Government of **Western Australia**
Department of **Environment and Conservation**

INTERIM RECOVERY PLAN NO. 310

FRINGED KERAUDRENIA

(*Keraudrenia exastia*)

INTERIM RECOVERY PLAN

2010-2014

January 2010
Department of Environment and Conservation
Kensington

FOREWORD

Interim Recovery Plans (IRPs) are developed within the framework laid down in Department of Conservation and Land Management (CALM) Policy Statements Nos. 44 and 50. Note: CALM formally became the Department of Environment and Conservation (DEC) in July 2006. DEC will continue to adhere to these Policy Statements until they are revised and reissued.

IRPs outline the recovery actions that are required to urgently address those threatening processes most affecting the ongoing survival of threatened taxa or ecological communities, and begin the recovery process.

DEC is committed to ensuring that Threatened taxa are conserved through the preparation and implementation of Recovery Plans (RPs) or IRPs, and by ensuring that conservation action commences as soon as possible and, in the case of Critically Endangered (CR) taxa, always within one year of endorsement of that rank by the Minister.

This plan will operate from January 2009 to December 2014 but will remain in force until withdrawn or replaced. It is intended that, if the taxon is still ranked as Critically Endangered (CR), this IRP will be reviewed after five years and the need for further recovery actions assessed.

This IRP was given regional approval on 23 February 2011 and was approved by the Director of Nature Conservation on 14 March 2011. The provision of funds identified in this IRP is dependent on budgetary and other constraints affecting DEC, as well as the need to address other priorities.

Information in this IRP was accurate at January 2010.

IRP PREPARATION

This IRP was prepared by Robyn Luu[1] and Andrew Brown[2].

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ACKNOWLEDGMENTS

The following people provided assistance and advice in the preparation of this IRP:

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Sharon Ferguson	Acting Nature Conservation Coordinator, DEC West Kimberley District
Amanda Shade	Assistant Curator (Nursery) Botanic Gardens and Parks Authority
Troy Sinclair	DEC West Kimberley District
Melanie Smith	Senior Botanist, DEC Species and Communities Branch
Greg Woodman	Woodman Environmental Consulting

Thanks also to the staff of the W.A. Herbarium for providing access to Herbarium databases and specimen information, and DEC's Species and Communities Branch for assistance.

Cover photograph by Sharon Ferguson.

CITATION

This IRP should be cited as:

Department of Environment and Conservation (2010) *Keraudrenia exastia* Interim Recovery Plan 2010-2014. Interim Recovery Plan No. 310. Department of Environment and Conservation, Western Australia.

SUMMARY

Scientific Name:	***Keraudrenia exastia***	**Common Name:**	Fringed Keraudrenia
Family:	Sterculiaceae	**Flowering Period:**	April - December
DEC Region:	Kimberley	**DEC District:**	West Kimberley
Shire:	Broome	**NRM Region:**	Rangelands
Recovery Team:	NA		

Illustrations and/or further information: Trudgen, M. (2006) A Report on *Keraudrenia exastia* and related issues. Draft Report prepared for UrbanPlan; Western Australian Herbarium (1998−) *FloraBase − The Western Australian Flora*. Department of Environment and Conservation. http://florabase.dec.wa.gov.au/; Wilkins, C.F. (1999) *Keraudrenia exastia* and *Keraudrenia katatona* (Malvaceae: Byttnerioideae), new species from the Kimberley region of Western Australia. *Nuytsia* 13(1): 233−242.

Current status: *Keraudrenia exastia* was declared as Rare Flora under the Western Australian *Wildlife Conservation Act 1950* in June 2006. It is currently ranked as Critically Endangered (CR) under World Conservation Union (IUCN 1994) criteria B1+2de due to its extent of occurrence being less than 100 km^2, it only occurring at the one location, and a projected decline in the number of mature individuals. *Keraudrenia exastia* is listed as CR under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act 1999). The main threats to the species are road maintenance, inappropriate fire regimes, lack of tenure security, industrial development, competition, weeds, poor genetic diversity and recreational use.

