



Recovery Plan for *Endiandra floydii* (Crystal Creek Walnut)



**Draft for Public
Comment**

February 2004

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Recovery Plan for *Endiandra floydii* (Crystal Creek Walnut)

Foreword

The New South Wales Government established a new environment agency on 24 September 2003, the Department of Environment and Conservation, which incorporates the New South Wales 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 the *Endiandra floydii* (Crystal Creek Walnut), 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 Crystal Creek Walnut in nature and the parties who will undertake these actions.

The Crystal Creek Walnut is included as Endangered on the Commonwealth *Environment Protection and Biodiversity Conservation Act* 1999, as Endangered on the New South Wales *Threatened Species Conservation Act* 1995 and as Endangered on the Queensland *Nature Conservation (Wildlife) Regulation* 1994. The Crystal Creek Walnut is a small to medium-sized rainforest tree in the laurel family. About 28 populations are known in south-east Queensland and north-east New South Wales.

The recovery actions detailed in this Recovery Plan include: surveys to improve understanding of distribution, abundance and site characteristics; habitat management; protection of genetic diversity and local genetic adaptation; and investigation into population dynamics.

It is intended that this Recovery Plan will be implemented over a five year period. Actions will be undertaken by the Department of Environment and Conservation (NSW), with support from the Gold Coast City Council and the Queensland Parks and Wildlife Service.



TONY FLEMING

A/Director-General

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The draft Recovery Plan was prepared by Barbara Stewart and funded by the NSW Roads and Traffic Authority as part of a Department of Environment and Conservation (formerly NPWS) Concurrence Condition for the Pacific Highway Upgrade from Brunswick Heads to Yelgun.

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1 Introduction

Endiandra floydii Hyland (Crystal Creek Walnut) is a small to medium-sized rainforest tree in the laurel family. It occurs only in New South Wales (NSW) and Queensland, and is currently known from 28 populations, of which 22 are in NSW and six in Queensland. The northern-most occurrence is at Pimpama, just north of the Queensland Gold Coast, and the southern extremity of the species' range is at Byron Hills near Byron Bay, NSW. Many occurrences consist of a small number of adults and saplings, and occasional seedlings. Up to 80 trees are known in some localities. In these instances, single trees or small clusters may be scattered over areas of the order of a square kilometre. About 400 individuals, including all size classes, have been recorded, but many sites require further survey.

The Crystal Creek Walnut was first described and named in 1989 based on seven collections on the far north coast of NSW. An original collection from Pimpama in Queensland dates from 1986, but its determination as the Crystal Creek Walnut is more recent (Barry & Thomas 1994).

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

This plan has been prepared by a botanical expert for the Department of Environment and Conservation (NSW) (DEC) with assistance from Gold Coast City Council (GCCC) and the Queensland Parks and Wildlife Service (QPWS). Funding was provided to prepare this plan by the NSW Roads and Traffic Authority as part of the DEC (formerly NPWS) Concurrence Conditions for the Pacific Highway Upgrade from Brunswick Heads to Yelgun.

2 Legislative Context

2.1 Legal status

The Crystal Creek Walnut is listed as Endangered on the NSW *Threatened Species Conservation Act 1995* (TSC Act) and as Endangered on the Commonwealth

Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act). It is also listed as Endangered on the Queensland *Nature Conservation (Wildlife) Regulation 1994*. This Regulation comes under the Queensland *Nature Conservation Act 1992*.

2.2 Legislative framework for threatened species, populations and communities in NSW

Responsibilities under the NSW *Threatened Species Conservation Act 1995*

Recovery plan preparation, exhibition and implementation

The TSC Act and the NSW *Threatened Species Conservation Amendment Act 2002* (hereafter referred to jointly as the TSC Act) provide a legislative framework to protect and encourage the recovery of Endangered and Vulnerable Species, Endangered Populations and Endangered and Vulnerable Ecological Communities in NSW. Under this legislation the Director-General of the Department of Environment and Conservation (formerly National Parks and Wildlife) 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 draft Recovery Plan will be placed on public exhibition and submissions invited from the public. To make your submission as effective as possible, please:

- refer to the section or action of the plan you wish to address;
- briefly explain the reasons for your comments, providing source information or examples where possible; and
- provide your name and address to enable receipt of your submission to be acknowledged.

Submissions may be made as letters or other documents, or on the DEC form 'Submission: Draft Recovery Plan'. This is available in Appendix 1 of the plan, at website www.nationalparks.nsw.gov.au.

The DEC will consider all submissions to this Recovery Plan received during the exhibition period and must provide a summary of those submissions to the NSW Minister for the Environment prior to final approval of the plan.

Submissions on this draft plan may contain information that is defined as 'personal information' under the NSW *Privacy and Personal Information Act* 1998 that identifies the person providing the submission. Following adoption of the Recovery Plan by the Minister copies of all submissions, including personal details, will be available for public inspection. If any person wishing to prepare a submission does not want personal details to become public, the submission needs to be clearly marked that personal details are to remain confidential. All submissions are stored in the DEC records system.

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 Crystal Creek Walnut are the responsibility of the DEC in NSW, and the GCCC and QPWS in Queensland. Other public authorities may have statutory responsibilities relevant to the conservation and protection of the Crystal Creek Walnut. NSW public authorities with core legislative responsibilities relevant to the protection and management of the Crystal Creek Walnut and its habitat are listed in Appendix 2.

Consultation with indigenous people

Local Land Councils, elders and other groups representing indigenous people in the areas where the Crystal Creek Walnut occurs have been identified and a copy of the Crystal Creek Walnut Recovery Plan will be sent to them. Their comments on this draft have been sought and will be considered in the preparation of the final Recovery Plan. It is also 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 ecological communities listed as Endangered. Once declared, it becomes an offence to damage Critical Habitat (unless the action is specifically exempted by the TSC Act) and a Species Impact Statement is mandatory for all developments and activities proposed within Critical Habitat.

Key Threatening Processes

As of February 2004 there are 22 key threatening processes listed on the TSC Act. Of these 'clearing of native vegetation' (Scientific Committee 2001) is relevant to the Crystal Creek Walnut. In addition to this key threatening process, a range of other processes

are recognised as threatening the survival of the species in NSW.

Licensing

Any activity not requiring development consent under the NSW *Environmental Planning and Assessment Act* 1979 (EP&A Act) or the NSW *Native Vegetation Conservation Act* 1997 (NVC Act), which is likely to pick the Crystal Creek Walnut or damage its habitat, requires a Section 91 licence from the DEC under the provisions of the TSC Act and the NSW *National Parks and Wildlife Act* 1974 (NPW Act) as a defence against prosecution. If the impact is likely to be significant, a Species Impact Statement is required.

Other conservation measures

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

2.3 Relationship to other NSW legislation

Additional NSW legislation relevant to the conservation and recovery of the Crystal Creek Walnut includes the following:

- *National Parks and Wildlife Act* 1974;
- *Environmental Planning and Assessment Act* 1979;
- *Local Government Act* 1993;
- *Native Vegetation Conservation Act* 1997;
- *Forestry and National Park Estate Act* 1998;
- *Rural Fires Act* 1997; and
- *Rural Fires and Environmental Assessment Legislation Amendment Act* 2002.

The interaction of the above legislation with the TSC Act with respect to the Crystal Creek Walnut is varied. The most significant implications are described below.

