during the record flood event in January 1998, when high levels of sedimentation in some parts of the cave system occurred. More recently there is clear evidence of sediment from adjoining land washing into the Park and into caves in association with relatively minor rainfall events. Recent significant levels of erosion at cave entrances have also been noted.

The Park's landscape exhibits a range of surface weathering features unique to karst. These include pinnacles and small towers, ground collapse structures (dolines) and limestone pavement dissected with deep crevices that have developed from chemical weathering along rock joints (grikes). There are at least four extensive caves on the Park, each nearly one kilometre in total length. There are also as many as 50 smaller caves with passages up to 50 metres long.

The Top End Speleological Society has been active in exploring, mapping and documenting the cave systems on the Park for many years. This group has made significant contribution to the body of knowledge on the caves and have numbered and tagged eight caves (see Map 4).

The cave systems are mainly horizontal although a few caves have vertical entrances that cannot be accessed without equipment. Many parts of the cave system display interesting calcite formations, or *speleothems*, including stalactites, stalacmites, helictites, shawls, flowstones and rim-pools. Such features are often delicate and easily damaged. Oolites, commonly called "cave pearls", are another interesting feature of the caves. Oolites are spheroidal calcium carbonate concretions, formed where calcite has deposited from solution in concentric layers around an extraneous nucleus. They occur in small basins, where drips splashing into the pool disturb the accreting pearl so it remains loose and acquires a coating of precipitate (calcium carbonate) around it. Oolites usually have a highly polished, reflective outer surface. They are normally pea-sized, but unusually large examples up to 70 millimetres in diameter, have been found in caves on the Park.

Some caves within the Park exhibit interesting markings in the form of a series of incised lines on rock faces and boulders, many of these being long distances into the caves well beyond natural daylight. First documented in 1964, the markings are not easily explained as having either human, animal or geological origin (Walsh, 1964). Similar markings have been documented in other caves around Australia. Even today cave and archaeology experts cannot agree on their origin, some authors believing in a human origin, others in an animal origin (Flood, 1990).

The 800 metre cave tagged KAB 87, has been the subject of scientific study by the Department of Lands, Planning and Environment as a means to understanding the geological history and hydrology of the Tindall Limestone Formation in the Katherine area (see Map 3). This cave exhibits superb examples of convection cupolas, large smooth hemi-spherical scallops in the cave walls and ceilings that indicate a time when the cave carried fast flowing heated water, that is, the cave was a thermal spring (Lauritzen and Karp, 1993).

The prospect of economic minerals on the Park is poor and any occupation of the area by Mineral or Exploration Lease is precluded by a Reservation from Occupation current over the area, under Section 178 of the Mining Act (RO 1114, Gazette No. s25 of 6 June, 1985). In addition, the declaration of the Park as a Heritage Place under Section 26 of the *Heritage Conservation Act* protects the Park and its values from damage.

Management Considerations

- The relationship between surface and underground hydrology requires that any surface disturbance that could interfere with the natural hydrology of the Park must be minimised. Park management activities such as grading of firebreaks and tracks can impact on local drainage patterns and hydrology. Pastoral and agricultural activities on neighbouring properties within the surface catchment can also alter natural water flows, leading to erosion and sedimentation that negatively impacts cave environments.
- There are opportunities for scientific study of cave sedimentation rates and how these have changed over time. Prehistoric sedimentation regimes may be compared with recent flood events and could indicate changes due to local land use.
- The knowledge of the Park's karst features and caves is reasonable, although ongoing survey, documentation and database development is desirable from a management viewpoint. Speleological groups represent an important resource to progress the knowledge base.
- Cave environments are often fragile and potentially dangerous. They are susceptible to damage and pose a potential danger when visited by persons uneducated in minimal impact and safe caving techniques.
- Every visit by a person to a cave has some impact on that sensitive environment. Unregulated access to the caves can disturb wildlife, particularly sensitive bat colonies and can potentially affect cave water quality and sensitive invertebrates using this habitat.

Management Guidelines

1. Any Park management activity involving soil disturbance that could potentially alter water flow on the Park will not be permitted.
2. To improve understanding of the hydrological dynamics of the cave systems and the area of influence around them, surface and subsurface catchments and water flows will be subject to further study.
3. The Parks and Wildlife Commission will endeavour to ensure adjoining landholders appreciate the values of the caves and their vulnerability to disturbance from outside the Park. If necessary, formal agreements between landholders and the Commission will be pursued.
4. To improve understanding of the Park's karst resources, the study and mapping of the karst and cave features and hydrological processes will be ongoing. The assistance of speleological groups will be sought in this regard. A karst and caves database will be developed that is compatible with the Parks and Wildlife Commission's Geographic Information System (GIS). Information to be acquired and entered on the GIS database will include:
 - spatial information on cave openings and network passages.
 - location and description of significant speleothems.
 - data on fauna including bats and invertebrates.
 - location and description of art sites, engravings and artefacts.
5. Public access to the Park and its caves will be restricted. Access will be subject to criteria outlined in Section 4 of this plan.

2.3 Vegetation

Information Summary

To date there has been no comprehensive survey of the Park's flora. A list of the recorded plant species is presented in Appendix 2. The Park lies within an area of the Daly River basin that has been mapped into land units. This is a land classification system whereby land with similar elements of topography, soils and vegetation are grouped (Aldrick and Robinson, 1972). The following description of the Park's vegetation is derived from this data.

About 60 percent of the Park is very rocky comprising limestone ridges and pavement with thin soils supporting scrubby low woodland with deciduous non-eucalyptus trees. Most of the remaining area comprises low to mid-high open woodland with *Eucalyptus tectifica*, *E. foelscheana*, *E. miniata*, *Corymbia polysciadia* and *Erythrophleum chlorostachys*. The understorey includes *Hakea arborescens*, *Cochlospermum fraseri*, *Brachychiton paradoxum* and *Bauhinia cunninghamii*. The grass understorey includes *Sorghum* species, *Sehima nervosum*, *Chrysopogon fallax*, *Heteropogon triticeus* and *Themeda triandra*.

