

**NATIONAL RECOVERY PLAN FOR THE
CENTRAL AUSTRALIAN CABBAGE PALM**

Livistona mariae subsp. *mariae*



© Catherine Nano



Australian Government



Northern Territory Government

Title: National Recovery Plan for the Central Australian Cabbage Palm

Livistona mariae* subsp. *mariae

© Department of Natural Resources, Environment The Arts and Sport, Northern Territory

This publication is copyright. It may be reproduced for study, research or training purposes subject to an acknowledgement of the sources but no commercial usage or sale. Requests and inquiries regarding reproduction should be addressed to:

Threatened Species Officer

Biodiversity Conservation Unit

NRETAS

PO Box 1120

ALICE SPRINGS NT 0871

This recovery plan sets out the actions necessary to stop the decline of, and support the recovery of, the listed threatened species or ecological community. The Australian Government is committed to acting in accordance with the plan and to implementing the plan as it applies to Commonwealth areas.

The plan has been developed with the involvement and cooperation of a broad range of stakeholders, but individual stakeholders have not necessarily committed to undertaking specific actions. The attainment of objectives and the provision of funds may be subject to budgetary and other constraints affecting the parties involved. Proposed actions may be subject to modification over the life of the plan due to changes in knowledge.

This plan should be cited as follows: Nano, C. 2008 National Recovery Plan for the Central Australian Cabbage Palm *Livistona mariae* subsp. *mariae*. Department of Natural Resources, Environment, The Arts and Sport, Northern Territory.

Copies of the plan are available at

<http://www.environment.gov.au/biodiversity/threatened/recovery-list-common.html>:

Table of Contents

Abbreviations	4
Summary	5
Species Information	6
Distribution	6
Populations	7
Habitat critical to survival	7
Threats	8
Recovery Information	10
Objectives	10
Criteria	10
Actions	13
Costs	15
Management practices	15
Biodiversity benefits	15
Affected interests	16
Social and economic impacts	16
International obligations	16
References	17

Abbreviations

APS	Australian Plant Society, a non-profit, independent, incorporated community organisation with members throughout Australia that encourages the growing, propagating, preservation and conservation of Australian plants.
ASDP	Alice Springs Desert Park, a Northern Territory government run park that displays plants and animals in typical central Australian settings
CLC	Central Land Council, a statutory authority representing Aboriginal people in the southern Northern Territory under the <i>Aboriginal Land Rights (Northern Territory) Act 1976</i> . It also has functions under the <i>Native Title Act 1993</i> and the <i>Pastoral Land Act 1992</i>
CLMA	Central Land Management Association
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i> , Commonwealth Government Legislation
MSBP	Millennium Seed bank Project
NP	National Park
NRETAS	Department of Natural Resources, Environment, The Arts and Sport (formerly Department of Infrastructure, Planning and Environment) of the Northern Territory; includes the Parks and Wildlife Service
NT	Northern Territory
OPBG	Olive Pink Botanic Garden, a 16 ha arid zone gardens in Alice Springs that displays over 300 species of central Australian plants and is administered by a voluntary Board of Trustees.
PWSNT	Parks and Wildlife Service, Alice Springs, Northern Territory, a service within NRETAS
Tjuwanpa Rangers	Indigenous ranger group based at Ntaria (Hermannsburg) formed in 2005 and coordinated by the Land Management section of the CLC in close co-operation with the Tjuwanpa Outstation Resource Centre.
PACSOA	Palm and Cycad Societies of Australia
TSN	The Threatened Species Network is a joint initiative of the Australian Government and WWF-Australia. The TSN is a national network developed to involve the community in conservation programs for threatened species

SUMMARY

The Central Australian Cabbage Palm, *Livistona mariae* F.Muell. subsp. *mariae* Rodd is classified as Vulnerable under the Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999* (EPBC Act) and under the Northern Territory *Territory Parks and Wildlife Conservation Act 2000*. This species is of significant cultural importance to central Australian Aboriginal groups.