Description *Keraudrenia exastia* is an erect, compact, multi-stemmed shrub 0.7 to 0.9 meters high. The flowers are purple, and appear from April to December.

Habitat requirements: *Keraudrenia exastia* is restricted to the Dampier Peninsula near Broome. The species grows in relict desert dune swale in red sand (pindan), in *Acacia* shrubland to three metres, with *Gyrostemon*, *Triodia*, *Hakea* and *Eucalyptus* (Wilkins 1999).

Habitat critical to the survival of the species, and important populations: Given that *Keraudrenia exastia* is ranked as CR, it is considered that all known habitat for the wild population is critical to the survival of the species, and that the wild population is an important population. Habitat critical to the survival of *K. exastia* includes the area of occupancy of the population, areas of similar habitat surrounding the population (these providing potential habitat for population expansion and for pollinators), additional occurrences of similar habitat that may contain undiscovered populations of the species or be suitable for future translocations, and the local catchment for the surface and/or groundwater that maintains the habitat of the species.

Benefits to other species or ecological communities: Recovery actions implemented to improve the quality or security of the habitat of *Keraudrenia exastia* will also improve the status of associated native vegetation. The species occurs adjacent a Priority 1 species *Goodenia byrnesii*. It also occurs adjacent (300 m) the Vulnerable Threatened Ecological Community (TEC) 'Species-rich faunal community of the intertidal mudflats of Roebuck Bay'.

International obligations: This plan is fully consistent with the aims and recommendations of the Convention on Biological Diversity, ratified by Australia in June 1993, and will assist in implementing Australia's responsibilities under that convention. *Keraudrenia exastia* is not listed under any specific international treaty however, and this IRP does not affect Australia's obligations under any other international agreements.

Indigenous Consultation: A search of the Department of Indigenous Affairs Aboriginal Heritage Inquiry System has identified that the *Keraudrenia exastia* population co–occurs with three culturally significant sites (Site ID No's 12410, 12873 and 12924). Input and involvement is being sought through the Kimberley Land Council, Department of Indigenous Affairs and the traditional owners of the area, the Yawaru, to determine if there are any issues or interests. The area containing the taxon is part of Native Title negotiations currently taking place for the Yawaru Native Title Claimants. There is potential for changes in tenure and Native Title in the Broome area when negotiations are finalised. Consultation has been included as a recovery action to ensure there has been Indigenous engagement in relation to the recovery actions posed in this plan.

Social and economic impacts: As the population occurs on Broome Port Authority land, the protection of *Keraudrenia exastia* may potentially affect industrial activities and further development of the site. Actions will involve liaison and cooperation with the stakeholders with regard to this area.

Affected interests: The stakeholder potentially affected by the implementation of this plan includes the Broome Port Authority as the manager of the land containing the population.

Evaluation of the Plans Performance: DEC's West Kimberley District will evaluate the performance of this IRP. In addition to annual reporting on progress and evaluation against the criteria for success and failure, the plan will be reviewed following five years of implementation.

Existing Recovery Actions: The following recovery actions have been or are currently being implemented:

1. The Broome Port Authority and the Public Transport Authority have been made aware of the existence of this species and its location.
2. A proposal for Ecological Consideration has been written for *Keraudrenia exastia* by Wilkins (2006).
3. DEC staff from West Kimberley District regularly monitor the population.
4. DEC's West Kimberley District staff are overseeing the implementation of this IRP and will include information on progress in their annual report to DEC's Corporate Executive and funding bodies.

IRP Objective: The objective of this IRP is to abate identified threats and maintain or enhance *in situ* populations to ensure the long-term preservation of the species in the wild.

Recovery Criteria
Criteria for success: The area of the population has increased and/or further populations are established.
Criterion for failure: The area of the population has decreased.

