

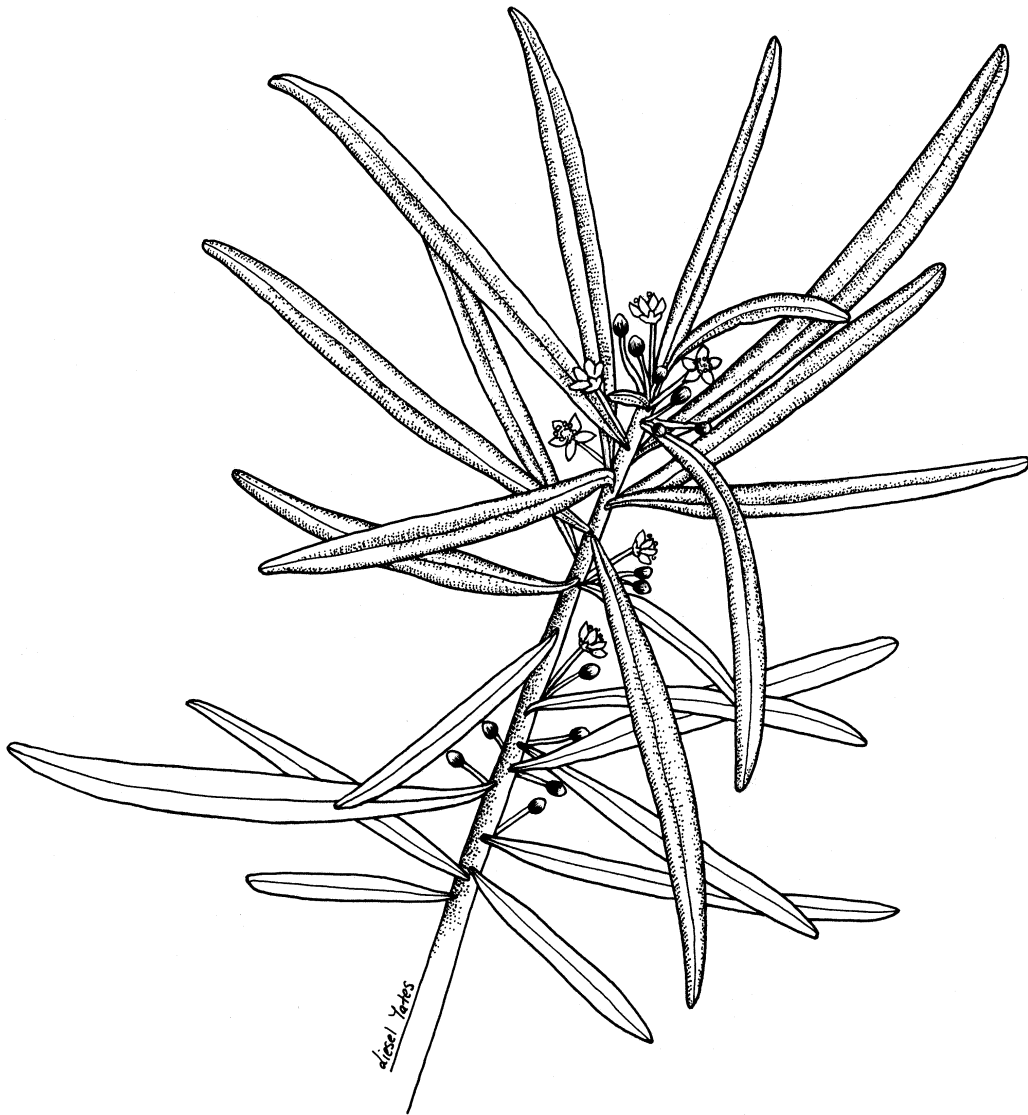
Approved NSW & National  
Recovery Plan

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# *Quassia* sp. Mooney Creek (Moonee Quassia)

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July 2005



Department of  
Environment and Conservation (NSW)



Natural Heritage Trust  
*Helping Communities Helping Australia*  
A Commonwealth Government Initiative

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Department of Environment and Conservation (NSW)  
43 Bridge Street  
(PO Box 1967)  
**Hurstville NSW 2220**  
Tel: 02 9585 6444  
[www.environment.nsw.gov.au](http://www.environment.nsw.gov.au)

Requests for information or comments regarding the recovery program for the Moonee Quassia are best directed to:

The Moonee Quassia Recovery Co-ordinator  
Threatened Species Unit, North East Branch  
Department of Environment and Conservation (NSW)  
Locked Bag 914  
**Coffs Harbour NSW 2450**  
Tel: 02 6651 5946

**Cover illustrator:** Liesel Yates

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# Recovery Plan for *Quassia* sp. Mooney Creek (Moonee Quassia)

## Foreword

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The New South Wales Government established a new environment agency on 24 September 2003, the Department of Environment and Conservation (DEC), which incorporates the NSW National Parks and Wildlife Service. Responsibility for the preparation of Recovery Plans now rests with this new department.

This document constitutes the formal National and New South Wales State Recovery Plan for *Quassia* sp. Mooney Creek (Moonee Quassia) and, as such, considers the conservation requirements of the species across its known range. It identifies the actions to be taken to ensure the long-term viability of the Moonee Quassia in nature and the parties who will undertake these actions.

The Moonee Quassia is included as Endangered on the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*, and on the New South Wales *Threatened Species Conservation Act 1995*. The Moonee Quassia is a shrub that grows to two metres high or, rarely, a small tree. The species is endemic to the north coast of NSW, and is known from only 18 locations between Mooney Beach (north of Coffs Harbour) and McCraes Knob (east of Ulmarra).

The recovery actions detailed in this Recovery Plan include: (i) research into the life cycle of and threats to the species; (ii) surveys to locate any additional populations; (iii) management actions and protection mechanisms to assist the recovery of the species; (iv) community awareness and involvement in the conservation of the species; and (v) monitoring of populations and individuals of the species.

It is intended that this Recovery Plan will be implemented over a five-year period. The NSW Department of Environment and Conservation will undertake recovery actions.