This species is restricted to the Finke River and its tributaries in the southern arid region of the Northern Territory. The species almost wholly contained within Finke Gorge National Park in the West MacDonnell Ranges. It is the only palm in central Australia and is separated by 1000 km from any other *Livistona* species.

Its persistence in arid central Australia is linked to the occurrence of perennial groundwater seepages in the habitat it now occupies. It is known from several closely spaced populations and faces a range of extant and potential threats including: exotic grass invasion; fire; tourism and stock impacts; ground water depletion; and climate change.

This plan outlines identified threats and the actions required to help maintain or eventually improve the conservation status of this species.

SPECIES INFORMATION

Distribution

Livistona mariae subsp. *mariae* is endemic to the southern arid region of the Northern Territory (Fig. 1). It is the only palm occurring in central Australia, and is separated by approximately 1000 km from any other member of the genus. This species has a highly restricted distribution pattern and is characterised by a few closely distributed small populations (usually <1000 individuals) that are very limited in area.

This palm is wholly restricted to the MacDonnell Ranges Bioregion where it is confined to a small portion of the Finke River and its tributaries. The extent of occurrence is less than 60 km² and the area occupied is less than 50 ha. The latitudinal range is 35 km and the longitudinal range is 20 km. (Latz 1975; Kerrigan & Albrecht 2006).

The majority of plants are contained within Finke Gorge National Park. There are three occurrences on neighbouring unreserved tenure: Two are at Ntaria, (one to the north of and the other to the west of the park boundary) and the other is at Running Waters on Henbury pastoral station, south of the park.

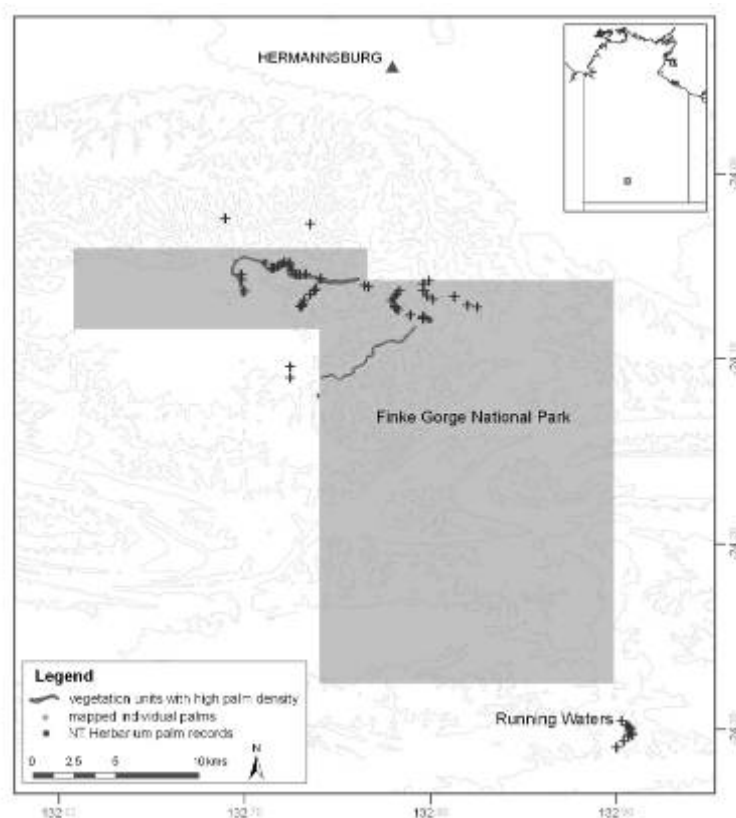


Figure 1: Map of the distribution, locations of populations and habitat critical to the survival of *Livistona mariae* subsp. *mariae*

Populations

There are several small populations of *L. mariae* subsp. *mariae*. The total wild count in 1987 was approximately 12,000 plants, of which, the great majority were seedlings (PWSNT unpublished data). The greatest concentration of *Livistona* palms occurs at Palm Valley (Finke Gorge NP). In 1987 this population was estimated to contain 1280 adult plants. The second largest population occurs in Little Palm Creek. Census data from 1987 indicate that there were close to 600 adult plants present (PWCNT unpublished data). A comparison of census data of Palm Valley and Little Palm Creek populations from 1987 with that from 1973 shows a combined 33% increase in mature plant numbers over that 15 year period. More recent population data were obtained in 1993 but this has not yet been assessed.