One rare species is recorded from the Park, an annual grass *Sorghum macrospermum*. This species is confined to one population in the area to the northwest of Katherine, part of which is conserved in the Park.

The cycad *Cycas calcicola* occurs in the Park in an extensive stand of mature plants that has been largely protected from severe fires. The species is of scientific interest as it has a limited range and is confined to a few disjunct populations in the Top End of the Northern Territory. The main threats to populations of this cycad are fire and illegal collection of seeds and plants. Adult plants will die if subject to frequent high intensity fires and juvenile plants are generally more prevalent in less frequently burned populations (Parks and Wildlife Commission, 1998). The nearest *Cycas calcicola* population is not far from the Park, along both sides of the Stuart Highway. This population however, is under threat from fire and illegal collection of seeds and whole plants. These threats are significant and increase the importance of the Park cycad population.

The Kintore Caves cycad population is one of several both on and off reserves that are part of a project to investigate the ecology of cycads and the impacts of contemporary land management practices on the plants and their habitat. Three permanently marked plots were established on this Park in 1996 by research scientists with the Parks and Wildlife Commission. Three hundred and fifty plants have been tagged as part of this project. The plants are assessed periodically to derive data on reproductive activity, recruitment, growth and mortality rates, as well as response to disturbance from fire and insects. Data from the Kintore Cave population will be compared with data from other sites to gain an understanding of the impact of contemporary fire regimes on the species and its habitat. A key outcome of the study will be the refinement of fire management prescriptions for the Park. The study will be ongoing with findings from the first five years representing the initial phase.

There are a number of small monsoon vineforest communities on the Park. Ecologically important species occurring in these patches include *Canarium australianum*, *Grewia brevifolia*, *Diospyrus humilus* and the fig trees, *Ficus virens* and *Ficus platypoda*. A strong interdependence exists between these communities and mobile fauna such as fruit and blossom feeding bats and birds such as Common Koels, Figbirds and Bowerbirds (personal communication, O. Price). Although vineforest patches are not uncommon across northern Australia, they are generally very small in area and contain a distinctive assemblage of plants which warrants conservation measures. (See Map 4.) These communities were probably more common in the past but have declined due to the impacts of fire and changing climate. Vineforest species are also often associated with cave entrances and limestone depressions on the Park.

Weeds recorded from the Park include rubber bush *Calotropis procera*, hyptis *Hyptis suaveolens* and sida *Sida cordifolia*. All of these species are noxious weeds declared under the *Noxious Weeds Act*, requiring that their spread is contained. Each species has the potential to be ecologically threatening as they form thickets, which exclude native species. Rubber bush is very adaptable to different habitats, and is able to grow equally well on limestone ridges as on the flats. In the past, rubber bush has posed a threat to the cycad population. Hyptis is common along boundary tracks and firebreaks and can be controlled by early dry season burning which kills the seed deposit. Fortunately all three species can be controlled within small areas.

Management Considerations

- The information base on the Park's vegetation resources is relatively poor. Effective resource management is dependent upon good resource knowledge.
- The conservation of the rare *Sorghum macrospermum* is a high priority. The species is susceptible to a fire regime of hot late dry season fires and invasion by other increaser (native or non-native) grass species.
- The *Cycas calcicola* and monsoon vineforest communities are of conservation value. The fire-sensitivity of these communities warrants close attention in the Park's fire management program.
- Weeds generally invade disturbed habitat. Anecdotal information indicates that weed infestations on the Park have been highest at times that stock from neighbouring properties had entered the Park. Weeds are also more likely to colonise areas of active soil erosion and graded firebreaks and tracks.
- Vegetation plays an important role in the regulation of cave environments. Openings to most caves are semi-concealed or covered in vegetation, influencing air flow in and out of cave systems and therefore cave temperature and humidity.

Management Guidelines

6. A comprehensive survey of the Park's vegetation will be undertaken early in the life of this plan to acquire detailed community descriptions and a species list.
7. The distribution of *Sorghum macrospermum* on the Park will be mapped and ecological requirements for its conservation will be determined. Appropriate action will be taken to ensure the protection of the species on the Park.
8. The cycad monitoring program will be continued and findings from it will be incorporated into the Park's fire management program to ensure the long term protection of this important population.

9. Fire protection measures for the cycad and vineforest communities will be described in detail in the Park's fire management strategy.
10. The Park's weed control strategy will be the basis of annually prepared weed action plans and will include the following key elements to ensure effective ongoing control of weeds and protection of vegetation communities:
 - .Criteria for prioritising weed threats and control actions in consideration of potential environmental threat and available resources.
 - .Provide for programming weed surveys.
 - .Control options, which impose the least environmental impact.
 - .Follow up monitoring after control efforts.
 - .Reporting mechanisms so that the effectiveness of control efforts are recorded.
 - .Training needs of staff in terms of control methods and safety.

2.4 Fauna

Information Summary

The vertebrate fauna recorded for the Park to date includes a total of 62 species. These are 36 bird, 16 mammal, 10 reptile and 2 frog species. A fauna survey conducted on the Park in 1998 added significantly to the recorded fauna of the Park. The species list is still however particularly poor and further work will doubtless reveal the presence of many more. Appendix 1 presents a vertebrate fauna list for the Park.