LISA CORBYN  
Director-General



BOB DEBUS MP  
Minister for the Environment

## Acknowledgments

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- Dr Caroline Gross, University of New England, Armidale, for advice and commenting on the Draft Recovery Plan for the species.

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## 1 Introduction

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*Quassia* sp. Mooney Creek (Moonee Quassia) is a shrub that grows to 2 metres high or, rarely, a small tree. The species is endemic to the north coast of New South Wales (NSW), and is currently only known from 18 locations between Moonee Beach (near Coffs Harbour) in the south to McCraes Knob (12 km east of Ulmarra) in the north.

Approximately 5000–7000 individuals of the Moonee Quassia are known to occur in the wild. Populations totalling about 3000 individuals occur in Orara East and Conglomerate State Forests. Based on stem counts and density estimates, the single largest known population of the Moonee Quassia occurs in Compartment 566 of Orara East State Forest.

This document constitutes the formal National and NSW State Recovery Plan for the Moonee Quassia and, as such, considers the requirements of the species across its known range. It identifies the actions to be taken to ensure the long-term viability of the Moonee Quassia in nature and the parties who will undertake these actions. The attainment of the objectives of this Recovery Plan is subject to budgetary and other constraints affecting the parties involved.

## 2 Legislative Context

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### 2.1 Legal status

The Moonee Quassia is listed as Endangered on the NSW *Threatened Species Conservation Act 1995* (TSC Act) and on the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

### 2.2 Responsibilities under the *Threatened Species Conservation Act 1995*

The TSC Act provides a legislative framework to protect and encourage the recovery of Endangered and Vulnerable Species, Endangered Populations and Endangered Ecological Communities in NSW. Under this legislation the Director-General of the NSW Department of Environment and Conservation (DEC) (formerly National Parks and Wildlife Service (NPWS)), has a responsibility to prepare Recovery Plans for all species, populations and ecological communities listed as Endangered or Vulnerable on the TSC Act schedules. The TSC Act includes specific requirements for both the matters to be addressed by Recovery Plans and the

process for preparing Recovery Plans. This Recovery Plan satisfies these provisions.

This Recovery Plan was placed on public exhibition from 24 September to 5 November 2004.

The *Threatened Species Conservation Amendment Act 2002* states that an approved Recovery Plan must include a summary of advice given by the NSW Scientific Committee with respect to the plan, details of any amendments made to the plan to take account of that advice, and a statement of the reasons for any departure from that advice. This summary is provided in Appendix 1.

The TSC Act requires that a government agency must not undertake actions inconsistent with a Recovery Plan. The actions identified in this plan for the recovery of the Moonee Quassia in NSW are the responsibility of the DEC. Other public authorities may have statutory responsibilities relevant to the conservation and protection of the Moonee Quassia.

### Consultation with indigenous people

Local Aboriginal Land Councils, Elders and other groups representing indigenous people in the areas where the Moonee Quassia occurs have been identified. It is the intention of the DEC to consider the role and interests of these indigenous communities in the implementation of the actions identified in this plan.

### Critical Habitat

The TSC Act makes provision for the identification and declaration of Critical Habitat for species, populations and Endangered Ecological Communities. It is an offence to damage listed Critical Habitat (unless the action is specifically exempted by the TSC Act) and a Species Impact Statement (SIS) is mandatory for all developments and activities proposed within Critical Habitat.

To date, Critical Habitat has not been declared for the Moonee Quassia under the TSC Act. The declaration of Critical Habitat in NSW is not considered to be a priority for this species at this stage, as other mechanisms provide for its protection.

### Key Threatening Processes

As of January 2005 there are 25 key threatening processes listed on the TSC Act. Of these, clearing of native vegetation, is relevant to the Moonee Quassia. In addition to this Key Threatening Process, a range of other processes are likely to threaten the survival of the species in NSW.

The current distribution of the plant suggests that populations may have always been disjunct (D. Binns pers. comm.) or, alternatively, that a variety of

threatening processes were or may still be active (for example, weed infestation, inappropriate logging and fire regimes) (Horton 2000). More research is needed to assess the impacts of disturbances on the species.

### Licensing

Any activity not requiring development consent under the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) or NSW *Native Vegetation Act 2003*, but which is likely to pick the Moonee Quassia or damage its habitat, requires a Section 91 licence from the DEC under the provisions of the TSC Act. If the impact is likely to be significant, a SIS is required.

### Other conservation measures

The TSC Act includes provision for other measures that may be taken to conserve the Moonee Quassia or its habitat, including the making of a Stop Work Order or Joint Management Agreement.

### 2.3 Environment Protection and Biodiversity Conservation Act 1999

The EPBC Act provides a legislative framework for the protection of threatened species across Australia. An important role of the EPBC Act is to facilitate the preparation and implementation of Recovery Plans for species listed under the Act in co-operation with the States in which populations of listed species occur. Commonwealth agencies are required to comply with recovery plans made or adopted under the Act. This Recovery Plan will be submitted to the Commonwealth for approval under the EPBC Act.

Under the EPBC Act, Critical Habitat may be registered for any Nationally listed threatened species or ecological community. When adopting a Recovery Plan the Australian Government Minister for the Environment and Heritage must consider whether to list habitat identified in the Recovery Plan as being critical to the survival of the species or ecological community. It is an offence under the EPBC Act for a person to knowingly take an action that will significantly damage Critical Habitat (unless the EPBC Act specifically exempts the action). This offence only applies to Commonwealth areas. However, an action that is likely to have a significant impact on a listed species is still subject to referral and approval under the EPBC Act.

The Moonee Quassia is listed Nationally as Endangered under the EPBC Act. Any person proposing to undertake actions likely to have a significant impact on this species should refer the action to the Australian Government Minister for

the Environment and Heritage for consideration. The Minister will then decide whether the action requires EPBC Act approval. This is in addition to any State or Local Government approval requirement specified for the EP&A Act.

Administrative guidelines are available from the Department of Environment and Heritage to assist proponents in determining whether their action is likely to have a significant impact.