Other concentrations (over 100 mature plants) occur within the park at the Glen of Palms on the Finke River; and along Kunara Creek (Palm Creek tributary). An initial assessment of the Running Waters population on Henbury Station was undertaken in September 2007. This population is small (< 25 individuals were counted in a 5 km transect) and comprises scattered adult plants intermixed with *Eucalyptus camaldulensis* (River Red Gum) trees and *Acacia* shrubs (C. Nano & M. Harris pers. obs.). This population is important as it represents the southern most occurrence of this taxon.

The two stands to the north of the park contain 15 and 23 individuals; while those to the west contain 2 and 43 individuals, respectively (A. Schubert, PWSNT unpublished data).

As a result of the rarity of this species all populations are considered necessary for its long-term survival and recovery.

Habitat critical to survival

L. mariae subsp. *mariae* is believed to be a relict of a once mesic climate in central Australia (Latz 1975). Its present range is characterised by a mean annual rainfall of approximately 250 mm. This is substantially more arid than typical palm habitat (Rodd 1988). This species has a strong association with permanently watered, protected gorges.

Three specific habitat requirements are currently recognised:

- permanent ground water discharge;
- protection from flood water scouring; and
- infrequent fire exposure.

This species is concentrated along the Palm Valley gorge floors that are continuously fed by bicarbonate-rich spring waters. Research shows that the shallow ground water originates from the vast supply of water moving slowly through the Hermannsburg Sandstone formation (Wischusen *et al.* 2004). The restriction of *L. mariae* subsp. *mariae* to this habitat likely relates to its shallow fibrous root system, forcing its reliance on the presence of a permanent shallow water supply over a continuous area (Latz 1975).

While this species also occurs along the sandy beds and banks of the Finke River, it is less strongly associated with these latter habitats possibly because establishing plants are periodically removed by flood waters (Kerrigan & Albrecht 2006). By comparison, the relatively gentle slope of the Palm Valley floors allows flood water to move slowly and deposit rather than erode soil and plant debris.

Available fire response data (Latz 1975) indicate that *L. mariae* subsp. *mariae* is likely to be intolerant of repeated fire exposure. This means that it has a requirement for habitat with

comparatively low fuel loads and hence low fire incidence. The mainly bare rocky gorge floors at Palm Valley do not allow for the development of a continuous fuel layer, thereby preventing regular fire occurrence in the palm habitat.

There are very few areas in central Australia that meet all of these requirements. Given the small number of occurrences of this palm species, all sites where it occurs are considered to be areas of habitat critical for survival.

Fire and weed management and, possibly, water-supply monitoring are therefore needed to maintain the habitat quality of important populations.

THREATS

Currently, *L. mariae* subsp. *mariae* is not under immediate threat of extinction, and populations have exhibited an upward trend. Improvements have been particularly marked since the establishment of the feral horse removal program in 1986 by the NRETAS. Horses most likely reduced palm seedling survival through trampling.

Specific details relating to the biology and genetics of this species are lacking, meaning that it is currently difficult to predict the likely impacts of stochastic processes such as reduced gene flow through loss of pollinators or seed dispersers. The most immediate threats include exotic grass invasion, increased fire exposure, tourism impacts and stock and feral animal disturbance. Other potential threats may include aquifer drawdown and climate change.

Resource competition from invasive plants

Resource competition from invasive grasses *Cenchrus ciliaris* (buffel grass) and *Cynodon dactylon* (Couch-grass) may result in recruitment failure. Both grasses form dense stands that dramatically alter microhabitat conditions. In severely affected sites *L. mariae* subsp. *mariae* regeneration requirements may be constrained by reduced nutrient and moisture supplies.