Recovery actions

1. Coordinate recovery actions
2. Map habitat critical to the survival of *Keraudrenia exastia*
3. Achieve long-term protection of habitat
4. Install Declared Rare Flora markers
5. Determine genetic variation within population
6. Control weeds and *Cassytha* sp.
7. Deter access to the population
8. Collect cutting material to preserve genetic diversity
9. Undertake hydrological investigations
10. Monitor the population
11. Conduct further surveys
12. Develop and implement a fire management strategy
13. Remove rubbish, when required
14. Start the translocation process, if necessary
15. Liaise with relevant land managers and Indigenous groups
16. Promote awareness
17. Obtain biological and ecological information
18. Re-evaluate and update ranking criteria
19. Review this IRP and assess the need for further recovery actions

1. BACKGROUND

History

The first known collection of *Keraudrenia exastia*, housed at the WA Herbarium, was made in 1985 by K. Kenneally. Although further collections have been made, the species is only known from the original location.

Keraudrenia exastia occurs on Broome Port Authority land and is highly threatened by industrial development, particularly for the port and marina. An aquaculture centre was also proposed for the area but was rejected by native title claimants and is now located adjacent to the population. Due to the potential "Browse Basin gas project" and other industrial expansion there is likely to be a call for the Port to extend their operation. An application for a clearing permit for 25 hectares of land is currently being assessed. Initially the clearing proposed to impact 27% of the total population, however, the application has been revised to ensure that no plants will be impacted.

Two detailed surveys have been undertaken for *Keraudrenia exastia*. The Broome Botanical Society surveyed the species in 1995 and approximately 3300 mature plants were counted. An environmental study was also conducted in 2007 and 2008 by Woodman Environmental Consulting (WEC) for the Broome Port Authority prior to their clearing application being developed (WEC 2008). Approximately 21,000 plants (or stems) were counted.

Description

Keraudrenia exastia is an erect, compact, multi-stemmed shrub 0.7 to 0.9 meters high. The flowers are purple, and appear from April to December. The name *exastia* comes from the Greek *exastis* meaning rough edge or fringe, in reference to the strongly fringed margin of the mature calyx and bract (Wilkins 1999).

Keraudrenia exastia differs from *K. velutina* subsp. *elliptica* in having shorter mature pedicels; anthers that remain curved after dehiscence rather than becoming straight; anthers that are separate rather than laterally adherent to form a tube and are ventrifixed not ventri-adnate; and inflorescences that tend to have fewer flowers (Wilkins 1999).

Distribution and habitat

Keraudrenia exastia is restricted to a relict desert dune swale (pindan) on the Dampier Peninsula near Broome, growing in red sand in *Acacia* shrubland to three metres with *Gyrostemon*, *Triodia*, *Hakea* and *Eucalyptus* (Wilkins 1999). Associated species include *Acacia colei* var. *colei*, *A. adoxa*, *Sida cardiophylla*, *Corchorus sidoides*, *Yakirra australiensis* var. *australiensis*, *Cucumis maderaspatana* and *Carissa lanceolata* (Trudgen 2006).

Table 1. Summary of population land vesting, purpose and manager

Pop. No. & Location	DEC District	Shire	Vesting	Purpose	Manager
1. Broome Port	West Kimberley	Broome	Minister for Transport	Harbour Purposes	Broome Port Authority

The population in **bold text** is considered to be an important population.

Biology and ecology

From field observations it appears that *Keraudrenia exastia* may be clonal. What appears to be individual plants are clusters of stems arising from lateral roots that link the clusters. A few small occurrences have been observed away from the known patches suggesting that the species could rarely establish from a very low seed set. No seed has ever been observed (Trudgen 2006).

From the variation in fire ages visible at the population, and the absence of senescence, it is likely *Keraudrenia exastia* is not sensitive to fire and the population size is not significantly affected by fire (Trudgen 2006).

Threats

Keraudrenia exastia was declared as Rare Flora under the Western Australian *Wildlife Conservation Act 1950* in June 2006. It is currently ranked as Critically Endangered (CR) under World Conservation Union (IUCN 1994) criteria B1+2de due to an extent of occurrence less than 100 km^2, it only occurring at the one location, and there being a projected decline in the number of mature individuals. *Keraudrenia exastia* is listed as CR under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act 1999). The main threats to the species are road maintenance, inappropriate fire regimes, lack of tenure security, industrial development, competition, weeds, poor genetic diversity and recreational use.