### 2.4 Relationship to other legislation

Additional legislation relevant to the conservation and recovery of the Moonee Quassia in NSW includes the following:

- *National Parks and Wildlife Act 1974*;
- *Environmental Planning and Assessment Act 1979*;
- *Local Government Act 1993*;
- *Native Vegetation Act 2003*;
- *Forestry and National Park Estate Act 1998*;
- *Plantations and Reafforestation Act 1999*; and
- *Rural Fires and Environmental Assessment Legislation Amendment Act 2002*.

## 3 Species Information

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### 3.1 Description and taxonomy

The Moonee Quassia is recognised by its shrubby habit. The two-ranked discolorous leaves are very narrow with blunt tips, with numerous transverse secondary veins leading to an intramarginal vein. The small red-tinged flowers are typically in clusters of five or less. The fruit is a distinctive red colour of oval shape and 5–10 mm long (Quinn *et. al.* 1995). The Moonee Quassia has not yet been formally described, although a technical description of the species can be found in Quinn *et. al.* (1995) and in Harden (2002).

The Moonee Quassia belongs to class Magnoliophyta, sub-class Magnoliopsida (a flowering dicotyledon) and order Sapindales. It is in the Simaroubaceae family, of which four genera occur in Australia (*Ailanthus*, *Harrisonia*, *Brucea*, and *Quassia*).

Within Australia there are six species of Quassia: *Q. bidwillii*, *Q. baileyana*, *Q. sp. Mt Nardi* (Floyd 1198), *Q. sp. Mooney Creek*, and *Q. spp. 3 and 4*. Only two of the six species have been described. *Q. sp. Mooney Creek* and *Q. sp. Mt Nardi* (Floyd 1198) occur only in NSW, whereas the remaining four species occur in Queensland.



The Moonee Quassia populations in the Moonee and Grafton districts are commonly referred to as *Quassia* sp. B. (Mooney Creek) or *Quassia* sp. 1.

The *Quassia* genus contains approximately 40 species worldwide. Species occur in tropical to subtropical regions, particularly in South America. *Quassia amara* and *Q. simaroubae* are renowned for their medicinal use in the treatment of dyspepsia and constipation and as ornamental shrubs (Heywood 1985). The bark of *Q. amara* is extremely bitter and extracts from it are used as foliage spray to deter animal browsing (Floyd 1979). The distribution of the genus is of biogeographic significance since it has evolved from ancestors that originated on the super-continent of Gondwana.

The Moonee Quassia has previously been confused with *Quassia bidwillii* (Hook. F.) Nooteb. from northern Queensland. This name was used for the Moonee Quassia in Harden (1991). Plant species with which the Moonee Quassia occurs and with which it may be confused include *Maytenus silvestris* (Narrow-leaved Orangebark) and *Santalum obtusifolium* (Sandalwood).

### 3.2 Distribution

The Moonee Quassia is endemic to north-east NSW. Herbarium records indicate the Moonee Quassia was collected in 1949 by J. King in the Timbertop area, 32 km north-west of Coffs Harbour on the north coast of NSW. This population is now thought to be extinct due to competitive displacement by weeds (A. Floyd pers. comm.; Sheringham & Westaway 1995). The Moonee Quassia was rediscovered in 1984 when A.G. Floyd identified it in the Moonee Beach area.

Since this discovery, the Moonee Quassia has been recorded at a further 17 locations from its southernmost limit at Moonee Beach, 8 km north of Coffs Harbour, north to McCraes Knob, 12 km east of Ulmarra (Figure 1).

The known distribution of the species is contained within the catchments of the Orara and Coldstream Rivers (tributaries of the Clarence River) and the coastal drainage systems of Moonee Creek and Corindi River, in the Coffs Harbour City and Clarence Valley local government areas.

The range of the species extends over less than 80 km within latitudes 29°36'S and 30°13'S and longitudes 152°57'E and 153°08'E.

A register of all known locations of the Moonee Quassia is held by the DEC and will be amended as necessary to reflect the discovery of new sites and subsequent research. The register contains relevant

details of land tenure, landform, geology, soil, elevation, aspect, slope, disturbance, threats, population estimates and vegetation communities for each location.

### 3.3 Land tenure

The Moonee Quassia is known to occur in Wedding Bells, Conglomerate, and Orara East State Forests. In Conglomerate State Forest, a population occurs in Madmans Creek Flora Reserve, within the formal reserve system. There is also a record of the species from Sherwood Nature Reserve.

The species is known to occur on private land adjacent to Orara East State Forest.

### 3.4 Habitat

The habitat of the Moonee Quassia at Moonee and other coastal sites is wet sclerophyll forest, typically comprising canopy species such as *Eucalyptus microcorys* (Tallowwood), *Lophostemon confertus* (Brushbox), *Syncarpia glomulifera* (Turpentine), and *Allocasuarina torulosa* (Forest Oak). This wet forest habitat usually supports a varying density and diversity of rainforest understorey species.

The habitat of populations in the Grafton district consists of tall dry Eucalypt forests of *Eucalyptus planchoniana* (Needlebark Stringybark)/ *Eucalyptus pyrocarpa* (Large-fruited Blackbutt) above a well developed shrub layer.

The Moonee Quassia occurs with populations of the threatened plants *Boronia umbellata*, *Parsonsia dorrigoensis* and *Amorphospermum whitei*, each of which is listed under the TSC Act. Populations of *Eucalyptus rummeryi*, *Austrobuxus swainii* and *Marsdenia liisae* have also been recorded in the same area as the Moonee Quassia at Conglomerate State Forest.