The Palm Valley site is badly infested with both couch and buffel grass and the Running Waters site is infested with couch-grass (C. Nano & M. Harris pers. obs.). Buffel-grass is present at the northern off-park sites (A. Schubert pers.com. 2007).

An initial assessment of the Running Waters population in September 2007 revealed an absence of recruitment (C. Nano & M. Harris pers. obs.).

Increased fire exposure

L. mariae subsp. *mariae* is threatened by increased fire risk as a result of the invasion of Buffel-grass and Couch-grass into its core habitat areas. Both of these invasive species produce large amounts of plant biomass which, when dried, represents a significant increase in site fuel load. This shift may increase the frequency and intensity of fire regimes beyond threshold levels for palm persistence.

Grass cover is now exceptionally high at the Palm Valley and Running Waters sites and other sites may be similarly affected. Intense cattle and horse grazing at the Running Waters sites is currently reducing fuel loads there, meaning that the fire risk is presently low. Importantly though, the negative impacts of grazing far outweigh the benefits derived from grass removal and other methods of fuel reduction need to be investigated.

Habitat degradation associated with pastoral activities

The population at Running Waters is exposed to a range of threatening processes associated with stock production. Drought conditions have resulted in a concentration of cattle and feral horse activity at this site (C. Nano & M. Harris pers. obs. 2007). Many palm individuals are directly impacted by increased stream bank erosion. Soil compaction and spring water disturbance by cattle may be limiting regeneration. Vehicle tracks run directly through the core habitat area. One of the western off-park sites is also badly affected by cattle and horse grazing (A. Schubert pers. com. 2007).

Feral animal impacts

The Parks and Wildlife Service NT (PWSNT) has an ongoing feral horse control program in Finke Gorge NP which has been highly effective in reducing site degradation at reserved populations. Feral horses are present at the Running Waters site and are contributing to habitat degradation there (C. Nano & M. Harris pers. obs. 2007). The other off park populations are also potentially threatened by the presence of introduced large herbivores including horses, donkeys and camels.

Tourism impacts

L. mariae subsp. *mariae* is a prime tourist attraction at Palm Valley and, under current arrangements, this population is directly exposed to visitor impacts. Seedling trampling and other aspects of site degradation such as rubbish, track erosion, and the spread of weeds and pathogens are potential threats (A. Schubert, PWSNT, pers. comm., Kerrigan & Albrecht 2006). Some information (PWSNT unpublished data) suggests that palm recruitment is reduced at the 'tourist end' of the Palm Valley population. Individual palms occur in close proximity to frequently used camp sites at Running Waters.

Reduced gene flow

L. mariae subsp. *mariae* is potentially threatened by small-population effects such as inbreeding depression and genetic drift through disrupted gene flow. Populations are highly clumped, but it is uncertain whether this is more the result of poor dispersal than of a restriction on suitable microsites for germination and establishment. While seeds of this palm are consumed by fruit eating birds (e.g. western bowerbird, spiny-cheeked honey-eater), passive movement by water and gravity is thought to be the main mode of dispersal. It is likely, therefore, that upstream populations experience little seed exchange with other populations. Inter-population connectivity is also potentially constrained by pollinator availability and behaviour but data on this is lacking.

Use of the aquifer

Existing evidence shows that the survival of the Palm Valley ecosystem is dependent on the continued slow movement of groundwater through the Hermannsburg Sandstone formation (Wischusen *et al.* 2004). Since a natural drying up of this water source is highly unlikely, human usage is the only real potential threat to the supply of water to the palms. Current usage and small scale future developments (e.g. park visitor amenities and the Hermannsburg community water supply) are considered sustainable (Wischusen *et al.* 2004). However a more intense extraction program may threaten the palm and other ground water dependent species in

future. Further examination of the local and regional hydrology is warranted to avoid negative impacts of water use on these species (Wischusen *et al.* 2004).