- **Hydrological changes** may potentially impact on the species. *Keraudrenia exastia* appears to grow only in soil with slow drainage. Therefore, if the volume of run off into the area is altered as a result of nearby construction, it may have an impact on the species.
- **Road maintenance activities** threaten the population and its habitat. Maintenance actions include grading road reserves, spraying of chemicals, construction and maintenance of drainage channels and mowing the roadside vegetation to improve visibility. These disturbance events also often encourage weed invasion into adjacent habitat, as well as causing damage to actual plants. Relevant authorities need to be informed of the location of populations so that appropriate protective measures can be implemented.
- **Inappropriate fire regimes** are a threat to the population of *Keraudrenia exastia*. The species occurs within town limits and in an area which may be prone to arson. Although it is believed that the species is not directly affected by fire, fire may facilitate weed invasion and should be followed up with appropriate weed control.
- **Lack of tenure security and industrial development** is a threat to the population as it occurs on Broome Port Authority land, placing it at risk from development of infrastructure associated with the construction of the marina and port. Plans to develop the land in the future may directly affect the species, or may indirectly affect it by altering its habitat, such as drainage and weed levels. The Broome Port is currently proposing to clear a 25 hectare site within 50m of the known population which may indirectly impact the species through dust, pollution or hydrological changes.
- **Competition** from a local native species such as *Cassytha* sp. is a threat to the population.
- **Weeds**, including Stinking Passion Flower (*Passiflora foetida*) and Buffel Grass (*Cenchrus ciliaris*) are a threat to the population. Weeds not only compete with adult plants for light, moisture and nutrients, but they also reduce the chance of regeneration from soil-stored seed. Buffel Grass appears to respond well to disturbance and also increases fuel loads thereby exacerbating the fire risk.
- **Poor genetic diversity** is possible as it appears that known plants may have originated from one or a few clones. Genetic diversity is needed for a species to adapt to changes in its environment. Low genetic diversity would lower this capacity.
- **Recreational use** is a threat to the species as it occurs close to the town and vehicles and dirt bikes use the area potentially spreading weeds and crushing plants. This area is also used as an illegal dumping site for waste products including garden waste.

The intent of this plan is to provide actions that will deal with immediate threats to *Keraudrenia exastia*. Although climate change may have a long-term effect on the species, actions taken directly to prevent the impact of climate change are beyond the scope of this plan.

Table 2. Summary of population information and threats

Pop. No. & Location	Land Status	Year / No. of plants	Current Condition	Threats
1. Broome Port	Broome Port Authority Reserve	1995 3300 2007/08 *21,000	Healthy	Hydrological changes, inappropriate fire regimes, lack of tenure security, industrial development, competition, weeds, poor genetic diversity, recreational use

*Population count undertaken by Woodman Environmental Consulting

Guide for decision-makers

Section 1 provides details of current and possible future threats. Development and/or land clearing in the immediate vicinity of *Keraudrenia exastia* will require assessment. On-ground works should not be approved unless the proponents can demonstrate that their actions will have no significant negative impact on the species,

its habitat or potential habitat or on the local surface hydrology, such that drainage in the habitat of the species would be altered.

Habitat critical to the survival of the species, and important populations

Given that *Keraudrenia exastia* is ranked as CR, it is considered that all known habitat for the wild population is critical to the survival of the species, and that the wild population is an important population. Habitat critical to the survival of *K. exastia* includes the area of occupancy of the population, areas of similar habitat surrounding the population (this providing potential habitat for population expansion and for pollinators), additional occurrences of similar habitat that may contain undiscovered populations of the species or be suitable for future translocations, and the local catchment for the surface and/or groundwater that maintains the habitat of the species.

Benefits to other species or ecological communities

Recovery actions implemented to improve the quality or security of the habitat of *Keraudrenia exastia* will also improve the status of associated native vegetation. The species occurs adjacent a Priority 1 species *Goodenia byrnesii*. It also occurs near (300 m) the Vulnerable Threatened Ecological Community (TEC) 'Species-rich faunal community of the intertidal mudflats of Roebuck Bay'.