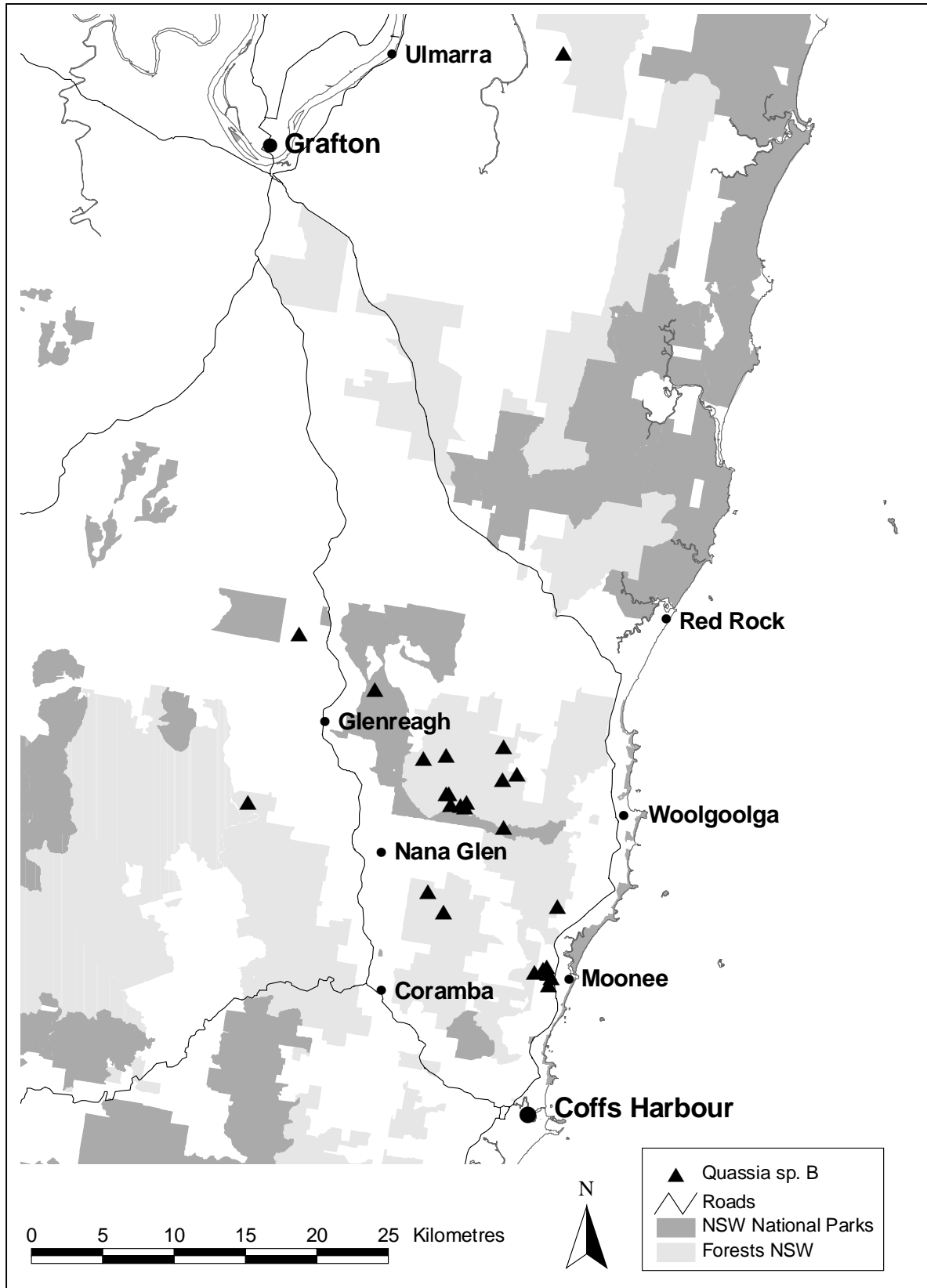


Figure 1. Location of known occurrences of the Moonee Quassia in New South Wales

### 3.5 Life history and ecology

#### Flowering and fruiting

The Moonee Quassia flowers in November and December. It is not known if this occurs annually. The flowers are small and red-tinged. Fruiting takes place in March and April. Flower and bud production has been observed at all sites but has involved only a low proportion of individuals (A. Floyd, pers. comm.). Flowering is inconsistent within populations and mainly occurs on plants that have access to direct sunlight and/or lateral light across the forest floor.

Few observations have been made of populations of the Moonee Quassia fruiting in the wild. Fruiting specimens have been observed at Orara East State Forest and Madmans Creek Flora Reserve (P. Richards, pers. comm.), although only a very small proportion of each population bore fruit. Very small plants with mature fruit have been recorded on private land adjacent to Orara East State Forest where regrowth from suckers may have occurred in response to clearing along a track (D. Binns, pers. comm.). Flowering during 1996 in Wedding Bells State Forest and possibly in other populations may have been due to unseasonal rainfall for 1996 across the Coffs Harbour District (S. Clemesha, pers. comm.). At the North Coast Regional Botanic Garden (NCRBG), fruiting of a plant that germinated in 1986 is irregular and infrequent (A. Floyd, pers. comm.).

#### Pollination

No pollination vectors have been observed for the Moonee Quassia.

A plant at the NCRBG has produced abundant fruit without cross-pollination from other individuals. Abundant fruiting does not necessarily imply that the plant is producing viable seed, although seed from NCRBG has been successfully germinated. This suggests that the species may be capable of self-pollination. It is unknown if individuals in wild populations do self-pollinate, but the potential for inbreeding by the species may be high.

Information on the proportion of self- versus cross-pollination, the pollination vector and the frequency of pollination is essential to determine the extent of gene flow between populations (Cropper 1993) and therefore the long term viability of this species.

#### Seed dispersal

The seed dispersal mechanisms of the Moonee Quassia are not known, although the location of most populations along watercourses suggest that rainfall runoff may be important. The mature

individual at the NCRBG has produced many fruit that have fallen to the ground, but these have been untouched by insects or animals (A. Floyd pers. comm.). This may be due to the plant being in an area where it does not naturally occur and which may lack dispersal agents.

Plants occur in clusters that appear to be of a similar age class. It is unclear whether the clusters have resulted from the same germination event, or whether the plants have vegetatively reproduced by means of suckers from buried stems or from the root system. There has been no investigation of a possible seed bank or of the potential for the species to clone. This Recovery Plan proposes research into this aspect of the species' breeding ecology.