The terrestrial fauna of the Park is typical of tropical open woodland habitat. The agile wallaby, *Macropus agilis* is common in the Park and the euro, *Macropus robustus* and antilopine wallaroo, *Macropus antilopinus* are also seen frequently. Inside caves the droppings of echidnas are common enough to suggest the caves may be an important local refuge. Six species of bats are recorded from the Park's caves:

- . Little cave epitesicus
- . Common sheathtail bat
- . Ghost bat
- . Dusky horse-shoe bat
- . Common bent-wing bat
- . Orange Leafnosed-bat

Two bat species are of conservation interest. The Ghost Bat *Macroderma gigas* is the largest member of the sub-order of microbats, Microchiroptera and one of relatively few species of Australian carnivorous bats. The Ghost Bat has a widespread and patchy distribution over northern Australia. Its conservation status is currently listed in the category "Lower Risk" (Duncan, A.,1999). The species is however sensitive to environmental disturbance (Strahan, 1995).



Figure 1. The Ghost Bat, *Macroderma gigas*.

Populations of the Orange Horseshoe Bat, *Rhinonictoris aurantius* are sparsely distributed but no longer considered rare or threatened. The species is known to be highly sensitive to human interference and, if subject to continual disturbance will abandon roosts completely. The Orange Horseshoe bat prefers caves of very high humidity such as exist in sections of some caves on the Park.

The Park's invertebrate cave fauna is of very high scientific interest although it unfortunately is still considered quite poorly known. Some cave fauna data has been acquired from surveys conducted by the Parks and Wildlife Commission and the Top End Speleological Society (TESS). Surveys indicate the diversity of cave invertebrates is probably equal to other karst regions in northern Australia and the potential for an extremely rich diversity within the caves. More intensive surveys are likely to discover further species of invertebrates restricted to cavernous environments and possibly individual caves (Bannink, 1998).

Cave invertebrates include aquatic and non-aquatic species. Some species are troglobites, animals that have evolved within dark cavernous environments and lack any pigment and in some species, functional eyes. Examples include blind shrimp and other tiny crustaceans inhabiting cave waters within the Park.

Of non-aquatic cave invertebrates, all major orders commonly associated with karst areas of northern Australian are represented, including spiders, pseudoscorpions, snails, segmented worms, millipedes, centipedes cockroaches, beetles, predatory bugs, cave crickets, moths and slaters. For some species the cave environment is their natural habitat other species are classed as "accidental visitors".

Spiders form a dominant percentage of any cave community. A number of different species have been collected of which some appear to have troglomorphic characteristics, lacking pigmentation and with reduced eyes. Centipedes and millipedes are common with centipedes reaching extraordinary sizes up to 15 cm. Millipedes appear to be troglotic and are located in the deep, humid passages of the caves. Nine species of terrestrial snail shells have been recorded within the entrance, twilight and transition zones of caves, associated with leaf litter of monsoon vineforest vegetation common at cave entrances.

A new species of Gryllid cricket from the genus *Endacusta* has been recorded within Kintore Caves. Three species of cave beetle are commonly associated with deposits of bat guano on which their larvae feed. One of these, *Brises katherinae* is so far known only from Kintore and Cutta Cutta Caves Nature Parks.

Aquatic invertebrate fauna found in sumps within the caves include crustaceans (Isopods, Amphipods and Decapods) and a species of freshwater worm (*Diploptrema* sp.) which is the first recording of this kind in the Territory and possibly Australia.

The report "Cave Fauna of the Kintore Cave Region" by the Top End Speleological Society provides information on invertebrate and vertebrate cave fauna found within Kintore Caves Nature Reserves from 1991 – 1994 (Bannink, unpublished 1999).

Cattle and other stock have previously entered the Park from neighbouring properties. Feral animals seen occasionally include feral cats and feral pigs. Cats are widespread, mobile, solitary predators whose numbers are difficult to survey and control. Pigs do considerable damage to soils and vegetation, their disturbance creating opportunities for weeds to invade. Their preferred habitat includes access to water, which is not represented on the Park. The occurrence of pigs on the Park is occasional and usually during the wet season only.

Most of the Park is enclosed within stock-proof fencing. The current fence alignment however, encloses some neighbouring land whilst excluding a portion of the Park. See Map 5 and Section 5.

Management Considerations

- The information base on the Park's fauna species is poor. Effective resource management is dependent upon good resource knowledge.
- Detailed knowledge on bat fauna is general lacking. Documented knowledge on inhabited caves, and changing bat numbers would be of scientific value.
- Invertebrates are usually the most poorly surveyed and recorded of fauna. The uniqueness of the cave environment means cave-dwelling invertebrates are of high scientific interest. Protection of cave habitats from disturbance is vital to conservation of the species inhabiting them.
- Cattle and other stock may enter the Park from neighbouring properties through poorly maintained fences. If they are not quickly removed, native vegetation is impacted and the risk of soil erosion and weed invasion increases.

- Feral cats are known to inhabit caves which makes these sites very suitable for trapping cats.
- It is not feasible to permanently eradicate cats and pigs from the Park, but to keep their numbers as low as possible is highly desirable.
- Pigs enter the Park from neighbouring properties. Their control would be assisted by locating their origin and working cooperatively with neighbouring landholders.

Management Guidelines

11. Fauna surveys will be carried out by park management and scientific staff of the Commission to improve knowledge of the Park's fauna. Special attention will be given to furthering knowledge of the Park's cave fauna, especially the little known but scientifically interesting invertebrate fauna. In this regard consideration will be given to enlisting the support of groups with expertise in cave environments and this type of fauna.
12. A basic monitoring program for the bat species of highest significance, the Orange Horseshoe and Ghost Bat populations will be instigated. This will involve assessment of caves inhabited and bat numbers present. Scientific staff of the Parks and Wildlife Commission will be consulted with regard to methods.
13. Cattle will be excluded from the Park by maintaining boundary fencing.
14. The Park's feral animal control program will identify methods for control of feral animals on the Park, in particular cats and pigs.

2.5 Fire Management

Information Summary

The open woodland vegetation in Kintore Caves Nature Park is typical of that found over vast areas of tropical Australia. These landscapes have evolved over thousands of years as part of a system involving regular fire. There is substantial evidence to support the notion that Aboriginal people fired the land frequently in the past. Since settlement, fires have remained a common event that continues to shape the landscape.