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Indigenous Consultation

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Social and economic impacts

As the population occurs on Broome Port Authority land the protection of *Keraudrenia exastia* may potentially affect industrial activities and further development of the site. Actions will involve liaison and cooperation with the stakeholders with regard to this area.

Affected interests

The stakeholder potentially affected by the implementation of this plan is the Broome Port Authority as the manager of the land containing the population.

Evaluation of the Plans Performance

DEC's West Kimberley District will evaluate the performance of this IRP. In addition to annual reporting on progress and evaluation against the criteria for success and failure, the plan will be reviewed following four years of implementation.

2. RECOVERY OBJECTIVE AND CRITERIA

Objective

The objective of this Interim Recovery Plan (IRP) is to abate identified threats and maintain or enhance *in situ* populations to ensure the long-term preservation of the species in the wild.

Criterion for success: The area of the population has increased and/or further populations are established.
Criterion for failure: The area of the population has decreased.

3. RECOVERY ACTIONS

Existing recovery actions

The Broome Port Authority and the Public Transport Authority have been made aware of the existence of this species and its location. These notifications detailed the Declared Rare status of the species and the associated legal obligations.

A proposal for Ecological Considerations has been written for *Keraudrenia exastia* (Wilkins 2006) to:

- Establish the number of actual individual plants that are made up from the approximate 21,000 stems in the population by examining genetic variation for 10%.
- Confirm that plants of this species flower prolifically but do not set fruit.
- Undertake hydrological investigations to establish the effect of construction, run off or lack of run off if leachates are contained from the large area of hard stand to be situated within 300 metres of the population.
- Monitor population size and health of plants by setting up permanent quadrats.

A flora survey was undertaken on the land containing *Keraudrenia exastia* in 2008 by WEC on behalf of the Broome Port Authority.

DEC staff from West Kimberley District regularly monitor the population.

DEC's West Kimberley District are overseeing the implementation of this IRP and will include information on progress in their annual report to DEC's Corporate Executive and funding bodies.

Future recovery actions

Where recovery actions occur on lands other than those managed by DEC, permission has been or will be sought from appropriate owners/land managers prior to recovery actions being undertaken. The following recovery actions are generally in order of descending priority, influenced by their timing over the life of the plan. However this should not constrain addressing any of the actions if funding is available and other opportunities arise.

1. Coordinate recovery actions

The West Kimberley District will continue to oversee the implementation of the recovery actions for *Keraudrenia exastia* and will include information on progress in their annual report to DEC's Corporate Executive and funding bodies.

Action: Coordinate recovery actions
Responsibility: DEC (West Kimberley District)
Cost: $3,000 per year

2. Map habitat critical to the survival of *Keraudrenia exastia*

It is a requirement of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC) (Section 207A) that spatial data relating to critical habitat be determined. Although habitat critical to the survival of the species is alluded to in Section 1, it has not yet been mapped and will be addressed under this action. If

additional populations are located, then habitat critical to the survival for those populations will be determined and mapped also.

Action: Map habitat critical to the survival of *Keraudrenia exastia*
Responsibility: DEC (Species and Communities Branch (SCB), West Kimberley District)
Cost: $3,000 in year 2

3. Achieve long-term protection of habitat

DEC will seek to have land that contains the population declared as a reserve.

Action: Achieve long-term protection of habitat
Responsibility: DEC (West Kimberley District, Land Acquisition Branch), Department of Planning and Infrastructure (DPI)
Cost: $1,500 per year

4. Install Declared Rare Flora markers

Declared Rare Flora (DRF) markers are needed on the road which straddles the population to ensure plants are not accidentally destroyed.

Action: Install Declared Rare Flora markers
Responsibility: DEC (West Kimberley District)
Cost: $2,000 in year 1

5. Determine genetic variation within population

Currently, it is difficult to determine how many genetically distinct individuals are present. Molecular studies need to be carried out to determine the amount of genetic variability within the population. This will provide information on the actual number of plants and allow the long-term viability of the population to be ascertained. Most importantly, it will also allow the conservation status of the species and importance of recovery actions to be assessed accurately. A proposal written by Wilkins (2006) may provide a basis for the work required.