#### Germination and regeneration

At most locations where the Moonee Quassia is known to occur, the lower vegetation stratum is sparse, with forest litter covering most of the ground. Although the Moonee Quassia plants may maximise survival rate and growth where there is little or no competition from surrounding plants (A. Floyd, pers. comm.), the species may also be found in more shady areas with a sparse ground cover and a dense upper stratum (D. Binns, pers. comm.). Disturbance trials are needed to better understand the impacts of competition with adjacent plants on the Moonee Quassia.

The Moonee Quassia can be associated with Forest Oak, possibly due to the needles restricting the germination of competitive plant species while still providing an opportunity for the Moonee Quassia individuals to establish (A. Floyd, pers. comm.). However, the ubiquitous nature of Forest Oak, and the fact that the Moonee Quassia is absent across most of its range, suggests that any association is likely to reflect local similarities in microclimatic requirements, rather than any mutualistic or symbiotic relationship (Horton 2000).

It is possible that plant growth may be hampered by animals and/or insects removing new season flush. Small orange and brown caterpillars have been observed nesting and feeding on terminal growth of some individuals, and others appeared to have been bitten off by vertebrate animals (possibly wallabies or rabbits) (A. Ridgway, pers. comm.). The caterpillars and vertebrate animals need to be identified to determine any dependence on the Moonee Quassia as a food source, and the impact that herbivores may be making on species growth and vigour.

Seedling recruitment of the Moonee Quassia at most locations appears minimal. Recruitment may currently be limited in the wild by infrequent fruiting and low seed production. However, the ease with

which cultivated seed can be germinated suggests that this limit is not an inherent characteristic of the species.

It is also possible that the Moonee Quassia populations are producing non-viable seed for reasons presently unknown.

The role of fire in regeneration of the Moonee Quassia is uncertain. Evidence of past fire is apparent in or near each known population. While some populations survive in wet gully systems and are presumably burnt infrequently, other populations occur in dry sclerophyll forest, where the frequency of fires is higher. This suggests that the species lacks a fire recruitment cue and may possess some level of fire tolerance. Seed collected from an individual at the NCRBG was easily germinated without the application of heat. More research is needed into the effects of fire frequency and intensity on the Moonee Quassia.

Whilst the reason for poor seedling recruitment is not known, seedlings appear to go through a dormant stage with sparse leaf cover and no feeding roots until they are able to resume growing (A. Floyd, pers. comm.). The root system of mature Moonee Quassia is massive (A. Floyd, pers. comm.) and it is likely that the plant can vegetatively reproduce by suckers and coppicing in response to disturbance (D. Binns, pers. comm.). Further investigation into these aspects of the plant ecology is warranted.

### Population structure

The maturation rate of the species is difficult to determine. Stems usually possess a series of 'kinks' where the stem has been broken or removed, and from where shoots have regrown (A. Ridgway pers. comm.). Because of this, calculation of age using the presence of periodic growth kinks as an indicator is difficult. A mature plant can be relatively small as a result of continuing breakages during its growth. It is not known whether these kinks are a result of natural (wildfire, storms) or human (logging, clearing) events, or from animal grazing and trampling. The fact that plants at most locations are at a uniform height suggests that previous climatic and local conditions may have favoured simultaneous germination. Long-term demographic studies are required to reveal the factors affecting maturation rate.

### 3.6 Ability of species to recover

The ability of the species to recover is dependent on the successful implementation of management strategies that abate the threatening processes. Research, identified as recovery actions in this plan, will provide information on how to manage this

species so that it can recover. At present, the species' ability to recover is not known.

On-site protection is likely to be the most cost effective method to enable recovery. The reservation of one of the largest populations by Forests NSW in Madmans Creek Flora Reserve may demonstrate this in the longer term. However, most populations remain outside the formal reserve system. Careful management is needed by all land owners where the Moonee Quassia occurs to ensure the recovery of the species.

## 4 Threats and Management Issues

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### Low population numbers

If a species is in decline due to threatening processes and activities, low population numbers can affect the survival of the species due to possible inbreeding and reducing genetic variation that might otherwise assist in buffering populations from catastrophic events. The genetic variation within and between populations of the Moonee Quassia has not been assessed. The Moonee Quassia has a fragmented distribution and it is possible that it may have always been this way. Further research into genetic variability of the Moonee Quassia is warranted.

### Weed infestation

Shading of native plants by weeds can be responsible for the displacement of native vegetation and loss of habitat integrity. Introduction of weeds can also be correlated with the local extinction of susceptible native species (Sheringham & Westaway 1995).

The invasive weed *Lantana camara* (Lantana) appears to pose the most obvious threat to the Moonee Quassia, and it is found at almost all known sites. Research is needed to confirm the nature and extent of the threat by Lantana.

In areas where Lantana has been removed, other weeds such as *Ochna serrulata* (Ochna) and *Ageratina adenophora* (Crofton Weed) can proliferate, unless adequate follow-up weeding and monitoring are conducted. The Moonee Quassia may be capable of colonising disturbed forest, but with the incursion of aggressive weeds, its ability to colonise may be significantly limited.

Logging operations have the potential to remove individual plants. However, Forests NSW Threatened Species Licence for Upper North East NSW requires that at least 90% of the Moonee Quassia individuals in any population must be protected by an exclusion zone at least 20 m wide. Post-logging control of weeds may be essential for the persistence of the Moonee Quassia.

## Grazing

Historically, grazing by cattle may have occurred at many Moonee Quassia locations on both public and private land. Trampling by cattle may also pose a threat to the species, due to the spindly nature of the species and proximity to drainage lines. Grazing of the Moonee Quassia habitat on public land is now largely absent, and is unlikely to be a significant or continuing threat (D. Binns, pers. comm.). However, cattle grazing and trampling of plants on freehold land may still constitute a threat at some Moonee Quassia locations. Community education is needed to manage this potential threat.

Most populations are also affected by other herbivores, possibly wallabies and/or rabbits. Caterpillars have also been observed nesting and feeding on leaves at some locations (A. Ridgway, pers. comm.).

Research is needed into the impacts of grazing by cattle and other herbivores on the Moonee Quassia populations.