Annual grasses, mainly *Sorghum* species, grow quickly during the wet season producing fuel loads capable of supporting annual fires. Generally, most species in these communities are fire tolerant and will persist with reasonably frequent fire. This tolerance to fire however, diminishes in respect of increasing fire intensity and frequency. In general terms, a mixed fire regime involving variable fire seasonality, frequency and intensity will maintain biodiversity in the environment while a fire regime marked by frequent, intense fires will in time, reduce biodiversity.

Management of fire on Parks and Reserves is critical for the management of biodiversity. The small size of this Park necessitates careful fire management planning. For many years the entire Park was burnt annually by severe wildfires originating off the Park, very likely to the detriment of the Park's habitats.

Monsoon vineforest communities possess some resilience to fire. Fire is usually starved at the margins of monsoon vineforest communities such as those represented on the Park. However, the small size of these communities still makes them vulnerable to intense fires. Continued exposure to fire tends to open the canopy, permitting the entry of weeds and grasses, and hence further fires, particularly late in the dry season. As previously mentioned, the cycad, *Cycas calcicola* community and rare annual grass *Sorghum macrospermum* is also at risk if over-exposed to intense fires.

Fire-sensitive vineforest species such as *Ficus platypoda* and *F. virens* commonly form small thickets near cave entrances where they have an important influence on cave air flow and hence temperature and humidity, thereby altering habitat for sensitive cave fauna, particularly bats.

Management Considerations

- Management of the Park's biodiversity can be enhanced with careful use of fire, using prescribed burning to create a fire regime marked by fires of varied seasonality, intensity and frequency.
- Extensive intense late dry season fires have been too frequent in the past and should be prevented as far as possible.
- Effective fire-breaks around the Park are essential for its protection from wildfires entering from adjoining land. Fire-breaks will be produced, as far as possible, by burning early in the dry season. Graded firebreaks, whilst effective, carry the risk of altering water flows, creating erosion and present the opportunity for weeds to establish.
- Large unbroken areas of high, dry fuel load pose the greatest risk for hot destructive wildfires, especially late in the dry season.

- The dry monsoon vineforest patches, cycad and *Sorghum macrospermum* communities on the Park should be protected from fire as much as possible, in particular from fires of high intensity.
- The vegetation around major cave entrances should be protected from fire as far as possible.
- Fire suppression on the Park is difficult given its rocky terrain, and wildfires are likely to be stopped only at firebreaks.
- Fire may be used in an ecologically-friendly way to eliminate some weed species
- The Parks and Wildlife Commission have a duty of care to ensure that fires started on the Park do not enter neighbouring properties.

Management Guidelines

Actions regarding the use and control of fire in managing the Park are outlined in annually prepared fire action plans. Fire management actions on the Park will comply with a fire management strategy that will address the following key principles and objectives:

15. Fire management of the Park will aim toward the maintenance of diverse habitats by prescribing a pattern of varied fire seasonality, frequency and intensity.
16. Wildfires of high intensity will be prevented as far as possible.
17. The Park will be protected from wildfires with boundary breaks maintained jointly with neighbouring landholders. Cooperative arrangements with neighbours in this regard, is of paramount importance. Slashed and / or burned firebreaks will be preferred to graded breaks that may present weed and cave siltation risks.
18. A wildfire response plan will guide the prevention of wildfire spreading from, or into, the Park.
19. The risk of wildfire burning the entire area of the Park will be reduced by fragmenting continuous areas of grass fuels in the wet and early dry seasons.
20. Research will be undertaken into the regeneration requirements of the rare annual grass, *Sorghum macrospermum*, and fire management actions will adapt to ensure the conservation of this species.
21. The monsoon vineforest and cycad communities will be protected from wildfire with regular reduction of fuel around their perimeters.

- 22. Fire sensitive vegetation screening major cave entrances will be identified and protected from wildfire as far as possible by reducing fuel in their vicinity.
- 23. Park management staff will be trained in the safe and skilful use and control of fire in order to effectively implement the strategy.
- 24. Fire mapping, recording and reporting standards will be implemented so that fire history information and improved understanding of the effects of past fires can guide future fire management decisions.
- 25. The implementation of the fire management strategy will be monitored and the

3. MANAGEMENT OF CULTURAL RESOURCES

3.1 Objectives

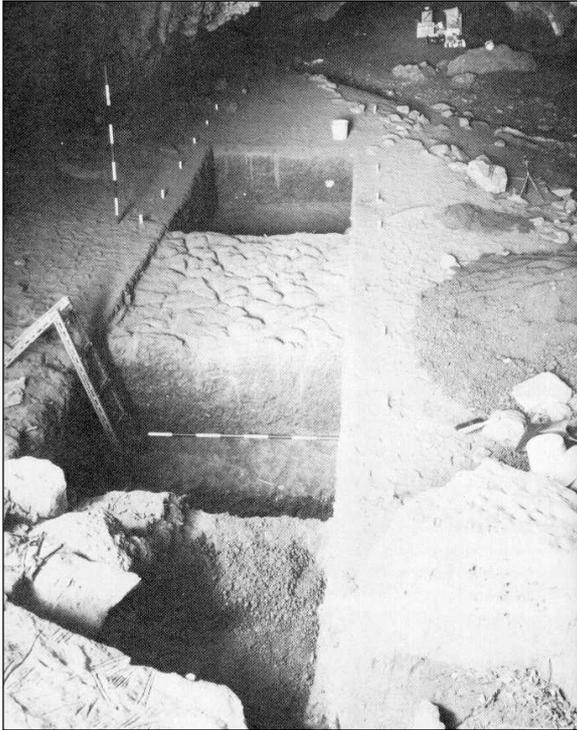
- To record, document and conserve sites and resources of historical, cultural and archaeological value.
- To advance knowledge of the cultural heritage of the Park by actively encouraging scientific and archaeological research.
- To involve Aboriginal interests in cultural resource management issues whenever those interests may be identified.