National Parks and Wildlife Act 1974

The NPW Act is administered by the DEC. Under this Act it is an offence to 'harm', 'pick' or knowingly 'damage the habitat' of Crystal Creek Walnut. Certain circumstances may provide a defence from prosecution, including where actions are approved under the EP&A Act or NVC Act or licensed by the DEC under the NPW Act or TSC Act.

The NPW Act allows for the reservation of areas as national parks, nature reserves and other categories of protected area under the management of the DEC. The Crystal Creek Walnut is known from Mount Warning National Park and Inner Pocket Nature Reserve.

Owners of private properties with significant habitat values for the Crystal Creek Walnut may enter into Voluntary Conservation Agreements (VCAs) under the NPW Act whereby the DEC can provide assistance in the protection and management of these values on the property. Properties under VCAs may qualify for rate exemptions.

Environmental Planning and Assessment Act 1979

This Act provides for the consideration of the Crystal Creek Walnut in land use planning issues. Areas providing important habitat for the Crystal Creek Walnut can be protected under appropriate environmental zoning in Local Environmental Plans (LEPs) prepared under Part 3 of the EP&A Act. Certain State Environmental Planning Policies (SEPPs) (Part 3 EP&A Act) also afford a level of protection to some areas of the Crystal Creek Walnut habitat. This includes SEPP 71 – Coastal Protection.

Consent and determining authorities are required to consider potential impacts on the Crystal Creek Walnut and its habitat when considering an activity or development proposal under Part 4 or Part 5 of the EP&A Act. An action included in this Recovery Plan is the preparation and dissemination of environmental impact assessment guidelines for the Crystal Creek Walnut, to assist consent and determining authorities and environmental consultants in undertaking tests of significance under Section 5a of the EP&A Act.

Where a consent or determining authority considers that a proposed development or activity may result in a significant effect on the Crystal Creek Walnut or its habitat, a Species Impact Statement is required to be provided and approval cannot be granted without the concurrence of the DEC.

Local Government Act 1993

The NSW *Local Government Act 1993* (LG Act) requires councils to have regard for the principles of ecologically sustainable development (ESD). Section 8(1) of the LG Act requires a council to manage, develop, protect, restore, enhance and conserve the environment of the area for which it is responsible, in a manner that is consistent with and promotes the principles of sustainable development. This

includes the integration of biodiversity considerations into the decision-making process. The LG Act also requires that Recovery Plans be taken into account when preparing management plans for community land.

Native Vegetation Conservation Act 1997

The clearing of native vegetation in NSW is subject to consent from the Department of Infrastructure, Planning and Natural Resources (DIPNR) in accordance with the NVC Act. This Act is integrated with the EP&A Act, and requires that threatened species such as the Crystal Creek Walnut are taken into account by the DIPNR when considering clearing applications under Part 4 of the EP&A Act.

Where an activity or development that may impact upon the Crystal Creek Walnut or its habitat is not subject to approval under the EP&A Act, an approval may nevertheless be required under the NVC Act or the TSC Act. These approvals should also take this Recovery Plan into consideration.

Landholders may enter into Property Agreements with the DIPNR whereby government assistance can be provided to protect significant native vegetation.

Forestry and National Park Estate Act 1998

In NSW, an Integrated Forestry Operations Approval (IFOA) granted under Part 4 of the NSW *Forestry and National Park Estate Act 1998* (FNPE Act) regulates the carrying out of certain forestry operations, including logging, in the public forests of a region. The terms of the Threatened Species Licence (TSL) of the IFOA outline the minimum protection measures required to limit the impact of forestry activities on threatened species and their habitats, and forms the basis for the DEC regulation of those activities. The TSLs for the Upper and Lower North East Regions (1999) include measures for the protection of the Crystal Creek Walnut in north-eastern NSW. See also Section 6.4.

Rural Fires Act 1997

The NSW *Rural Fires Act 1997* (RF Act) requires that all parties involved in fire suppression and prevention must have regard to the principles of ESD when exercising their functions and when preparing Plans of Operations and Bush Fire Risk Management Plans. Consideration of the principles of ESD must include the conservation of biological diversity and ecological integrity. Within this,

consideration must be given to the impact on threatened species and their habitats, including the Crystal Creek Walnut.

Rural Fires and Environmental Assessment Legislation Amendment Act 2002

The *Rural Fires and Environmental Assessment Legislation Amendment Act 2002* amends the RF Act and several environmental assessment-related Acts. This Act provides for development of a Bush Fire Environmental Code that allows for an alternative assessment process for hazard reduction works in some circumstances. Threatened species are considered under the Code and, in certain circumstances, ameliorative measures have been developed for species adversely affected by hazard reduction activities.

2.4 Legislative framework for Endangered plants in Queensland

Nature Conservation Act 1992

The object of the Queensland *Nature Conservation Act 1992* (NC Act) is to conserve nature, through the protection of native wildlife and its habitat, the ecologically sustainable use of wildlife or an area, ecologically sustainable development and the application of internationally accepted criteria relating to the establishment and management of protected areas.

The NC Act provides for an improved planning and management framework for nature conservation within and outside the reserve system. The Act establishes 11 classes of protected areas including nature refuges, co-ordinated conservation areas and wilderness areas to enable private landholders and other Crown landholders to provide protection and management of their land for nature conservation and wilderness purposes. To date, few of the region's national parks and conservation parks have approved management plans.

Critical Habitat

Critical Habitat is defined in Sections 12 and 13 of the NC Act as habitat that is essential for the conservation of a viable population of protected wildlife or community of native wildlife, whether or not special management considerations and protection are required. To date, no Critical Habitat has been declared for the Crystal Creek Walnut in Queensland.

Conservation Agreements

Division 4 of the NC Act provides for the establishment of conservation agreements between the Minister and landholders. Lands subject to conservation agreements may be declared as Nature Refuges, Coordinated Conservation Areas or Wilderness Areas.

Nature Conservation (Protected Plants) Plan 2000

Management policies for Endangered as well as all other protected (ie. indigenous) plants in Queensland are set out in the Nature Conservation (Protected Plants) Plan 2000 (NCC Plan) which was proclaimed in the Queensland Government Gazette of 15 December 2000.

Section 12 of the NCC Plan (Restriction on taking and using endangered plants) stipulates circumstances under which Endangered plants may be taken in the wild.

Section 13 of the NCC Plan states that the Chief Executive of the QPWS must not grant a licence, permit or authority for taking endangered plants if the taking may reduce the ability of the species population to expand.

Section 26 (2) of the NCC Plan covers the granting of recreational harvesting licences for taking protected plants for conservation purposes. The applicant must be a voluntary conservation organisation and have the expertise to take the seed or other propagating material and propagate the plants for reintroduction to the wild. The species must be Endangered (or Vulnerable) and adequate seed or other propagating material must be available from the wild; the species must have been part of the original flora of the place to be re-vegetated; and the taking and reintroduction of the (Endangered) plant must be consistent with a Recovery Plan or Conservation Plan for the species.

Integrated Planning Act 1997

Consistent with the requirements of the Queensland *Integrated Planning Act 1997*, the Gold Coast Planning Scheme seeks to achieve ecological sustainability; coordinate and integrate matters of local, regional and state interest; and regulate new development in a manner consistent with ecological sustainability.

The City is divided into Domains (eg Rural, Detached Dwelling) and Local Area Plans (LAPs). In all Domains and some LAPs, proposals to remove or damage vegetation 40 cm or more in girth must comply with the Gold Coast Planning Scheme Vegetation

Management Code. In addition, proposals to remove or damage vegetation 4m or more in height in the Rural, Park Living and Emerging Communities Domains and some LAPs must comply with the Vegetation Management Code.