Action: Determine genetic variation within population
Responsibility: DEC (West Kimberley District, Science Division)
Cost: $15,000 in years 1 and 2

6. Control weeds and *Cassytha* sp.

The best method for controlling weeds and *Cassytha* sp. will be investigated and implemented. Such methods may include the use of a appropriate herbicide or hand weeding.

Action: Control weeds and *Cassytha* sp.
Responsibility: DEC (West Kimberley District)
Cost: $2,000 per year, as required

7. Deter access to the population

To deter access to the population by bike riders, 4WD's, and vehicles dumping rubbish, barriers such as bollards or fencing may be needed. Signs indicating the significance of the area may also be needed.

Action: Deter access to the population
Responsibility: DEC (West Kimberley District)
Cost: $3,000 in year one; $1,000 per year thereafter

8. Collect cutting material and establish plants to preserve genetic diversity

Due to the apparent absence of seed production, cuttings will be collected by District staff and forwarded to the Botanic Garden and Parks Authority (BGPA) to establish a living collection of genetic material.

Action: Collect cutting material and establish plants to preserve genetic diversity
Responsibility: DEC (West Kimberley District), BGPA
Cost: $4,500 per year

9. Undertake hydrological investigations

Hydrological investigations including the impact of clearing vegetation and from construction run off or lack of run off, should be investigated prior to any clearing approval (as per Wilkins 2006).

Action: Undertake hydrological investigations
Responsibility: Broome Port Authority through DEC (West Kimberley District)
Cost: Covered by action 16

10. Monitor population

Monitoring of factors such as weed invasion, habitat degradation, hydrology, population stability (expansion or decline), pollinator activity, seed production, recruitment, and longevity is essential. The population will be inspected annually and an accurate location recorded.

Action: Monitor population
Responsibility: DEC (West Kimberley District)
Cost: $3,500 per year

11. Conduct further surveys

It is recommended that areas of potential suitable habitat be surveyed for the presence of *Keraudrenia exastia* during its flowering period. Information on potential suitable habitat may be obtained from members of the Broome Botanical Society, who undertook surveys in the past. All surveyed areas will be recorded and the presence or absence of the species documented to increase survey efficiency and reduce unnecessary duplicate surveys. Where possible, volunteers from the local community, Landcare groups, wildflower societies and naturalists clubs will be encouraged to become involved.

Action: Conduct further surveys
Responsibility: DEC (West Kimberley District)
Cost: $4,000 in years 1, 3 and 5

12. Develop and implement a fire management strategy

Fire will be prevented from occurring in the habitat of the population, except where it is being used experimentally as a recovery tool. A fire management strategy will be developed in consultation with relevant authorities and land managers that recommends appropriate fire frequency, intensity, season, and control measures.

Action: Develop and implement a fire management strategy
Responsibility: DEC (West Kimberley District), relevant authorities
Cost: $2,500 in first year and $1,000 in subsequent years

13. Remove rubbish when required

The area containing the population of *Keraudrenia exastia* is prone to rubbish dumping, in particular garden waste, and removal may be required.

Action: Remove rubbish when required
Responsibility: DEC (West Kimberley District)

Cost: $5,000 per year, if required

14. Start the translocation process, if necessary

Translocation may be deemed desirable for the conservation of this species if surveys fail to locate new populations. A translocation proposal will be developed and suitable translocation sites selected. Information on the translocation of threatened plants and animals in the wild is provided in DEC's Policy Statement No. 29 *Translocation of Threatened Flora and Fauna* (CALM 1995). All translocation proposals require endorsement by DEC's Director of Nature Conservation. Monitoring of translocations is essential and will be included in the timetable developed for the Translocation Proposal.

Action: Start the translocation process, if necessary
Responsibility: DEC (West Kimberley District)
Cost: $2,500 in year 5

15. Liaise with relevant land managers and Indigenous groups

Staff from DEC's West Kimberley District will liaise with the Broome Port Authority to ensure that the population of *Keraudrenia exastia* is not accidentaly damaged or destroyed. Indigenous consultation will take place to determine if there are any issues or interests in areas that are habitat for *K. exastia*.