Information Summary

Kintore Caves Nature Park is a declared *Heritage Place* under the *Heritage Conservation Act*. This status was awarded based on the following two heritage assessment criteria:

- 1) *The principal characteristics of the range of human activities which take or have taken place in the Territory, including ways of life, customs, processes, land uses, functions, designs or techniques are demonstrated.*
- 2) *The Park possesses close association with individuals whose activities have been significant in the history of the Territory.*

The Park lies within the traditional lands of the Dagoman Aboriginal people, a group and language that effectively no longer exists. Traditional affiliations and mythology in connection with the caves appear to have been lost. Art sites in this area include both Jawoyn and Wardaman styles and the area is now considered “shared” between Jawoyn and Wardaman Aboriginal groups (G. Chaloupka, NT Museum, personal communication).



metres, and revealed a striking change with depth in the type of both sediment and stone tools (Mulvaney, 1969). There was a marked change from an earlier stone tool

Figure 2. Mulvaney's 1963 excavation in Kintore Cave. Incised grooves can be seen in the large rocks in the foreground. (Reproduced from Mulvaney (1969) with the kind permission of DJ Mulvaney.)

industry of large, hand-held flake and core tools to a younger industry including specialised stone spear points, and other hafted artefacts. The work was significant in providing some insights into the survival techniques and way of life of early Aboriginal inhabitants. The site was not dated but showed “a comparable industrial sequence” to that excavated by Mulvaney in 1963 and 1966 at Ingalladi Rock-shelter in the Victoria River Region, first occupied over 7,000 years ago (Flood, 1990).

At the time of Mulvaney's work the floor of the main cave was littered with stone implements, flakes, chippings and bone fragments. Although the cave has been subject to regular flooding and siltation since that time it is reasonable to expect that such artefacts are still to be found in this, and other caves on the Park. Rocks at the entrance to the main caves have many incised grooves cut into them, which are obviously of human origin. Their meaning, whether based on ritual or beliefs, or the result of sharpening tools in the past, is unknown. Walsh (1964) documented another series of incised lines deep in some caves in the Park. The origins of these lines, whether human, animal or geological remains in dispute.

The cave complex is known to contain some Aboriginal rock paintings. The best known of these were near the entrance to the main (Kintore) cave. These paintings were unfortunately removed by floodwaters during record floods in the Katherine area in early 1998. There is currently only one other known painting site, at another cave. This large painting is of a snake or serpent, which George Chaloupka of the NT Museum believes is significant and probably associated with creation mythology.

In his visit in 1963 the eminent archaeologist Dr DJ Mulvaney made an excavation near the entrance to the main cave to a depth of about 1.3

metres, and revealed a striking change with depth in the type of both sediment and stone tools (Mulvaney, 1969). There was a marked change from an earlier stone tool industry of large, hand-held flake and core tools to a younger industry including specialised stone spear points, and other hafted artefacts. The work was significant in providing some insights into the

There are currently no sacred sites on the Park recorded or registered with the Aboriginal Areas Protection Authority. The Kintore Caves Nature Park is also listed with the Australian Heritage Commission on the Register of the National Estate as an indigenous place.

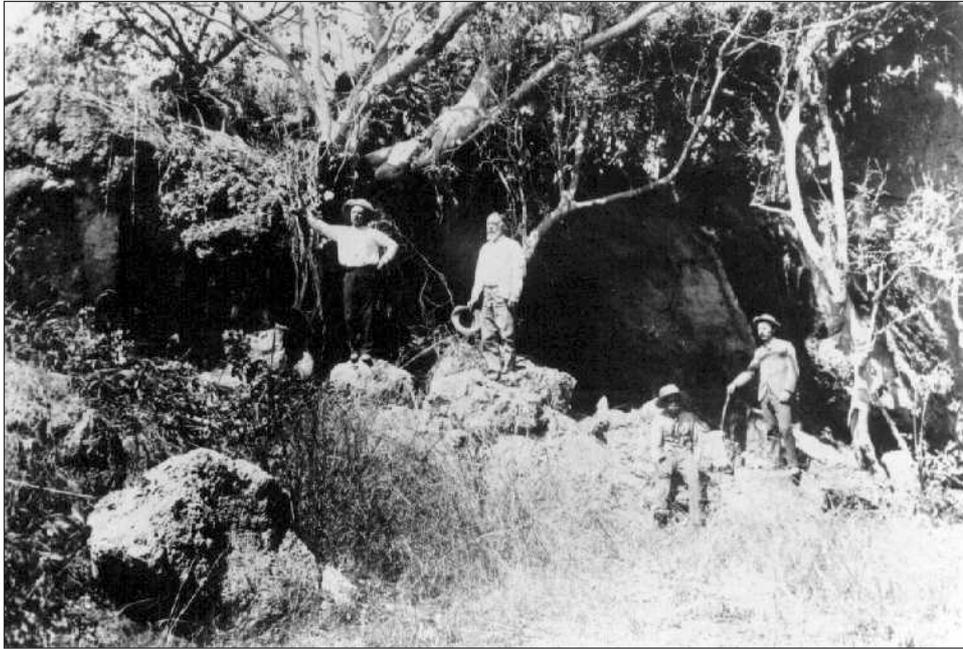


Figure 3. Historic photograph of Kintore Caves taken in 1891. The cave's European discoverer, Alfred Giles is in the centre of the picture (from Parks and Wildlife Commission collection).