The Vegetation Management Code seeks to provide for the protection and management of vegetation which is located on freehold land within the City, to facilitate the sustainable development of the City, and to ensure the protection of the City's biodiversity and ecological values, landscape character and amenity. The code applies to vegetation clearing. The code requires that vegetation must be protected to ensure that habitats are provided for rare and threatened flora and fauna as defined by the *Nature Conservation Act 1992* and *Nature Conservation (Wildlife) Regulations 1994*; vegetation of historical, cultural or visual significance is retained; vegetation is retained for erosion prevention and slope stabilisation; the character of the local area is maintained; and the conservation of the City's biodiversity is assisted.

The purpose of the Gold Coast Planning Scheme Nature Conservation Code includes seeking to ensure the conservation of rare or threatened flora species.

Vegetation Management Act 1999

The objectives of the Queensland *Vegetation Management Act 1999* (VM Act) are to: preserve remnant Endangered regional ecosystems and areas declared to be of high nature conservation value; ensure that clearing does not cause land degradation; maintain biodiversity and ecological processes; and allow for the sustainable use of land. The objectives of the Act are intended to be achieved by: giving the State the power to regulate the clearing of vegetation on freehold land; requiring the development of a State vegetation management policy; providing for the development of regional vegetation management plans, to be approved by the Minister following public consultation, which will set out detailed assessment criteria for each region; establishing penalties for illegal clearing and the power for Courts to order restoration of damage caused by the illegal clearing; and establishing provisions for enforcement and compliance.

The VM Act requires that permission be must be gained prior to clearing of Remnant Vegetation (as mapped and defined by the Queensland Department of Natural Resources and Mines).

2.5 Commonwealth 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 and Territories in which populations of listed species occur. The Act also seeks to impose the obligation (arising from the listing) for responsible agencies (particularly Commonwealth) to adopt protective measures. 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 Commonwealth 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 which is likely to have a significant impact on a listed species is still subject to referral and approval under the EPBC Act.

As the Crystal Creek Walnut is listed Nationally 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 Commonwealth 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 required.

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

3 Species Information

3.1 Description and taxonomy

The Crystal Creek Walnut is a small to medium-sized tree to 15 m tall in the family Lauraceae. The crown is dark-green and shiny, while the

new leaves are a distinctive pinkish-brown. The trunk is straight, without buttresses, and often has coppice shoots at the base. The bark is grey, sometimes flaky or fissured. The lance-shaped leaves are about 10.5 cm long and 3.5 cm wide, tapering to a point at the apex, and narrowing at the base to a petiole of length 9 mm. Both leaf surfaces are hairless, or with scattered pale hairs when young. The upper surface is glossy dark-green and paler underneath. There are about seven pairs of primary veins and the midrib is flush with the upper leaf surface. The flowers are inconspicuous, pale-green or creamy, in clusters in the leaf axils. Fruits are black (reddish when immature), large and ellipse-shaped with maximum diameter 30 mm. The flesh is thin and surrounds a single seed of diameter up to 25 mm.

Further taxonomic description is provided by Hyland (1989) and Harden (2000).

3.2 Distribution

The Crystal Creek Walnut is known from Pimpama, just north of the Queensland Gold Coast, south to Byron Hills, 6 km south of Cape Byron, NSW. Several large populations are known. Two are in the ranges to the north of Murwillumbah, where numerous other smaller occurrences are also found. At least 50 individuals are known from the Urliup Road area (Barry & Thomas 1994) and 40–50 trees have been reported from Crystal Creek (R. Cremer pers. comm.). A further concentration of plants is in Mooball National Park where nearly 80 individuals have been recorded (NPWS survey data, 1997). In Queensland, the largest numbers are in the Wongawallen area, in total about 50 individuals with others likely in unsurveyed adjacent habitat (J. Searle, GCCC, pers. comm.). All known occurrences are within 30 km of the coast. It is not possible to estimate the total number of individuals of the Crystal Creek Walnut as counts or estimates have not been made for a large number of sites, but at least 400 individuals, including seedlings, saplings and mature trees, are known.

3.3 Land tenure

The Crystal Creek Walnut is known from the following land tenures:

- Couchy Creek Nature Reserve, Mooball National Park, Marshalls Creek Nature Reserve and Brunswick Heads Nature Reserve, managed by the DEC;

- reserves at Wongawallen made up of freehold land managed by GCCC;
- roadside reserves managed by Tweed Shire Council;
- within areas impacted by both the Pacific Highway Upgrade between Brunswick Heads to Yelgun and Yelgun to Chinderah Freeway which are located within the Byron and Tweed local government areas; and
- freehold land, owned and managed by various private landholders.

3.4 Habitat

The Crystal Creek Walnut occurs in subtropical (including littoral) rainforest or wet sclerophyll forest, often with *Lophostemon confertus* (Brush Box) in the canopy and occasionally with *Araucaria cunninghamii* (Hoop Pine) emergents. Disturbed and regrowth sites may include *Cinnamomum camphora* (Camphor Laurel) and *Lantana camara* (Lantana) as weed components. Most locations are on soils derived from paleozoic metamorphics, sometimes with basalt nearby. A small number of sites are on alluvium or sand. Sheltered locations are apparently preferred, and landforms including ridgelines, slopes, gullies and creek flats have been documented. The altitude varies between close to sea level up to 430 m above sea level (Floyd 1989).

Habitat characteristics have not been documented for many sites, hence the full range of variation may not have been recorded.

3.5 Life history and ecology

Life cycle

Floyd (1989) records the flowering time of the Crystal Creek Walnut as between April and May, but flowering has also been observed in January and February (in cultivation, H. Bower pers. comm.), August (D. Milledge pers. comm.) and November (Trevor Miles pers. comm. quoted in Barry & Thomas 1994). No information about pollinating agents is available.

Fruiting occurs from December to February (Floyd 1989), and in May (Trevor Miles pers. comm. quoted in Barry & Thomas 1994). Fruit is not produced every year, and heavy crops are produced at irregular intervals (L. Fitzgerald pers. comm.). Following the severe drought conditions of the 2002 dry season, heavy fruit crops were reported throughout the range of the Crystal Creek Walnut. Seeds germinate readily and rapidly in nursery conditions (L.

Fitzgerald pers. comm.), after 25–30 days (Barry & Thomas 1994).

No information about seedling development is available, and limited observations of growth rates are available only from cultivated trees. The large energy reserves present in the seeds are likely to assist early seedling establishment, and they are likely to have the capacity to persist in the forest understorey until conditions favour further growth. Development may be dependent on the formation of canopy gaps or the maintenance of a lightened canopy and midstorey on rainforest ecotones, including wet sclerophyll forest. Further investigation is required.

The large seeds are assumed to be poorly dispersed, but may occasionally be dragged by rats and left unconsumed. Rodents are seed predators, but movement of undamaged seeds from the parent tree has been observed in other rainforest trees (Floyd 1990), and may also occur for seeds of the Crystal Creek Walnut. Seeds will move by gravity on the steep slopes where some of the known populations are found. Floodwaters may move seeds in riparian sites (Barry & Thomas 1994).