Action: Liaise with relevant land managers and Indigenous groups
Responsibility: DEC (West Kimberley District)
Cost: $2,000 per year

16. Promote awareness

The importance of biodiversity conservation and the protection of *Keraudrenia exastia* will be promoted to the public. This will be achieved through an information campaign using local print and electronic media and by setting up poster displays. An information sheet that includes a description of the plant, its habitat type, threats and management actions, and photos will be produced. Formal links with local naturalist groups and interested individuals will also be encouraged.

Action: Promote awareness
Responsibility: DEC (West Kimberley District, SCB, Strategic Development and Corporate Affairs Division)
Cost: $1,500 in year 1 and $1,000 in years 2-5

17. Obtain biological and ecological information

Increased knowledge of the biology and ecology of the species will provide a scientific basis for management of *Keraudrenia exastia* in the wild. Overall investigations will ideally include:

1. Study of the soil seed bank dynamics and the role of various factors including disturbance, competition, drought, inundation and grazing in recruitment and seedling survival.
2. Determination of reproductive strategies, phenology and seasonal growth.
3. Investigation of the mating system and pollination biology.
4. Investigation of population genetic structure, levels of genetic diversity and minimum viable population size.
5. The impact of changes in hydrology in the habitat.

Action: Obtain biological and ecological information
Responsibility: DEC (Science Division, West Kimberley District)
Cost: $15,000 per year

18. Re-evaluate and update ranking criteria

Keraudrenia exastia is currently ranked as CR under B1+2de using IUCN 1994 criteria. The species will be re-evaluated and the criteria updated according to IUCN 2001 criteria.

Action: Re-evaluate and update ranking criteria
Responsibility: DEC (SCB, West Kimberley District)
Cost: $500 in year 1

19. Review this IRP and assess the need for further recovery actions

If *Keraudrenia exastia* is still ranked as CR at the end of the five-year term of this IRP, the need for further recovery actions, or a review of this IRP will be assessed and a revised plan prepared if necessary.

Action: Review this IRP and assess the need for further recovery actions
Responsibility: DEC (SCB, West Kimberley District)
Cost: $2,000 in year 5

Table 3. Summary of Recovery Actions

Recovery Action	Priority	Responsibility	Completion Date
Coordinate recovery actions	High	DEC (West Kimberley District)	Ongoing
Map habitat critical to the survival of *Keraudrenia exastia*	High	DEC (SCB, West Kimberley District)	2011
Achieve long-term protection of habitat	High	DEC (West Kimberley District, Land Acquisition Branch), DPI	Ongoing
Install DRF markers	High	DEC (West Kimberley District)	2010
Determine genetic variation within population	High	DEC (West Kimberley District, Science Division)	2011
Control weeds and *Cassytha* sp.	High	DEC (West Kimberley District)	Ongoing
Deter access to the population	High	DEC (West Kimberley District)	2014
Collect cutting material to preserve genetic diversity	High	DEC (West Kimberley District, TFSC), BGPA	2014
Undertake hydrological investigations	High	Broome Port Authority through the DEC (West Kimberley District)	Prior to any clearing approval
Monitor population	High	DEC (West Kimberley District)	Ongoing
Conduct further surveys	High	DEC (West Kimberley District)	Ongoing
Develop and implement a fire management strategy	High	DEC (West Kimberley District), relevant authorities	Developed by 2010 with implementation ongoing
Remove rubbish when required	Medium	DEC (West Kimberley District)	Ongoing
Start the translocation process, if necessary	Medium	DEC (West Kimberley District)	2014
Liaise with relevant land managers and Indigenous groups	Medium	DEC (West Kimberley District)	Ongoing
Promote awareness	Medium	DEC (West Kimberley District, SCB, and Strategic Development and Corporate Affairs Division)	Ongoing
Obtain biological and ecological information	Medium	DEC (Science Division, West Kimberley District)	2014
Re-evaluate and update ranking criteria	Medium	DEC (SCB, West Kimberley District)	2010
Review this IRP and assess the need for further recovery actions	Medium	DEC (SCB, West Kimberley District)	2014

4. TERM OF PLAN

This IRP will operate from January 2010 to December 2014 but will remain in force until withdrawn or replaced. If the species is still ranked CR after five years, the need for further recovery actions will be determined.