## Fire

The effects of fire on the Moonee Quassia have not been determined. Research to determine the effects of fire on the species is needed.

## 5 Previous Recovery Actions

### Habitat protection and management

Forests NSW undertakes surveys in relevant habitat. Under the Threatened Species Licence for Upper North East NSW, Forests NSW is required to protect at least 90% of individuals in any population.

### Research

Ridgway (1996) completed population monitoring surveys as part of the development of this Recovery Plan. Horton (2000) completed a review of all known sites.

### Captive breeding

Eight plants have been propagated at NCRBG at Coffs Harbour. Seed collected from a single plant at Moonee was successfully germinated in 1984, and one plant from this germination trial was planted at NCRBG in 1986. Other plants have been germinated from the NCRBG plant, and planted throughout the NCRBG. Three individuals from an unknown plant were planted at Royal Botanic Gardens in Sydney in 1993, but have since perished.

## 6 Proposed Recovery Objectives, Actions and Performance Criteria for 2005-2010

The overall objective of this Recovery Plan is to provide for the continued and long term survival of Moonee Quassia in the wild by preventing the loss of populations of the species.

Specific objectives of the Recovery Plan for the species are listed below. For each of these objectives a number of recovery actions have been developed. Performance criteria are provided to measure whether the objectives have been met.

### Objective 1: To co-ordinate the recovery of the Moonee Quassia.

#### Action 1.1

*The DEC will co-ordinate the implementation of the actions outlined in this Recovery Plan.*

A co-ordinated approach is essential to oversee and assist in the implementation of the actions outlined in this Recovery Plan in a timely, cost-effective and efficient manner.

Performance criterion: The DEC has co-ordinated the recovery actions included in this Recovery Plan for the life of the plan.

#### Action 1.2

*The DEC will integrate the recovery program for this species with relevant Recovery Plans, management and conservation strategies and management plans developed and implemented by the DEC and other public authorities.*

By integrating the Moonee Quassia Recovery Plan actions with those proposed in other Recovery Plans, management and conservation strategies and management plans, limited resources can obtain a greater conservation benefit.

Performance criterion: Over the life of this Recovery Plan, where practicable, related recovery actions identified in this Recovery Plan and other Recovery Plans, management and conservation strategies and management plans have been integrated.

### Objective 2: To increase the level of understanding of the ecology and life history of the species.

#### Action 2.1

*The DEC will support research into the biology, ecology, and genetics of the Moonee Quassia that will improve management of the species.*

Research will include, but not necessarily be restricted to:

- flowering, fruiting, pollination mechanisms, seed dispersal, germination, regeneration;
- population structure of the species, associations with other species;
- genetic variability within and between populations; and
- threats to the species, response to disturbance.

Performance criterion: Research on the above has commenced within the life of the plan.

### **Objective 3: To locate any additional populations.**

#### *Action 3.1*

*The DEC will identify potential habitat for the species, and will support systematic survey work to establish the presence of additional populations.*

Systematic and comprehensive surveys of all areas of habitat where the Moonee Quassia may potentially occur are required to ensure that all extant populations are identified and recorded. Site assessment utilising the 'Threatened Flora Site Assessment' form (Appendix 2) will occur for each new population recorded.

Performance criteria: Comprehensive and systematic surveys have been completed within one year of the commencement of this Recovery Plan. Site assessment has occurred for each new population recorded.

### **Objective 4: To ensure the broader community has access to information about the distribution, conservation and management of the Moonee Quassia and its habitat.**

*Action 4.1: The DEC will develop and implement a broad scale education and awareness strategy, including conservation and management of the species, and mechanisms and incentives for protection and on-ground management.*

The education and awareness strategy will provide information on the Moonee Quassia and its conservation, processes threatening the species, and mechanisms and incentives available to ameliorate or eliminate these threats. This strategy will aim to identify a wide variety of target groups and provide relevant information at a level appropriate for each group. Interested groups or individuals may then have a role in management of the species and implementation of recovery actions.

Target groups should include, but not be restricted to:

- local Aboriginal community and Local Aboriginal Land Council;

- public authorities;
- local council staff;
- Councillors;
- visitors to the area;
- Catchment Management Authorities;
- local community groups;
- schools; and
- landholders and land managers.

To ensure the conservation of threatened species it is essential to provide the community and relevant regulatory bodies with information that enhances awareness, and aims to achieve beneficial conservation outcomes in a co-operative manner.

Communication and education should be seen as a method of providing landholders, land managers and the wider community with relevant information and skills to enable informed decision-making in land management practices. In addition to information on the Moonee Quassia, this should include information on land use planning mechanisms for the protection of populations. These include rezoning, voluntary conservation agreements, and property management planning. In some cases assistance may be available for on-ground management including weeding and fencing.

Performance Criteria: Target groups have been identified within six months of the commencement of this Recovery Plan. Required levels and extent of information are established within eight months of the commencement of this Recovery Plan. Appropriate information packages have been developed and distributed within 12 months of the commencement of this Recovery Plan.

### **Objective 5: Retention of each known population at its current size.**

#### *Action 5.1*

*The DEC will support a program to monitor population structure known locations to detect any variation in population dynamics, and the species' response to a range of disturbance regimes.*

#### *Action 5.2*

*As part of the above program, the health of Moonee Quassia individuals will be monitored on a regular basis.*

#### *Action 5.3*

*If monitoring shows a decline in population health or numbers, amelioration or control of the threatening processes will be implemented.*

Population monitoring is essential to understand population stability, and to assist in the early identification of and amelioration or control of any processes that may be threatening a sub-population.

Performance criteria: A monitoring program has been developed within one year of the commencement of this Recovery Plan. Populations are monitored over the life of this Recovery Plan. Amelioration measures are applied if populations are found to be declining.

## 7 Implementation

Table 1 outlines the implementation of recovery actions specified in this Recovery Plan to relevant government agencies and/or parties for the period of five years from publication.

## 8 Social and Economic Consequences

The total cost of implementing the recovery actions over five years will be \$110 150. The inclusion of the Moonee Quassia populations in Madmans Creek Flora Reserve ensures that the species has formal protection at that location.