Population structure

Little information about the structure of known populations is available. Many of the documented populations consist only of a small number of adults or immature trees. Despite the heavy production of fruit, seedlings are infrequently observed in the vicinity of parent trees. However, early observations of seed germination in the field following the heavy fruiting of the 2003 fruiting season have been reported from Crystal Creek (R. Cremer pers. comm.). High levels of seed predation or disease, seedling herbivory or disease or dense canopy closure could all contribute to seed and seedling mortality.

Disturbance and competition

The Crystal Creek Walnut occurs in previously logged areas of Mooball National Park. One consequence of logging disturbance is forest invasion by Lantana, which may smother seedlings and small trees. A formerly cleared regrowth site near Mullumbimby is dominated by Camphor Laurel, a species that strongly competes for resources with natives.

Like many rainforest species that favour rainforest edges and wet sclerophyll ecotones, the Crystal Creek Walnut may have some limited tolerance to fire. The only direct observation of fire response has been made at Wongawallan, where a management fire accidentally burnt individuals of the Crystal

Creek Walnut. The main trunks were killed by the fire, but suckers were produced from the base (J. Searle, GCCC, pers. comm.). Suckers have been observed around the trunks of trees at many locations – whether these have been produced as a response to fire or other damage is currently not known.

A further instance of fire in the habitat of the Crystal Creek Walnut has had unknown consequences. In approximately 1995, a wildfire burned through known and potential habitat between Tomewin Road and Urliup Road (F. Court pers. comm.). No follow up surveys have been carried out.

It is likely that intense fire, or frequent fire, will kill mature trees and that small plants will be vulnerable to any fire event. A precautionary approach involving protection of the Crystal Creek Walnut from fire is indicated until more information is available.

Several occurrences are on roadsides where the habitat of the Crystal Creek Walnut is subject to ongoing disturbance from roadside maintenance activities (slashing, roadworks, herbicide spraying). Weed competition poses an additional threat on disturbed roadsides.

3.6 Ability of species to recover

Habitat clearing and fragmentation are believed to be the primary causes of past decline of the Crystal Creek Walnut. Reforestation initiatives currently underway through government, community and private endeavours will create and reconnect suitable habitat for the Crystal Creek Walnut. However, regeneration appears to be sparse in the vicinity of known adult trees, and seeds are believed to be poorly dispersed. The ability of trees to produce suckers from the base should help to ensure the persistence of existing adults, but unmanaged expansion of known sites will probably be slow, and colonisation of new ones is unlikely.

4 Threats and Management Issues

4.1 Low numbers

The low numbers of individuals, and particularly of mature trees, leaves the Crystal Creek Walnut vulnerable to the effects of chance catastrophic events. The loss of isolated trees and small clumps distant from other populations may result in local extinctions and range contractions.

4.2 Habitat clearing and fragmentation

Clearing and fragmentation of known and potential habitat for agriculture, development and infrastructure remains an ongoing threat to Crystal Creek Walnut.

Though disturbed, some relatively large areas of continuous forest habitat remain in the eastern McPherson Range and Burringbar Range. In the foothills and lowlands, clearing has resulted in the loss of individuals of Crystal

Creek Walnut, and its habitat. Habitat patches are often left isolated in a matrix of agricultural or developed land. There are a number of probable consequences, including edge effects and long term genetic problems. Many ecosystem processes require large areas for natural functioning, for instance, regeneration may depend on dynamic natural disturbance mosaics. Suitable conditions for seedling and sapling development may be formed by chance events such as tree or branch falls. In a small area this may not occur, or other

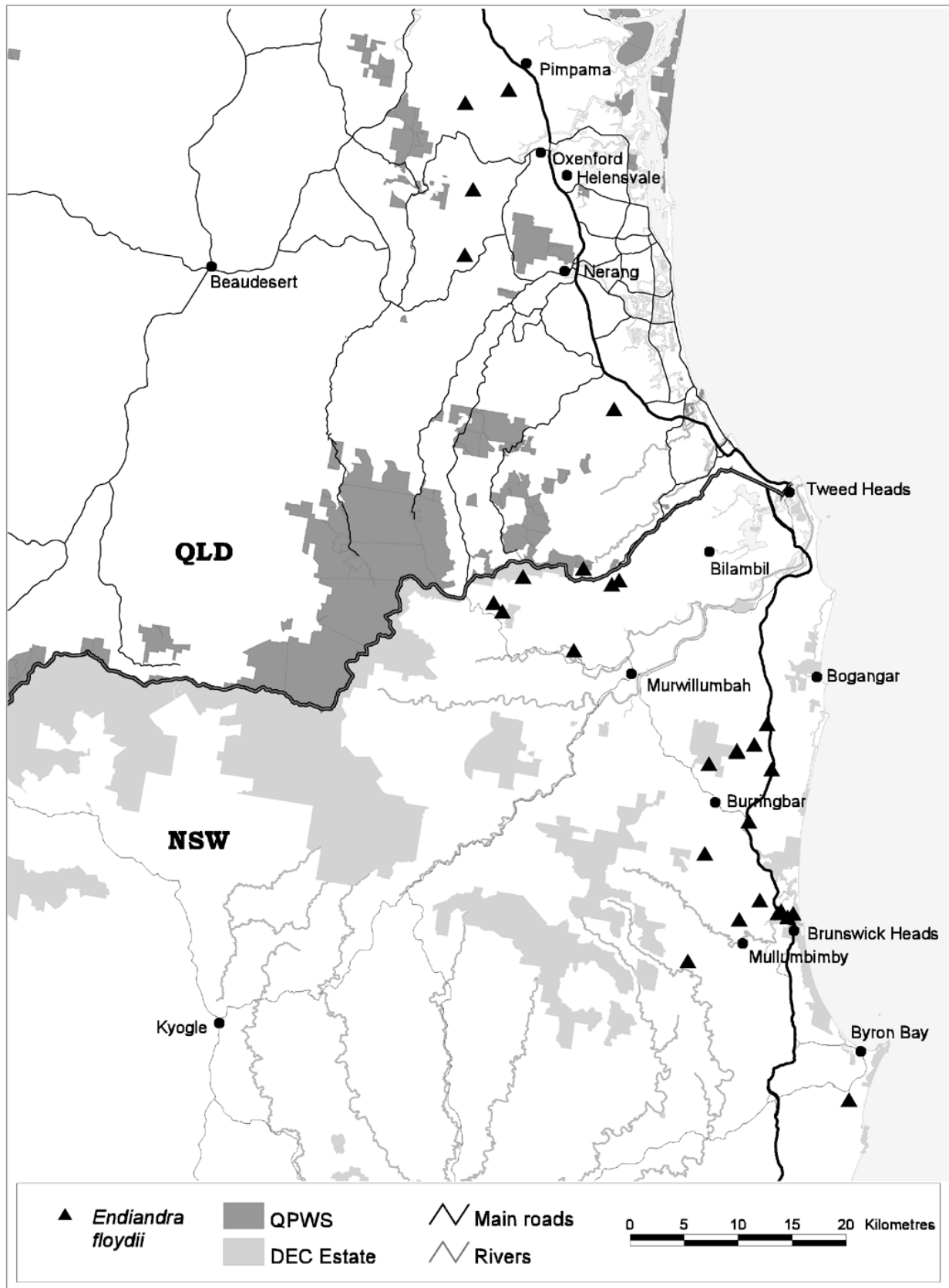


Figure 1. Locations of populations of the Crystal Creek Walnut

threats may accompany their formation. Fauna, including pollinators or seed dispersers, may not be able to persist in small fragments, nor to move between patches across a hostile matrix. The Pacific Highway Upgrading Program has resulted in works being undertaken between Brunswick Heads and Chinderah. Works between Brunswick Heads and Yelgun are in the advance planning stage, while works between Yelgun and Chinderah have been finalised. Activities undertaken or proposed to be undertaken include translocation of individuals, removal of habitat and bisection of habitat, specifically at Christies Creek, Sleepy Hollow and some locations north of Brunswick Heads.