5. REFERENCES

Conservation and Land Management (1992) Policy Statement No. 44 *Wildlife Management Programs*. Department of Conservation and Land Management, Western Australia.

Conservation and Land Management (1994) Policy Statement No. 50 *Setting Priorities for the Conservation of*

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6. TAXONOMIC DESCRIPTION

Keraudrenia exastia

Wilkins, C.F. (1999) *Keraudrenia exastia* and *Keraudrenia katatona* (Malvaceae: Byttnerioideae), new species from the Kimberley region of Western Australia. *Nuytsia* 13(1): 233−242.

Shrub, erect, compact, multistemmed, 70−90 cm high, asexual reproduction by rhizomes not investigated. *Stems* terete; apical branchlets with a tomentum of pale tan and white stellate hairs to 0.2 mm diameter (*c*. 24 cells per hair). *Stipules* narrowly ovate or ovate, 1.5−4 x 0.3−0.5 mm; adaxial surface with medium density, stellate hairs and scattered, stipitate, clavate glands *c*. 0.1 mm long, abaxial surface with stellate-tomentum. *Leaves* alternate, spreading; petiole 3−6 mm long; base obtuse, blade flat or conduplicate, narrowly ovate, elliptic or oblong, (6)15−20(28) x 5−10 mm, margin entire; both surfaces with a pale grey-green tomentum of stellate hairs; abaxial surface with prominent veins and occasional, red, stipitate, capitate glands *c*. 0.25 mm in diameter; apex obtuse, rarely retuse; young growth leaves not observed. *Inflorescence* a dichasial cyme, 7−9 flowered, 15−22 mm long, flowers 5- rarely 4-merous. *Peduncle* 2−3 mm long, stellate-tomentose. *Pedicel* 4−7 mm long, faintly articulate, stellate-tomentose. *Bract* caducous, purple, petaloid, attached on pedicel below articulation, elliptic, 3.5−9.5 x 0.5−4 mm, margin fringed; adaxial surface with scattered, fine, white, stellate indumentum; abaxial surface with dense, pale-tan-centred stellate hairs; apex apiculate. *Calyx* purple, petaloid, with base of inner rib a yellow-green, tube and lobes initially deflexed from staminal tube, ovate, 9−12 mm long, longer than wide, lobes comprise 65-80% of calyx length; adaxial surface of lobe with prominent midrib and lateral veins prominent when fresh, margin of adaxial surface with few simple hairs, tube and centre of lobe with stipitate, white, clavate glands, 0.15 mm long, rarely stellate hairs at base; abaxial surface of calyx with medium density, stellate hairs, 0.2−1.0 mm diameter, denser at the base of the calyx, capitate glands absent; margin minutely denticulate with apical stellate hairs on the teeth; lobe apex acuminate; fruiting calyx not observed. *Corolla* usually absent (one petal observed on one flower, obovate, *c*. 1.0 x 1.2 mm, outer surface stellate-hairy). *Stamens* shortly fused at the base; *staminal tube c*. 0.8 mm long; *staminodes* narrowly triangular, yellow, *c*. 1.3 x 0.15 mm, frequently with recurved apex and rarely with minute sterile anther affixed; *filaments* yellow, *c*. 0.15 mm long; *anthers* extrorse, ventrifixed, curved, 1−1.3 x 0.6−0.7 mm, yellow when young, becoming faded purple with age, stellate hairs rarely present on anther margins, pollen yellow. *Ovary c*. 1 x 1 mm, 5-celled rarely 4-celled, carpels free centrally, fused laterally at lower centre, ovary outer surface with papillae, developing post anthesis into stellate hairy setae (bristles with stellate hairs along length and apex); ovules 5 or 6 per cell. *Styles* 5(4), 3.3−4 mm long, glabrous. *Stigma* simple. *Fruit* not observed.