Climate change

Climate change represents a future threat given its potential to disrupt reproductive output and germination and to decrease adult vigour and survival. Additionally, climate change in central Australia may cause more sporadic and heavier rainfall events. Severe flooding from these events poses a potential threat to *L. mariae* subsp. *mariae* given that this species is unlikely be able to withstand the full force of flood waters (Latz 1975).

RECOVERY INFORMATION

Overall Objective

To improve (or at least maintain) the current conservation status of *Livistona mariae* subsp. *mariae*.

Specific Objectives

- Maintain or increase habitat quality and extent.
- Understand critical biological attributes including the fire response, life history characteristics, flowering and fruiting phenology, and population dynamics.
- Implement *ex-situ* conservation measures that ensure the long-term preservation of representative samples of this species' genetic diversity.
- Understand connectivity and mode of seed dispersal to guide seed collection protocols.
- Indigenous people are actively engaged in the recovery planning process.
- Inform and involve the community and stakeholders in the recovery plan process.

Performance Criteria

- Habitat quality and extent is maintained or increased.
- Knowledge of the biology, population dynamics, and disturbance response traits is advanced and used to inform management.
- Seeds from populations of *L. mariae* subsp. *mariae* are held in suitable *ex-situ* storage facilities (potential long term goal).
- The genetic structure of *L. mariae* subsp. *mariae* populations is understood.
- Indigenous knowledge relating to the biology and cultural significance of *L. mariae* subsp. *mariae* is incorporated into recovery programmes.
- Community and stakeholder based networks are maintained and enhanced.

Performance of the plan will be evaluated by an independent consultant within five years from adoption as a national recovery plan.

Table 1: Relationship between specific objectives, performance criteria and actions.

Specific objectives		Performance criteria		Actions
Maintain or enhance habitat quality and extent.	↔	Habitat quality and extent is maintained or enhanced.	↔	1. Negotiate conservation agreements to secure significant populations on pastoral leasehold and Aboriginal land trust properties. 2. Undertake a weed reduction program at selected sites. 3. Carry out population and habitat monitoring at selected sites. 4. Implement management strategies for key threatening processes as required.
Understand critical ecological attributes including the fire response, life history characteristics, and reproductive and seed biology.	↔	Adequate knowledge of the influence of fire and other ecological processes on the persistence of the species is available.	↔	5. Undertake research on fire ecology, reproductive biology, and seed storage potential.
Implement <i>ex-situ</i> conservation measures that ensure representative sampling of intraspecific genetic diversity.	↔	<i>Ex-situ</i> seed collections are sourced from different populations.	↔	6. Store seeds from different populations in seed-banks.

Specific objectives		Performance criteria		Actions
Collate information on intra-specific genetic variation.	↔	Understand connectivity and mode of seed dispersal to guide seed collection protocols.	↔	7. Determine the degree of genetic differentiation across populations using molecular techniques.
Incorporate traditional ecological knowledge and management practice into the recovery process.	↔	Management of the species is informed by traditional ecological knowledge.	↔	8. Engage traditional ecologists to provide advice on biological aspects, threatening processes and cultural and economic significance of the species.
Inform and involve the community and all stakeholders in the recovery process.	↔	Community and stakeholder based networks are maintained and enhanced.	↔	9. Community and stakeholder education and information.

Actions

Action 1.

Negotiate conservation agreements to secure *L. mariae* subsp. *mariae* populations on leasehold and land trust properties. Three populations are unreserved making them priorities for off-park conservation actions. Avenues for effective protection (e.g. fencing and stock water diversion) of unreserved populations should be pursued by NRETAS with the assistance of relevant non-government agencies (specifically CLMA and CLC). Stakeholders include NRETAS (NT park rangers, Biodiversity staff), Ntaria and Roulmaulpma Land Trustees, Henbury Station leaseholders, CLMA and CLC.

Action 2.

Undertake a weed reduction program at selected sites. Currently, exotic grass invasion represents one of the most serious threats to the long term persistence of this palm in the wild. Weed removal at selected sites will increase opportunities for palm recruitment and will reduce the threat of fire. Stakeholders may include NRETAS (NT park rangers, Biodiversity staff), Tjuwanpa Rangers and Conservation Volunteers Australia. Weed and palm responses should be monitored over time (see Action 3).