4.3 Development

Another known population is on the edge of the Marshalls Creek Nature Reserve adjacent to a proposed coastal subdivision, and is threatened by edge effects and accidental and deliberate damage through human traffic (A. Murray pers. comm.).

4.4 Weeds

Weed competition threatens the Crystal Creek Walnut at a number of locations. *Asparagus densiflorus* (Ground Asparagus) is strongly competing with ground layer vegetation in the Marshalls Creek and Brunswick Heads Nature Reserves.

Lantana is present at a number of sites including Mooball National Park.

Camphor Laurel, Privet and others weeds are present at Pimpama and Camphor Laurel is a major competitor near Mullumbimby.

Weed control activities may result in accidental and unknowing damage to the Crystal Creek Walnut. Like many native laurels, it may be mistaken for Camphor Laurel. Unskilled clearing of weeds can also damage the habitat of the Crystal Creek Walnut.

4.5 Grazing

Grazing threatens the Crystal Creek Walnut at Pimpama.

4.6 Roadside damage

Several specimens at Tomewin have been destroyed by fire and herbicide drift from roadside spraying programs (Kingston *et al.* 1999).

4.7 Poor regeneration

Poor seed dispersal and regeneration are inherent characteristics of the species, limiting its ability to expand and recolonise.

4.8 Genetic problems

Reduced and fragmented populations are likely to suffer loss of genetic variation as a result of the loss of individuals containing unique genetic variants, and through inbreeding and genetic drift (Ellstrand & Elam 1993). In the long term, loss of genetic variation may threaten the evolutionary potential of the Crystal Creek Walnut and reduce its ability to respond to alterations in its environment, including climate change. Further studies are required to measure the extent and spatial distribution of genetic variation, to relate such variation to fitness and reproductive success, and to understand determinants of the flow of genes within the population (pollination and seed dispersal systems).

As many populations of the Crystal Creek Walnut are widely separated, it is likely that distinctive genetic combinations and variants have developed locally. Introducing genetic material from outside the population may result in displacement of local genotypes. Until appropriate studies have been carried out, planting of the Crystal Creek Walnut should not be conducted within a buffer zone surrounding wild populations.

In the long term, particularly if inbreeding depression is detected, the introduction of new genetic material to populations may be considered.

4.9 Collection of propagation material

The extent of current fruit collection from wild populations for the nursery industry is unknown, but if it is taking place, the regeneration potential of the Crystal Creek Walnut may be adversely affected.

4.10 Lack of information about threats

Many locations of the Crystal Creek Walnut have not been assessed for threats to the species. Further surveys are required.

5 Previous Recovery Actions

5.1 Co-ordination

The Rainforest Ecotone Recovery Team was established in 1999 to co-ordinate the recovery of threatened flora species found in the rainforest ecotones of south-east Queensland. To date, management has been focused on the removal of threats and rehabilitation measures for species other than the Crystal Creek Walnut, but indirect benefits may have accrued to the Crystal Creek Walnut and its habitat.

5.2 Surveys

Taxon-specific surveys for the Crystal Creek Walnut have been conducted rarely, though surveys for conservation and impact assessment purposes are commonly conducted throughout the range of the taxon, and target all threatened species of potential occurrence. Examples include surveys conducted during the Comprehensive Regional Assessment and detailed surveys associated with impact assessments for the Pacific Highway upgrades between Brunswick Heads and Chinderah. Associated with the Yelgun to Chinderah Freeway, targeted surveys were carried out in the vicinity of the route to ensure an adequate representation of the affected taxa in compensatory habitat (Stewart 1999, 2000).

5.3 Management plans

The Plan of Management for the Byron Coast Reserves (NPWS 1998) includes Brunswick Heads Nature Reserve. The plan includes:

- As a specific objective, the protection of the reserves' significant natural values including the conservation of littoral rainforest, of plant and animal communities of coastal and estuarine landsystems, and the protection of Critical Habitat required by Endangered plants and animals.
- As an action, the implementation of a strategy for the control of weeds with priority on the protection of littoral rainforest, and the protection of the habitat of rare and Endangered species.
- As a policy, the suppression of fire with the objective of reducing the level of unscheduled fire, aiming to protect specific communities including rainforest, from fire.

No Plans of Management are currently in place for Marshalls Creek or Couchy Creek Nature Reserves. A plan is in preparation for Mooball National Park.

Management plans are in preparation for Council managed reserves at Wongawallan (J, Searle, GCCC, pers. comm.).

Plans for the management of pest species are in place in many national parks and nature reserves in north east NSW under the umbrella of the DEC Parks Service Division Northern Rivers Region Pest Management Plan. Pest Management Plans have been developed for Brunswick Heads Nature Reserve and Mooball National Park.

5.4 Habitat protection and management

Should the Crystal Creek Walnut be found in State Forest, or within 50 m of the boundary, condition 6.22 of the Upper North East IFOA will apply:

1. An exclusion zone of at least a 50 m radius must be implemented around all individuals.
2. An exclusion zone at least 50 m wide must be implemented around all groups of individuals. A group is defined as more than one individual located less than 20 m apart.

Specific on ground management of the habitat of the Crystal Creek Walnut has not been conducted, apart from the translocation for salvage of plants affected by the Pacific Highway upgrade from Yelgun to Chinderah. Translocation of individuals is proposed as part of the Brunswick Heads to Yelgun upgrade.

However, general weed management has been undertaken at Brunswick Heads Nature Reserve. Similar actions by private landowners may have assisted the rehabilitation of habitat of the Crystal Creek Walnut, though no such actions have been documented to date.

5.5 Community awareness

The Rainforest Ecotone Recovery Team in south-east Queensland has prepared a poster illustrating the Crystal Creek Walnut together with other species which may share its habitat.

5.6 Other recovery actions

Ex situ plantings of the Crystal Creek Walnut have been established in public botanic gardens at Canberra, Coffs Harbour, Mullumbimby and Sydney and additional private collections (Barry & Thomas 1994).

6 Proposed Recovery Objectives, Actions and Performance Criteria

The overall objective of this Recovery Plan is to prevent the decline of populations of the Crystal Creek Walnut in the wild, to ensure ongoing viability of wild populations, and maintain the evolutionary potential of the species.

Specific objectives of this Recovery Plan are listed below. Recovery actions, each with a performance criteria, have been developed for the nine objectives.

Objective 1: To coordinate the recovery of Crystal Creek Walnut.

Action 1.1:

The DEC, in consultation with QPWS and GCCC, will coordinate the implementation of the actions outlined in this Recovery Plan.

The implementation of a recovery program for a threatened species is a complex task, requiring a coordinated approach. As most populations occur in NSW, it is appropriate that recovery is coordinated by the DEC in consultation with Queensland authorities.

Performance criteria: Administrative arrangements are in place within the first year of this plan, and are ongoing for the life of this plan.

Action 1.2:

The DEC will develop a record-keeping system to facilitate co-ordination.