Implementation of this Recovery Plan will not affect current Forests NSW harvesting operations.

Private property owners may volunteer to participate in the recovery of the species. The cost of recovery actions on private property will be assessed, and funding sought to contribute to those costs, including via the Northern Rivers Catchment Management Authority. The DEC may provide in kind support where possible.

It is anticipated that there will be no significant adverse social or economic costs associated with the implementation of this Recovery Plan and that the overall benefits to society of implementation of the Recovery Plan will outweigh any specific costs.

## 9 Biodiversity Benefits

The Moonee Quassia is regionally and nationally important as it is endemic to the north coast of NSW and provides an evolutionary link to South America. It therefore gives insight into the plant assemblages that existed on the super-continent of Gondwana and contributes to the high biodiversity value of the flora of the north coast of NSW.

The Moonee Quassia occurs with populations of the threatened plants *Boronia umbellata*, *Parsonsia dorrigoensis* and *Amorphospermum whitei*, each of which is listed under the TSC Act. Populations of *Eucalyptus rummeryi*, *Austrobuxus swainii* and

*Marsdenia liisae* have also been recorded in the same area as the Moonee Quassia at Conglomerate State Forest. Management of the Moonee Quassia will also benefit these other species where they are co-located.

## 10 Preparation Details

Angela Ridgway prepared a preliminary draft Recovery Plan for the Moonee Quassia in 1996 under contract to the former NPWS. The subsequent introduction of guidelines under the TSC Act necessitated alterations. Monica Collins of DEC Threatened Species Unit undertook these alterations. This draft also reflects more recent knowledge of the species' distribution following detailed surveys by Forests NSW and the former NPWS between 1997 and 2000.

## 11 Review Date

This Recovery Plan will be reviewed within five years of the date of its publication.

## 12 References

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**NCRBG** North Coast Regional Botanic Gardens, Coffs Harbour

**NPWS** NSW National Parks and Wildlife Service

**NSW** New South Wales

**SIS** Species Impact Statement

**TSC Act** NSW *Threatened Species Conservation Act 1995*

### 13 Acronyms Used in this Document

**DEC** Department of Environment and Conservation

**EP&A Act** NSW *Environmental Planning and Assessment Act 1979*

**EPBC Act** Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*



Table 1. Estimated costs of implementing the actions identified in the Recovery Plan

Action no	Action Title	*Priority	Cost Estimate (\$ per year)						Responsible Party/Funding Sources	#In-kind	^Cash
			Year 1	Year 2	Year 3	Year 4	Year 5	Total Cost			
1.1	Coordination of Recovery Plan implementation	1	3 500	3 500	3 500	3 500	3 500	17 500	DEC core duties and cash contribution	13 000	4 500
1.2	Integration of Recovery Plan with other relevant management documents	1	-	-	-	-	-	-	DEC core duties	-	-
2.1	DEC will support research into life history and ecology.	2	14 000	9 400	6 600	3 300	3 300	36 600	DEC to coordinate sourcing of funds.	6 600	30 000
3.1	Identify potential habitat and undertake systematic surveys.	2	6 600	-	-	-	-	6 600	DEC/ consultant to undertake surveys	1 600	5 000
4.1	Education and awareness	1	3 550	3 550	3 550	-	-	10 650	DEC core duties and cash contribution	4 200	6 450
5.1	Monitor population structure.	1	6 600	5 800	5 800	5 800	5 800	29 800	DEC to source external funds	11 600	18 200
5.2	Monitor population health.	1	800	800	800	800	800	4 000	DEC to source external funds	1 600	2 400
5.3	Amelioration or control of threatening processes.	1	1 000	1 000	1 000	1 000	1 000	5 000	DEC to source external funds	1 600	3 400
<b>Total</b>			<b>36 050</b>	<b>24 050</b>	<b>21 250</b>	<b>14 400</b>	<b>14 400</b>	<b>110 150</b>		<b>40 200</b>	<b>69 950</b>

\* Priority ratings are: 1 - action critical to meeting plan objectives; 2 - action contributing to meeting plan objectives; 3 - desirable but not essential action

#'In-Kind' Funds represent salary component of permanent staff and current resources

^'Cash' Funds represent the salary component for temporary staff and other costs such as the purchasing of survey and laboratory equipment

**Appendix 1 Summary of Advice from the NSW Scientific Committee**

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<b>Comment</b>	<b>Amendments made to Recovery Plan</b>
1. Little known about the species.	1. Noted.
2. No indication of how costs in Table 1 derived. Other comments in relation to costs.	2. Noted. Costs were derived from an estimate of staff time to undertake a task and/or estimate of cost for work to be contracted externally. Implementation of many of the actions in the plan is dependent on securing funding for those actions.

## Appendix 2 Threatened Flora Site Assessment

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To be utilised to record new sites and sites inadequately recorded previously.

### SPECIES

Scientific Name .....

Common Name .....

Caps Code .....

DATE OF RECORDING .....

### RECORDER/S

Name/s .....

Organisation .....

Address .....

Phone .....

### LOCATION

Map Name .....

Map Number .....

Grid Reference (from map)

Global Positioning System used? Y/N

Easting (6 digits) ..... Northing (7 digits) .....

Accuracy .....

**Land Tenure** local/state/federal government/freehold/National Park/Nature Reserve/Crown Land/Flora Reserve/State Forests/SEPP 14 wetland/SEPP 26 rainforest/reserve/environment zoning/conservation agreement/other .....

.....  
**Name and address of landowner, if known** .....

**Local Government Area** .....

**Precise Locality** (description to be detailed to allow population to be located)

.....  
 .....  
 .....  
 .....  
 .....  
 .....  
 .....  
 .....  
 .....  
 .....

**Location Sketch Map** (detailed map to enable site to be relocated)

### SITE DESCRIPTION

**Topography** crest/ridge/upper slope/mid slope/lower slope/gully/flat/ depression/watercourse/escarpment/other  
 .....