With regard to the second heritage assessment criterion above, Alfred Giles the European discoverer who named the Kintore Caves, was a key figure in the Territory's early history. He was second-in-command of John Ross's expedition to fix the course of the overland telegraph line in 1870 and undertook extensive survey and exploration work in the Katherine River area in 1871. In 1878-9 Giles overlanded 12,000 sheep and 8,000 cattle to the Katherine area to establish Springvale Station which he managed until 1894. Giles discovered the caves in 1879 and showed them to the Earl of Kintore, the then Governor of South Australia, when he visited the Northern Territory in 1891. The visit of the Governor in that year was an important event in the early history of the Darwin Region. No evidence of this visit remains on the Park. See Photo 2 above.

Management Considerations

- Whilst traditional affiliations to the Park are at this time unclear, this should not preclude Aboriginal interests in cultural resource management at a future time.
- The opportunity for continued archaeological survey and study both in the caves and open areas of the Park is important. Further research will assist in and enhance the continuing management of these sites.
- There is a high probability that further exploration of caves in the Park will locate more art and artefact sites.

- Any Aboriginal cave art is at risk of being lost in time to environmental factors that include flooding, humidity, and the growth of algae, lichens and aerial roots.

Management Guidelines

26. The Commission will continue communication with the Jawoyn and Wardaman Associations in respect of identifying Aboriginal interests in management of cultural resources of the Park.
27. Archaeological and scientific research to further knowledge of the cultural heritage of the Park will be actively pursued. This will include the application for grants for archaeological survey and research through programs administered by the Australian Heritage Commission and the Natural Heritage Trust. Tasks that will be considered include:
 - Comprehensive, systematic survey and documentation of the Park's archeological sites and artefacts and the development of conservation plans for these resources.
 - Re-analysis of the sediments and artefact sequence uncovered by Mulvaney using modern techniques, including dating technology.
 - The study of rock art, including the apparent loss and conservation of rock art, relationships with other regions and change through time.
 - Study of changing flood and sedimentation regimes and the relationship between this and archaeological findings.
 - A review of the markings in the caves described by Walsh (1964) to determine their origin.
28. As new art and artefact sites are found on the Park, they will be documented and recorded on the Park's Geographic Information System (GIS). Expert assistance will be sought with regard to the significance of sites and necessary conservation requirements will be implemented. The discovery of new archaeological materials will be reported to the Secretary, Department of Lands, Planning and Environment as soon as practicable after the discovery in accordance with Regulation 4 of the *Heritage Conservation Act 1991*.

4. MANAGEMENT OF VISITORS

4.1 Objective

- To manage the Park primarily as a scientific reserve and regulate access so that visitors are restricted mainly to those who can contribute to the archaeological and scientific knowledge of the Park.

Management Considerations

- The Park's purpose is based on its scientific and archaeological values. The Park contains scientific and archaeological resources relatively unimpacted by people, which enhances their value for research. Uncontrolled access to caves places the values of the caves and the safety of visitors at risk.
- There is no day-to-day visitation and no visitor facilities have been developed. There is no demand to open caves on the Park to the general public as high-quality cave-based tourism opportunities are represented only 40 kilometres from the Park at Cutta Cutta Caves Nature Park. In respect of these facts, public access to the Park will be restricted.
- Signs at all entrances to the Park convey the message that the Park is subject to By-Law 6 of the *Territory Parks and Wildlife Conservation By-Laws*, pertaining to access to Parks and Reserves.
- Zoning schemes are a commonly used planning tool for designating the purposes for which different areas of parks will be managed with respect to visitors. In the case of this Park zoning has little relevance. The whole area of the Park may be considered to be in one zone and the same purposes and management objectives will apply across the Park.

Management Guidelines

29. Public access to the Park will be managed in accordance with By-law 6 (1) of the *Territory Parks and Wildlife Conservation By-Laws*, pertaining to the right of the Commission to prohibit public access to a Park in the interests of public safety and the protection of the Park.
30. Recreational caving will not be permitted on the Park.
31. Persons will be permitted to enter the Park in the company of management staff, or if issued a permit to enter the Park by the Parks and Wildlife Commission.

32. A permit to enter the Park will be issued only for the purpose of speleological, archaeological or other approved scientific investigation or management action.
32. In the case of persons wishing to enter caves, a permit will be granted only provided significant caving experience and an appreciation of the Australian Speleological Federation's Code of Ethics and Minimal Impact Caving Code, can be demonstrated.
34. Persons wishing to conduct archaeological research in the Park that will involve the collection and/or excavation of sites must obtain permission under the Heritage Conservation Act 1991 from the Minister from Lands, Planning and Environment prior to commencing research. Additionally, persons wishing to undertake this type of research must also contact the Museum and Art Galleries of the Northern Territory to discuss their requirements for the receipt and lodgement of artefact collections.
35. The issue of a permit will be subject to permit applicants providing a report of their visit and any scientific data acquired, to the Parks and Wildlife Commission.
36. Signs will be maintained at each entry point to the Park pursuant to by-law 6(3)(b), denoting the control of access to the Park pursuant to By-Law 6 (1) of the *Territory Parks and Wildlife Conservation By-Laws*.