Details of all known populations must be available and accessible for coordination and management, and to identify knowledge gaps. A site index, and all available census data, habitat description, threat assessments, recovery actions and opportunistic observations should be compiled.

Performance criteria: A record keeping system will be developed during the first year of the plan, and maintained and updated during the life of the plan.

Objective 2: To improve the knowledge base for known populations

Action 2.1:

The DEC will review existing knowledge of known populations, identify information gaps, prioritise and arrange site surveys where necessary.

Census data, habitat description and threat assessment are essential background for the management of the recovery of the Crystal Creek Walnut. Currently this information is

not available, or is incomplete, for a large proportion of known sites. Unsurveyed suitable habitat adjacent or close to known locations should be included in surveys.

Performance criteria: Planning for site surveys is undertaken and surveys commenced in Year 1 of the plan, follow up surveys are conducted during the life of the plan.

Action 2.2:

The DEC will ensure that all the Crystal Creek Walnut records generated by research, surveys or management commissioned by the DEC are entered on the Atlas of NSW Wildlife.

It is important that the Atlas of NSW Wildlife database contains accurate records of the Crystal Creek Walnut as it is a primary resource for researchers, developers, environmental consultants and land managers.

Performance criteria: Consultants and staff undertaking research, surveys or management commissioned by the DEC within the life of the plan will provide details of new Crystal Creek Walnut records in a form suitable for entry on the database to the Wildlife Data Team on completion of the research.

Objective 3: To improve the consideration of the Crystal Creek Walnut in environmental impact assessment for developments and activities.

Action 3.1:

The DEC will develop and distribute standard survey and environmental assessment guidelines for the Crystal Creek Walnut to all relevant DEC and QPWS staff, consultants and consent authorities.

A standard minimum survey effort should be undertaken when determining if the Crystal Creek Walnut is present in or near the area of a potential development or activity. Presence of the species should require implementation of effective mitigation measures to reduce the impact of proposed development or activity.

The guidelines will address:

- maintenance and protection of roadside populations, and their habitats;
- protection of plants and their habitats where located close to developments; and
- measures to protect plants and their habits from indirect effects of proximity to human activity (rubbish and garden refuse dumping, damage from trail bike riding, trampling, clearing of understorey vegetation).

Developments or activities frequently include an environmental repair component. Guidelines will address aspects of habitat restoration and rehabilitation including:

- possible detrimental effects of misidentification of the species during bush regeneration works;
- adverse effects on microclimate conditions in regeneration sites during weed removal;
- planting of inappropriate species during habitat reconstruction; and
- use of planting material of inappropriate genetic origin.

Performance criteria: Standard survey and environmental assessment guidelines are developed and distributed within the life of the plan.

Specific objective 4: To manage and protect the Crystal Creek Walnut and associated habitat from threatening processes.

Action 4.1

The DEC will notify all relevant landholders/managers that the Crystal Creek Walnut is present on their land, and ensure they have access to information relevant to the conservation of the species. The DEC will liaise with relevant landholders/managers to ensure that they are aware of the long-term voluntary protection measures and incentive programs available.

Accidental damage to the Crystal Creek Walnut and its habitat is possible where landowners/managers do not know the species is present, and do not have access to management advice. Any protective measures indicated would be developed in conjunction with, and would require the consent of, the relevant landowner/manager.

Performance criteria: All landowners/managers of known locations of the Crystal Creek Walnut are notified of the presence of the species within the first year of the plan. Where appropriate, options for long-term voluntary protection measures and incentive programs are explained, management guidelines provided and sources of assistance are explained.

Action 4.2

To assess the need for detailed site-specific management planning and supply guidelines and assistance as required.

Planning for habitat management is highly desirable to ensure that objectives are

understood, management is effective and efficient, and that progress towards objectives is monitored. Objectives should include the removal or amelioration of specific local threats, and may include habitat expansion and rehabilitation, fire management, erosion control, and protection from livestock. Works should not have adverse impacts on the target species, its habitat or other threatened species or ecological communities present or the environment generally.

Management planning may be expensive and divert resources away from on-ground works. The extent of need for formal and detailed planning varies, and in some circumstances, adherence to habitat management guidelines may suffice.

Guidelines to determine the level of management planning required, and recommendations for habitat management and project evaluation will be supplied by the DEC.

Performance criteria: The site-specific management planning needs of all locations of the Crystal Creek Walnut on DEC estate are assessed and site-specific management plans are prepared or management guidelines are tailored to requirements, during Year 1 of the plan. Implementation of the plans will be ongoing until objectives are met. Where possible, similar assessments and planning will be undertaken at locations of the Crystal Creek Walnut on other land tenures.

Action 4.3

To control exotic weeds in the habitat of the Crystal Creek Walnut

Exotic weeds are serious threats to the Crystal Creek Walnut and its habitat at several locations. Ground Asparagus at Brunswick Heads Nature Reserve, Lantana at Mooball National Park, and Camphor Laurel and Privet at other locations require management.

Planning and assessment measures put in place to control exotic weeds will be included in the environmental assessment guidelines (Action 3.1) and habitat management guidelines (Action 4.2).

Performance criteria: Exotic weeds are managed (primary treatment in Year 1 of the plan, follow-up in Years 2 and 3) in Brunswick Heads Nature Reserve and Mooball National Park.

Action 4.4

To ensure the Crystal Creek Walnut and its habitat are adequately buffered from the effects of adjacent development.

Specimens of the Crystal Creek Walnut at Marshalls Creek Nature Reserve are adjacent to proposed development. Physical damage, enhanced edge effects and human visitation and trampling are possible impacts.

Planning and assessment measures put in place to ensure buffering from effects of adjacent development will be included in the environmental assessment guidelines (Action 3.1) and habitat management guidelines (Action 4.2).

Performance criteria: Physical barriers are erected at or near the Nature Reserve boundary in Year 1 of the plan, and management to divert human traffic away from sensitive habitat is in place.

Action 4.5

To protect roadside populations of Crystal Creek Walnut.

Roadside populations require protection from roadworks, slashing and herbicide. For roadside populations to be protected, several issues will require addressing. These include:

- identification of roadside populations so routine maintenance works avoid damage to the species;
- assessment of need for physical protection (barriers);
- provision of advice to ensure pruning, earthworks and other management is conducted with minimal damage; and
- development of contingency strategies for situations where individuals have been harmed or future harm is unavoidable.

Planning and assessment measures necessary to protect roadside populations will be included in the environmental assessment guidelines (Action 3.1) and habitat management guidelines (Action 4.2).

Performance criteria: Authorities are notified of known locations of the Crystal Creek Walnut on roadsides, and planning and management strategies and physical protection are in place within Year 1 of the plan.

Action 4.6:

To prevent genetic pollution of the Crystal Creek Walnut, landowners/managers will be advised not to plant the Crystal Creek Walnut

into wild populations, or within a buffer zone around the populations.

Buffers zones should be maintained to prevent possible adverse effects of the movement of genetic material between cultivated Crystal Creek Walnuts and naturally occurring populations. The DEC will estimate the dimensions of a suitable buffer zone from theoretical considerations and comparison with other species of similar ecologies, taking a precautionary approach. When results from research into genetics and reproductive biology are available (Action 6.2), recommendations will be refined.

Habitat management guidelines (Action 4.2) will include measures to prevent adverse effects on the genetic makeup of wild populations of threatened flora species.