Action 3.

Ensure that important *Livistona mariae* subsp. *mariae* populations are monitored regularly to detect any changes in habitat quality or declines in population size, health and age structure. Site selection should encompass the range of population sizes and tenures and results should be used to guide future management practice. Potential stakeholders may include NRETAS (Biodiversity Conservation division); Tjuwanpa Rangers and the CLC/traditional owners; CLMA and Henbury leaseholders; APS; PACSOA; TSN; and interested palm experts. Monitoring should assess:

- population size and age-structure dynamics;
- fire responses of seed, seedling and adult life-stages;
- pollinator and seed disperser activity;
- flowering and fruiting timing;
- seedling establishment and attrition;
- insect predation;
- habitat condition especially in relation to weed abundance; and
- presence of other threatening processes.

Action 4

Implement management strategies for key threatening processes as required. Action 5 (below) has been developed to provide information on *L. mariae* subsp. *mariae* ecology and on the threats faced by this species. Until such data are available, it is important to carry out adequate monitoring and to develop the capacity to respond to changes in existing conditions. Management strategies will be developed and implemented following the outcomes of Action 5. In particular, an understanding of the role of fire in the reproductive ecology of this species

is essential before adequate fire management strategies can be developed and implemented. Stakeholders include NRETAS (Biodiversity Conservation division), CLC, pastoralists and CLMA.

Action 5

Undertake research on the biology and ecology of *L. mariae* subsp. *mariae* to assist the formulation of a management strategy for this species. Stakeholders may include NRETAS (Biodiversity Conservation division), Kew Gardens (Millennium Seed Bank Project), relevant Australian Universities and interested palm specialists (e.g. PACSOA). Main areas of investigation recommended are:

- Fire research (e.g. field observations of established plant responses to wildfire, and laboratory experiments on seed and seedling survival) to determine the optimum fire regime for the species' long-term survival.
- Seedling emergence and survival experiments to determine the influence of microhabitat constraints on establishment.
- Reproductive studies to examine the role of climate (especially rainfall, drought and temperature) on flower and fruit production.
- Pollinator studies (e.g. presence/absence of pollinators at different sized colonies) to help determine minimal viable population size for this species.
- Seed dispersal studies to aid estimates of the level of inter-population seed exchange.
- Seed biology studies through the joint NRETAS-Kew Gardens MSBP to determine optimum seed germination conditions and seed storage potential.

Action 6

Collect seeds from core and outlying populations and store them in seed-banks. Pending the development of an effective seed storage methodology for this species (see Action 5) the joint NRETAS-Kew MSBP provides an opportunity to establish a properly-managed seed collection of *L. mariae* subsp. *mariae* as an insurance against extinction in the wild.

Action 7

Determine the degree of genetic variation among *L. mariae* subsp. *mariae* populations and among this, and other closely-related taxa (see Rodd 1988). Molecular analysis of genetic variation at these levels will help better define management units for this species. Stakeholders will include relevant researches at Australian Universities and NRETAS (Biodiversity Conservation division).

Action 8

Engage traditional ecologists to provide advice on biological aspects, threatening processes and the cultural and economic significance of this species. This palm is of great cultural importance throughout central Australia (Latz 1995). Engagement of Aboriginal people with knowledge of this species will enable the incorporation of traditional ecological knowledge and management practice into the recovery process.

Action 9

Improve the profile of *L. mariae* subsp. *mariae* within the community and ensure that all stakeholders are informed of recovery actions and the results of ongoing research and monitoring. The coordinator of Threatened Species projects in the NT (NRETAS, Biodiversity Conservation division) will ensure that information on research and management projects is disseminated to stakeholders. Information and specimens may be displayed at the Alice Springs Desert Park, the Olive Pink Botanic Gardens (OPBG) and the Darwin Botanical Gardens.