5. PARK ADMINISTRATION

5.1 Objectives

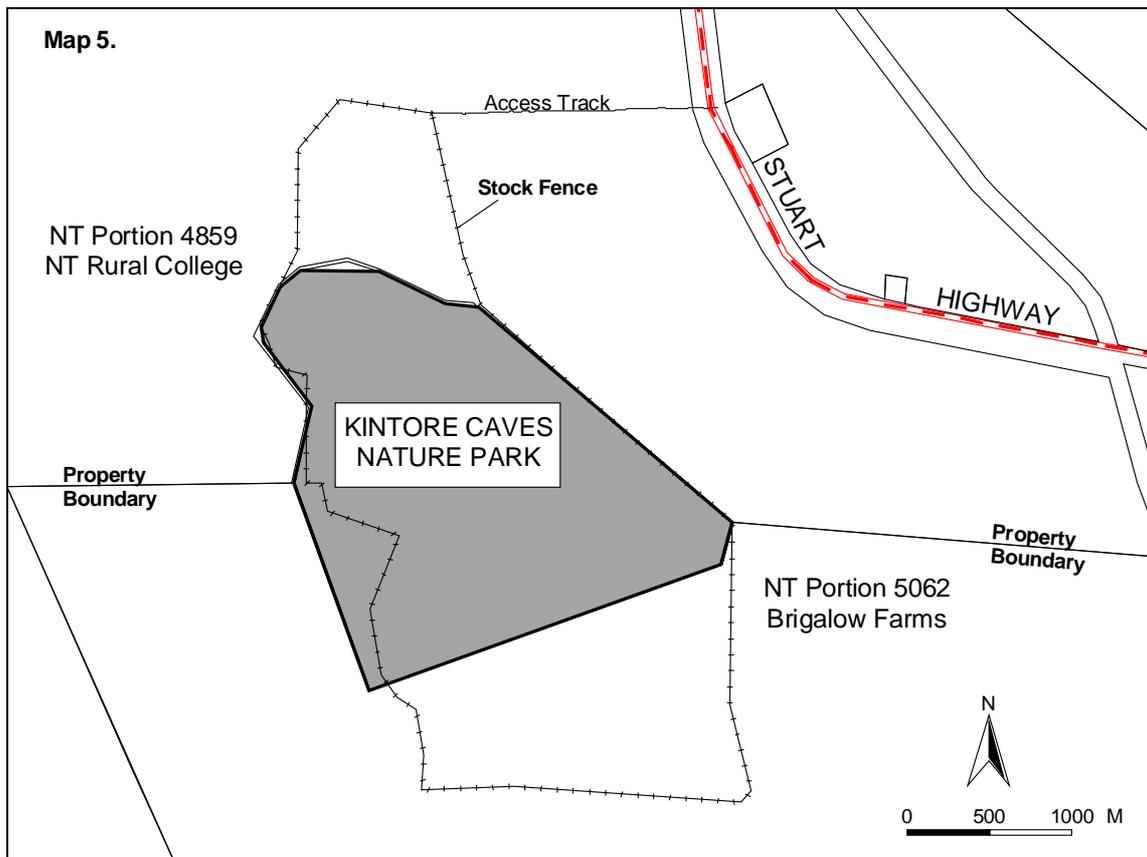
- To ensure that appropriate administrative arrangements are in place and sufficient resources are provided to enable the effective management of the Park and implementation of this plan.
- To ensure that effective communication is maintained with adjoining landholders and other groups who have an interest in the management of the Park.

Information Summary

The Park is managed by the Parks and Wildlife Commission of the Northern Territory within the Katherine River/Roper River District Park administrative unit. In addition to Kintore Caves Nature Park, this unit also manages Flora River Nature Park, Cutta Cutta Caves Nature Park and Elsey National Park. Current staffing of this unit comprises a Chief District Ranger, Senior Ranger level T4, two Senior Rangers level T3 and two Rangers level T2.

For some years the functional boundary of the Park has been based on the fenced area, which includes land both within and outside the Park's cadastral boundary. There are no formal agreements with adjoining landholders in respect to this. See Map 5.

Under section 33 of the *Heritage Conservation Act 1991* it is an offence to carry out work of any sort on, or damage, demolish, destroy, desecrate or alter a heritage place or object without the consent in writing of the Minister or his delegate under section 39K. The Director of the Commission has been delegated limited powers under the Act to allow routine maintenance and repair activities on places controlled by the Commission. However in that event that substantial new works are required, consent must be obtained from the Minister for Lands, Planning and Environment.



Map 5. Park site map showing fence alignment. Vehicle access is via four-wheel drive track which follows the fenceline. The double line adjacent the Park's northern boundary is a defunct public road easement of no current day relevance.

Significant conservation values that are reserved within the Park, such as surface karst features, cave systems, vegetation communities including *Cycas calcicola*, *Sorghum macrospermum* and a number of monsoon vineforest patches, are also found on adjoining land.

The maintenance of constructive relationships with adjoining landholders and other interest groups, including speleological groups is regarded as being of the highest importance toward achieving management objectives and the Commission will seek to involve such interests as much as possible.

The naming of the Park as a Nature Park implies an area of land set aside for public recreation and enjoyment. According to Parks and Wildlife Commission Policy, Conservation Reserves are established primarily to protect and manage places with significant or unique cultural and / or natural values.

Management Considerations

- While management of the Park based on the fenced area has not compromised management of the Park's main values, it would be preferable to formalise agreements in this respect.
- In general terms, the long-term viability of protected areas is linked to the size of the area. Small Parks are less able to meet long-term conservation objectives than larger Parks. The extension of the Park to include similar conservation values on adjoining land is hence an important future consideration.
- In acknowledgment of the area's purpose, it would be more appropriately named "Kintore Caves Conservation Reserve".

Management Guidelines

37. The Park's management resources will be reviewed from time to time to ensure that they are adequate to meet the objectives outlined in this plan.
38. Agreements will be pursued with the adjoining landholders in respect of the existing fence alignment and functional Park boundary. If possible, an agreement under Section 74 of the *Territory Parks and Wildlife Conservation Act* will be entered into. Otherwise, a new fence alignment will be considered in collaboration with the relevant neighbour.
39. The benefits of extending the Park to include conservation values represented on adjoining land will be investigated during the life of this plan and appropriate action taken.
40. Effective communication and cooperation with adjoining landholders and interest groups will be sought in relation to management programs on the Park as and when appropriate.

41. Operational Plans, guided by this plan of management, will be prepared annually. These will clearly state objectives, priorities, schedules and actions for each program area. In doing this management of the Park will be efficient and orderly, and the effectiveness of management can be measured against objectives.
42. Research opportunities identified in this plan will be pursued. As appropriate, project grants will be sought from programs such as the Natural Heritage Trust and authorities such as the Australian Heritage Commission.
43. The appropriate process will be pursued to rename the area "Kintore Caves Conservation Reserve".