Performance criteria: The extent of a buffer zone to prevent adverse effects of genetic exchange between cultivated and wild plants will be estimated from theoretical considerations, taking a precautionary approach, in Year 1 of the plan and refined as further information becomes available.

Landowners/managers will be advised of recommendations.

Objective 5: Fire planning and management**Action 5.1:**

The DEC will provide information on the ecological requirements of the Crystal Creek Walnut to the appropriate Bushfire Management Committees and DEC bushfire management planners.

The Rural Fires Act requires that the ecological requirements of threatened species are considered by Bushfire Management Committees in preparing Bushfire Management Plans for local government areas. The DEC prepares Fire Management Plans that complement the local Bushfire Management Plans, for areas under its control.

Performance criteria: The DEC has provided information on the ecological requirements of the Crystal Creek Walnut to the appropriate Bushfire Management Committees and DEC bushfire management planners within the life of the plan.

Objective 6: To investigate population dynamics and encourage research.**Action 6.1:**

The DEC will initiate a program of repeated census data collection, and observations of

flowering and fruiting patterns, from representative sites.

Factors limiting regeneration and development are poorly understood. Regeneration and development within wild populations is likely to take place over long time frames and may be episodic. Data collected can be expected to provide some preliminary guidance for future investigation. In selecting representative sites, consideration should be given to inclusion of sites in all National Parks/Nature Reserve where the Crystal Creek Walnut is known to occur. Where practical, areas affected by fire in the recent past should also be represented.

Performance criteria: Review of available site data will be undertaken to determine appropriate sites for data collection, and a program of data collection will be designed during Year 1 of the plan. Baseline data to be collected in Year 2, and repeat data collection to be undertaken in Year 4.

Action 6.2:

The DEC will encourage research into genetics and the reproductive biology of the Crystal Creek Walnut.

Information on genetics and the reproductive biology of the Crystal Creek Walnut will assist the DEC to refine management actions for Crystal Creek Walnut. Knowledge of fertility, pollination and dispersal vectors, germination rates and environmental constraints to germination and seedling recruitment and persistence will improve the basis of management in the future.

Research into genetics may demonstrate the presence of inbreeding depression, the range of genetic variation and the extent of differentiation across the population. The results will provide a guide to enable future genetic management, conserving genetic variation and local adaptations, preventing inbreeding depression and permitting future evolutionary development. In conjunction with knowledge of movements of pollinators and seed dispersers, genetic study will refine the estimation of a buffer zone around wild populations required to prevent genetic pollution (Action 4.6).

Performance criteria: The DEC will liaise with researchers and research organisations to discuss and encourage research into genetics and reproductive biology within the life of the plan. The extent of (and requirement for), a buffer zone around wild populations to prevent genetic pollution, will be refined as further information becomes available.

Objective 7: Assess need for contingency strategies to protect genetic content and sources of propagation material against unforeseen destruction of wild populations.

Action 7.1:

The DEC will collate information on the origin and reproductive status of the Crystal Creek Walnut in public collections.

The Crystal Creek Walnut is cultivated in a number of public collections. However the DEC has only basic information on the success and origin of these plantings. In the event of a catastrophic event affecting one or a number of wild Crystal Creek Walnut populations the genetic material contained in these plants may provide sources of propagules for re-introduction or population enhancement programs.

Performance criteria: Information is collated by the DEC on *ex situ* plantings in public botanic gardens or other conservation-oriented live collections within the life of the plan.

Action 7.2

The DEC will assess the need for collection of representative genetic material from populations of the Crystal Creek Walnut, and will collect and store material as indicated.

Should research actions under Objective 6 indicate significant local genetic differentiation, or within population genetic variation, there may be a need to store samples of genetic material as a record of the genetic make-up of the species. Genetic material will be available for future analysis to guide management should populations be destroyed through development or catastrophic stochastic events.

Performance criteria: The need for collection and storage of genetic material will be assessed as research results become available. If indicated to be of value, genetic material from as many populations as is practical will be collected and held at an appropriate research institution within the life of the plan.

Objective 8: To integrate the recovery of the Crystal Creek Walnut with the recovery of other biota.

Action 8.1:

Where practical, the DEC will integrate recovery actions for the Crystal Creek Walnut with those of other threatened species, populations or ecological communities occurring in similar habitats.

A number of other threatened species, populations or ecological communities are known or likely to occur in similar habitats to the Crystal Creek Walnut. The Crystal Creek Walnut occurs in the Endangered Ecological Community Lowland Rainforest on Floodplain, and also in association with threatened flora species such as *Endiandra muelleri* subsp. *bracteata* (Green-leaved Rose Walnut), *Corchorus cunninghamii* (Native Jute) and *Randia moorei* (Spiny Gardenia). By integrating the recovery actions of other threatened biota with those of Crystal Creek Walnut, limited resources can be used more effectively.

Performance criteria: Where practical, recovery actions have been integrated with those of other threatened species, populations or ecological communities.

Objective 9: To involve the community in the recovery of Crystal Creek Walnut

Action 9.1

The DEC will provide copies of the species profile for the Crystal Creek Walnut to landowners, landcare groups and other interested community members within the known range of the Crystal Creek Walnut.

Education of the community about the Crystal Creek Walnut will increase the probability of finding and protecting new populations. Learning conservation principles will have other benefits for biodiversity. Suggestions for involvement and management can be conveyed.

Performance criteria: Copies of the species profile for the Crystal Creek Walnut to be distributed to landowners, landcare groups and community members known to have specific interest in the Crystal Creek Walnut during Year 1 of the plan, and to be available on request throughout the life of the plan.

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 will be \$222 050 over the five year period covered by this plan. The inclusion of the Crystal Creek Walnut populations in Couchy Creek Nature Reserve, Marshalls Creek Nature Reserve, Brunswick Heads Nature Reserve and Mooball National Park, and the purchase for conservation management of the Crystal Creek Walnut habitat at Wongawallan by GCCC provide significant formal protection for the species. Management of NSW Nature Reserves will be in accordance with the requirements of the NPW Act and any costs incurred will be met by the DEC. The purchase of the Wongawallan properties has been funded by GCCC's environmental levy, and management is funded from the same source.

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

9 Biodiversity Benefits

The preparation and long term implementation of Recovery Plans for threatened species, populations and ecological communities, contributes to, and highlights the importance of, conserving biodiversity. The conservation of biodiversity has a number of wider community benefits. These include:

- provision and maintenance of a range of ecosystem processes;
- contributing to increased ecological knowledge of species, habitats and broader ecosystems; and
- cultural and aesthetic biodiversity values.

The appropriate ecological management of the Crystal Creek Walnut's habitat will contribute to the conservation of a large number of other rare and threatened species which have been recorded within, and adjacent to, known populations. For instance, 14 additional species of threatened flora, and the Endangered Ecological Community Lowland Rainforest on Floodplain, co-occur with the Crystal Creek Walnut at Brunswick Head Nature Reserve.

On land of other tenures in the foothills and lowlands, species co-occurring with the Crystal Creek Walnut include many which have been severely depleted as a result of the extensive clearing of habitat. In the matrix between reserves on the coast and coastal ranges, the Crystal Creek Walnut co-occurs with poorly reserved threatened species including the Green-leaved Rose Walnut, Davidson's Plum and the Spiny Gardenia.

At Wongawallen, the Crystal Creek Walnut occurs in an area set aside for the revegetation of habitat for *Calyptrorhynchus lathamii* (Glossy Black Cockatoo). The threatened flora species Native Jute co-occurs with the Crystal Creek Walnut at three sites in the Wongawallen area.