Costs

Estimated costs of recovery (in \$1000s)

Actions	Year 1	Year 2	Year 3	Year 4	Year 5	TOTAL
1				5	5	10
2	15	15				30
3	20	20	20	20		80
4				20	20	40
5		5	5	10	10	30
6	5	5				10
7			25	5		30
8		20				20
9	1	1	1	1	1	5
Total	41	66	51	61	36	255

Management practices

The majority of *L. mariae* subsp. *mariae* populations are reserved in Finke Gorge National Park which is managed by NRETAS. Management practices necessary to avoid a significant adverse impact on populations of this palm species include:

- Fire management plans that aim to reduce fire frequency;
- Weed cover reduction; and
- Feral horse, donkey and camel control programmes.

Biodiversity benefits

Palm Valley is a ground water dependent ecosystem that is likely to have acted as a refugium for flora and fauna since the onset of aridity in central Australia (Wischusen *et al.* 2004). It currently supports an exceptionally diverse range of plant species, many of which are rare and

unique to the area. The perennial spring fed pools are of particular ecological significance, housing a range of relict aquatic fauna (Davis 1997). Recovery actions may therefore also benefit a diversity of endemic, rare, or fire sensitive plant and animal species that do not necessarily interact with this palm, but occupy the same habitat.

The implementation of recovery actions described in this plan will help ensure the continued existence of key palm interactions with its pollinator and seed dispersal agents. Implementation may also ensure the continuation of non-symbiotic interactions between the palm and other organisms.

It is unlikely that negative affects on other native species and ecological communities would arise from the implementation of this plan.

Affected interests

L. mariae subsp. *mariae* is known from a conservation reserve jointly managed by the NT government and Aboriginal Traditional Owners, a pastoral lease and two Aboriginal land trusts. All affected interests will be involved in the implementation of this plan. Identified affected interests include:

- NT government (particularly the ASDP and PWSNT within NRETAS);
- Traditional Owners of Finke Gorge NP and other sites;
- Tjuwanpa Rangers;
- Central Land Council;
- Henbury pastoral leaseholder; and
- Central Land Management Association.

Social and economic impacts

The implementation of this recovery plan is unlikely to have any adverse social or economic impacts. All proposed actions are on a small scale and will not significantly alter existing land uses. Some positive social and economic impacts are likely to arise from implementation. On-ground recovery actions in the plan involve Aboriginal people in the recovery process, including the employment and training of the Tjuwanpa Rangers.

The population of *L. mariae* subsp. *mariae* at Palm Valley is of considerable interest to tourists and scientists alike, primarily due to its relict status. As a result, Palm Valley is a significant tourist destination which contributes directly to local businesses in the Northern Territory. Actions aimed at the conservation of this species will therefore benefit tourism in the area. They will also allow for the continuation of research into the ecological and biogeographical significance of the species.

International obligations

This species is not listed under any international agreement and the recovery plan is consistent with Australia's international obligations.

REFERENCES

- Davis, J.A. (1997) Conservation of aquatic invertebrate communities in central Australia. *Memoirs of the Museum of Victoria* **56** (2): 491-503.
- Kerrigan, R. and Albrecht (2006) Palm Valley Palm, Red Cabbage Palm, central Australian Cabbage Palm *Livistona mariae* subsp. *mariae*. Threatened Species Profile at http://www.nt.gov.au/NRETAS/wildlife/animals/threatened/pdf/plants/Livistona_mariae_mariae_VU.pdf
- Latz, P.K. (1975) Notes on the relict palm *Livistona mariae* in central Australia. *Transactions of the Royal Society of South Australia* **99**: 189-196.
- Parks & Wildlife Service of the Northern Territory n.d Finke Gorge National Park.
- Rodd, A.N. (1988) Revision of *Livistona* (Arecaceae) in Australia. *Telopea*: **8** (1): 49-154.
- Wischusen, J.D.H., Fifield, L. K. and Cresswell, R.G. (2004) Hydrogeology of Palm Valley, central Australia; a Pleistocene flora refuge? *Journal of Hydrology* **293**: 20-46.