6. MANAGEMENT PROGRAM SUMMARY

The key actions required to achieve the objectives outlined in this plan are summarised below and will be addressed in annually prepared operational plans. Priorities are assigned to tasks as follows:

- Ongoing:** Established activities that need to be continued.
High: Essential to achieve the Plan's stated objectives.
Medium: Very important to achieve the Plan's stated objectives, but may be subject to the availability of resources.
Low: May be undertaken only if other guidelines are met and the necessary resources are available.
Denotes a research opportunity for which external grants could be applied.

Action	Reference	Priority
• Implement a hydrological study to achieve an understanding of surface and subsurface catchments. #	2.2	Medium
• Liaise with adjoining landholders to encourage understanding and, if possible agreements, on land management practices that could impact cave values.	2.2	High
• Continue survey of cave systems and develop GIS-based karst and caves Park database. #	2.2	High
• Conduct a comprehensive vegetation survey of the Park.	2.3	High
• Continue assistance and support for <i>Cycas calcicola</i> monitoring study.	2.3	Ongoing
• Map distribution and commence research into conservation needs of <i>Sorghum macrospermum</i> . #	2.3 2.5	High
• Develop and implement Weed Control Strategy.	2.3	High
• Conduct approved fauna surveys.	2.4	Medium
• Initiate a monitoring program for Ghost Bat and Orange Leafnosed-bat populations.	2.4	Medium
• Continue feral animal management program.	2.4	Low
• Acquire data on little-known cave invertebrate fauna. #	2.4	Medium
• Maintain boundary fences to ensure neighbouring stock do not enter the Park.	2.4	Ongoing
• Develop and implement Fire Management Strategy.	2.5	High
• Conduct comprehensive survey of the Park to record art, artefacts and other cultural resources and develop conservation plans. #	3.1	Medium
• Re-analysis of sediment and artefact sequence excavated in main cave including use of modern dating techniques. #	3.1	Medium
• Conduct study of changing flood and sedimentation regimes and relationship to archaeological findings. #	3.1	Medium
• Review of incised lines / cave markings of disputed origin. #	3.1	Low
• Mount required regulatory signs at all Park entry points.	4.1	High
• Pursue agreement with adjoining landholders in respect of fence alignment and functional working boundary.	5.1	High
• Pursue name change to "Kintore Caves Conservation Reserve".	5.1	Medium
• Investigate benefits of extending the Park and follow appropriate course of action.	5.1	Medium

7. REFERENCES

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Fauna Records
Kintore Caves Nature Park

Birds

Black-breasted Buzzard
 Brown Goshawk
 Wedge-tailed Eagle
 Brown Quail
 Peaceful Dove
 Bar-shouldered Dove
 Crested Pigeon
 Red-tailed Black-cockatoo
 Galah
 Sulphur-crested Cockatoo
 Red-collared Lorikeet
 Red-winged Parrot
 Pallid Cuckoo
 Common Koel
 Channel-billed Cuckoo
 Pheasant Coucal
 Southern Boobook
 Blue-winged Kookaburra
 Rainbow Bee-eater
 Willy Wagtail
 White-winged Triller
 Red-backed Fairy Wren
 Varied Sittella
 Figbird
 Silver-crowned Friarbird
 Little Friarbird
 Blue-faced Honeyeater
 Yellow throated Miner
 White-gaped Honeyeater
 Yellow-tinted Honeyeater
 Spangled Drongo
 Great Bowerbird
 Australian Magpie-lark
 Black-faced Woodswallow
 Pied Butcherbird
 Torresian Crow

Mammals

Antilopine Wallaroo
 Euro
 Agile Wallaby

 Ghost Bat
 Common Bent-wing Bat
 Dusky Leafnosed-bat
 Little Cave Eptesicus
 Common Sheath-tail Bat
 Orange Leafnosed-bat

 Echidna
 Western Chestnut Mouse
 Delicate Mouse
 Common Rock Rat
 Black Flying Fox

Macropus antilopinus
Macropus robustus
Macropus agilis

Macroderma gigas
Miniopterus schreibersii
Hipposideros ater
Vespadelus caurinus
Taphozous georgianus
Rhinonicterus aurantius

Tachyglossus aculeatus
Pseudomys nanus
Pseudomys delicatus
Zyomys argurus
Pteropus alecto

Reptiles

Spiny tailed Gecko
 Gecko
 Knob-tailed Gecko
 Burton's Legless Lizard
 Brown Tree snake
 Black Whip-snake
 Whip snake
 Half-girdled Snake
 King Brown Snake
 Olive Python

Diplodactylus ciliaris
Diplodactylus stenodactylus
Nephrurus asper
Lialis burtonis
Boiga irregularis
Demansia atra
Demansia simplex
Simoselaps semifasciatus
Pseudechis australis
Liasis olivaceus

Frogs

Peter's Frog
 Pallid Tree Frog

Litoria inermis
Litoria pallida

Statement of Heritage Value

The Kintore Caves are of scientific and archaeological significance. The main cave contains an Aboriginal art gallery including paintings and engravings which have cultural links with motifs at Ingaladdi and Delamere. Excavations have shown that the Caves had been occupied for many thousands of years leaving a deep stratified deposit with a stone tool sequence showing a transition from large hand-held tools in the early layers to small specialised stone spear points and other hafted artefacts in the upper levels.

The Kintore Caves were discovered in 1879 by the manager of Springvale Station, Alfred Giles, who in 1891 named them after the visiting South Australian Governor, the Earl of Kintore. The cave was used by Katherine people for recreation and caving pursuits from the late 1880s and during the past 20 years has been the subject of relatively extensive speleological surveys by Speleological groups.