#### **Habitat Condition**

- Remnant Size ..... hectares .....m long .....m wide
- Large (> 40ha) area of contiguous native vegetation
- Corridor ..... m long .....m wide
- Isolated Remnant – size of nearest remnant and distance to next native vegetation
- Isolated Specimen

#### **Vegetation Condition**

- Understorey suppressed/developed/overmature/senescing
- Evidence of Dieback
- intact largely indigenous/partially degraded/severely degraded

**Current Land Use** .....

**Past Land Use** .....

**Time Since Last Fire/Fire History** .....

**Time Since Logging/Grazing** .....

**Evidence of other disturbance eg erosion, slashing**

#### **Disturbance History**

- Time since disturbance
- Accuracy
- Observation Types
- Overall conditions

**HABITAT CHARACTERISTICS**

Aspect ..... Slope ..... Altitude .....

Geology granitic/basalt/conglomerate/sandstone/siltstone-mudstone/alluvium/  
limestone/metamorphic/gravel/sand/unknown/other .....

Soil Landscape/Type .....

Soil Surface Texture sand/loam/clay/organic/gravel/skeletal/unknown/other  
.....

Soil Drainage waterlogged - permanently inundated/annually/rarely/never  
damp/well drained dry/well drained damp/other .....

Soil Depth skeletal/shallow/deep

Soil Disturbance intact/topsoil removed/landfill/other .....

Surface Stone/Rock ..... %

Vegetation Structural Formation (as per Wildlife Atlas)  
Closed Forest/Open Forest/Woodland/Open Woodland/Grassland/Heathland/ Shrubland/Rainforest

Species Association (list full floristics within 10m of perimeter of population)

- Canopy – tallest and upper strata  
.....  
.....  
.....  
.....
- Understorey – mid-strata  
.....  
.....  
.....  
.....
- Groundcover – low strata (up to 1 m)  
.....  
.....  
.....
- Vines/Climbers  
.....  
.....  
.....

<> Mark weed species with \*  
<> Mark other threatened flora with #  
<> Mark four most dominant species in each layer with (D)

**POPULATION DETAILS**

**Growth form**

**Local Abundance** frequent/occasional/rare

**Area covered by sub-population** ..... metres long ..... metres wide

**Spatial Distribution** small scattered clumps/large continuous clump/isolated scattered individuals/ other ...  
.....

**Distance to nearest known sub-population**

**Breeding Status** ..... buds ..... flowers ..... fruit .....

**Plant Height (s) (cm)** min. .... max. .... average ..... (ave.)

**Estimated Age of Plants** min. .... max. .... average .....

**Vegetative Recruitment** .....

**Response after Disturbance** .....

**Is population natural (N) or planted (P)?** .....

**Population Structure**

Life Stage	no. plants	min. no.	max. no.
Dead			
Senescent, dying			
Mature, non senescent			
Immature			
First year seedlings			

**THREATENING PROCESSES**

- 1) When is threat expected to operate? a) current b) < 1 year c) 1-5 years d) >5 years e) ongoing f) potential
- 2) How close is threat to population? a) on it b) 1-10m c) 10-100m d) >100m e) potential
- 3) Degree of Impact a) low b) medium c) high d) potential e) immediate f) long term
- 4) Discuss reason for assessment as threatening process.

**Threats**

- Vegetation clearance .....
- Earthworks Life Stage .....
- Mining/Quarrying .....
- Urban/Industrial Development/Expansion .....
- Utilities Construction/Maintenance .....
- Road/Track/Trail/Fence/Utilities construction/maintenance .....
- Isolation/Fragmentation .....
- Erosion/Sedimentation/Drainage/Irrigation/Pollution .....
- Inappropriate fire regimes/flooding regimes .....
- Rubbish dumping/Garden Refuse dumping .....

- Weed Invasion - specify species and % cover .....
- Trampling/Grazing stock/introduced herbivores/native herbivores .....
- Plant Collection .....
- Recreational damage walkers/4WD/trailbikes/other .....
- Herbicide .....
- Disease/Pathogens .....
- Pests .....
- Timber Harvesting/Forestry Activities .....
- Agriculture .....
- Poor recruitment .....
- Small population size .....
- Hybridisation
- Loss of Pollination Vector
- Inbreeding
- Other .....

**ASSESSMENT METHOD** (Delete incorrect statements)

**Population Assessment**

- All plants in the population were individually counted; population data is very accurate
- Plants were individually counted in small plots, and the entire population is estimated from plot data
- Entire population was inspected and population size is estimated visually
- Small parts of the population were inspected and the entire population is estimated roughly
- cursory inspection, estimate is a ball park guess or largely based on results from earlier assessments
- How much time was spent assessing the population? ..... hrs .....mins

**Threat Assessment**

- All potential threats examined, assessed and recorded thoroughly and comprehensively
- All potential threats examined, assessed and recorded roughly
- Obvious threats examined and recorded thoroughly and comprehensively
- Obvious threats examined assessed and recorded roughly
- Other (provide details) .....
- How much time was spent assessing threatening processes? ..... hrs .....mins
- Threats assessed on site only/part site/whole site
- Threats assessment off-site

**HISTORIC MANAGEMENT ACTIVITIES** (relevant to threatened species) (> 2 years old)

For example: fencing, signposting, fire management, grazing management, mowing/slashing, tree/shrub removal, visitor management, erosion control, weed control, pollination, seed collection, propagation, monitoring, research, translocation, liaison, reservation, enforcement, survey, other

Activity Type	Extended Notes	Date

**RECENT MANAGEMENT ACTIVITIES** (relevant to threatened species) (within last 2 years)

Activity Type	Extended Notes	Date

**SUGGESTED MANAGEMENT ACTIVITIES** (for future)

Activity Type	Extended Notes	Date

**OTHER RECORDS**

- Collection Made Yes/No
- Collection Type seed/cutting/plant/herbarium specimen/other .....
- Purpose of Collection .....
- Specimen lodged with National Herbarium/other .....
- Photographs Taken Yes/No of what (plant, flowers, fruit, seed, roots, habitat, works)





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**Environment and  
Conservation (NSW)**