Conservation actions that retain habitat quality, or permit habitat recovery for the Crystal Creek Walnut will benefit a wide range of fauna species, including some classified as threatened, particularly those preferring rainforest and wet sclerophyll forest. Threatened fauna species recorded within the range of the Crystal Creek Walnut include the rainforest pigeons *Ptilinopus magnificus* (Wompoo Fruit-Dove), *Ptilinopus regina* (Rose-crowned Fruit-Dove) and *Ptilinopus superbus* (Superb Fruit-Dove). In addition, frogs including *Assa darlingtoni* (Pouched Frog), reptiles including *Coeranoscincus reticulatus* (Three-toed Snake-tooth Skink) and *Hoplocephalus stephensii* (Stephen's Banded Snake), and mammals including *Planigale maculata* (Common Planigale) and *Potorous tridactylus* (Long-nosed Potoroo) may share the habitat of the Crystal Creek Walnut.

10 Preparation Details

This Recovery Plan has been prepared by Barbara Stewart in consultation with the DEC, the QPWS and the GCCC.

Funding was provided by the NSW Roads and Traffic Authority as part of the DEC (formerly NPWS) Concurrence Conditions for the Pacific Highway Upgrade project between Brunswick Heads to Yelgun

11 Review Date

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

12 References

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13 Acronyms Used in this Document

DEC	Department of Environment and Conservation (NSW)
DIPNR	Department of Infrastructure, Planning and Natural Resources
EIS	Environmental Impact Statement
EP&A Act	NSW <i>Environmental Planning and Assessment Act</i> 1979

EPBC Act	Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i>	NSW	New South Wales
		NVC Act	NSW <i>Native Vegetation Conservation Act 1997</i>
FNPE Act	Forestry and National Parks Estate Act 1998	QPWS	Queensland Parks and Wildlife Service
GCCC	Gold Coast City Council	RTA	Roads and Traffic Authority
IFOA	Integrated Forestry Operations Approval	SEPP	State Environmental Planning Policy
LG Act	Local Government Act 1993	SIS	Species Impact Statement
NPW Act	NSW <i>National Parks and Wildlife Act 1974</i>	TSC Act	NSW <i>Threatened Species Conservation Act 1995</i>
NPWS	NSW National Parks and Wildlife Service	VCA	Voluntary Conservation Agreement

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

Action no	Action Title	*Priority	Cost Estimate (\$'s/year)					Total Cost (\$)	Responsible Party/Funding sources	#In-kind	^Cash
			Year 1	Year 2	Year 3	Year 4	Year 5				
1.1	Co-ordination	1	1750	1750	1750	1750	1750	8750	DEC	8750	
1.2	Develop record keeping system	1	5000	1050	1050	1050	1050	9200	DEC	9200	
2.1	Improve knowledge base - surveys	1	20750	1000	1000	1000	1000	24750	DEC	4750	20000
2.2	Incorporate records into wildlife Atlas	2	350	350	350	350	350	1750	DEC	1750	
3.1	EIS guidelines	1	1050	350	350	350	350	2450	DEC	2450	
4.1	Habitat management – notify landholders	1	1050	350	350	350	350	2450	DEC	2450	
4.2	Site specific management planning	1	3500	1750	1750	1750	1750	10500	DEC	10500	
4.3	Control weeds	1	7000	3500	1750	1750	1750	15750	DEC	15750	
4.4	Protect roadside locations	1	1750	350	350	350	350	3150	DEC	3150	
4.5	Prevent genetic pollution	1	350	350	350	350	350	1750	DEC	1750	
5	Fire planning and management	1	3500	350	350	350	350	4900	DEC	4900	
6.1	Research - investigate population dynamics	2	4000	4000	4000	4000	4000	20000	DEC		20000
6.2	Reproductive biology and genetics	2	20,000	20,000	20,000	20,000	20,000	100000	DEC		100000
7.1	Contingency planning – ex situ collections	2	1750	1750				3500	DEC	3500	
7.2	Store genetic material	2	1750	1750				3500	DEC	3500	
8.1	Integrate with other recovery plans	2	1750	1750				3500	DEC	3500	
9.1	Involve community	1	4750	350	350	350	350	6150	DEC	6150	
Total	Annual cost of the Crystal Creek Walnut Recovery Program		80050	40750	33750	33750	33750	222050		82050	140000

* 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 Submission

Recovery Plan Submission

Name Individual/
Organisation:

.....

Postal Address:

.....

Postcode:

Contact Number(s):

.....

Date:

.....

Draft Recovery Plan: Endiandra floydii (Crystal Creek Walnut)

The DEC will consider all written submissions received during the period of public exhibition and must provide a summary report of those submissions to the Minister for the Environment prior to final approval of this Recovery Plan.

Please note, that for the purposes of the NSW *Privacy and Personal Information Protection Act 1998* any comments on this draft Recovery Plan, including your personal details, will be a matter of public record and will be stored in the DEC records system. Following approval of the plan by the Minister, copies of all submissions, unless marked "confidential", will be available, by arrangement, for inspection at the DEC Office responsible for the preparation of the Recovery Plan

Should you not wish to have your personal details disclosed to members of the public once the Recovery Plan has been adopted, please indicate below whether you wish your personal details to remain confidential to the DEC and not available for public access. Further information on the *Privacy and Personal Information Protection Act 1998* may be obtained from any office of the DEC or from the website: www.nationalparks.nsw.gov.au

- Yes, please keep my personal details confidential to DEC

Submissions should be received no later than the advertised date. Submissions should be addressed to:

The Director-General
 Department of Environment and Conservation (NSW)
 C/- the Crystal Creek Walnut Recovery Plan Co-ordinator
 Conservation Programs and Planning (Northern)
 Locked Bag 914
 Coffs Harbour NSW 2450.

Appendix 2 Public Authority Responsibilities

Public authority	Relevant responsibilities
DEC – Environment Protection and Regulation Division	<ul style="list-style-type: none"> • Assessment of licence applications under the TSC Act. • Assessment of licence applications under the NPW Act. • Assessment of proposed developments on DEC estate. • Advice to determining and consent authorities, with a possible concurrence role under the EP&A Act or NVC Act. • Preparation of Recovery Plans and co-ordination of implementation. • Regulation of certain forestry operations under the Integrated Forestry Operations Approval.
Relevant local governments	<ul style="list-style-type: none"> • Preparation of Local Environmental Plans under Part 3 of EP&A Act. • Consent authorities for development proposals under Part 4 of EP&A Act. • Approval authorities for council works under Part 5 of EP&A Act. • Responsibilities under <i>Rural Fires Act 1997</i>. • Management of council reserves with potential habitat. • Consideration of the content of Recovery Plans when preparing plans of management for community land under <i>Local Government Act 1993</i>.
Department of Infrastructure, Planning and Natural Resources	<ul style="list-style-type: none"> • Approval authority for native vegetation clearance applications under the NVC Act. • Administration of property plans under the NVC Act. • Management of crown land with potential habitat. • Co-ordination of Regional Vegetation Committees, Catchment Management Boards and Landcare programs. • Development of policy and strategies, including SEPPs, for land use planning and environmental assessment. • Advice and assistance on environmental planning matters. • Assessment of major development applications. • Administration of the general conditions of IFOA. • Concurrence role under the EP&A Act for certain developments and activities. • Making of SEPPs and Local Environmental Plans under Part 3 of EP&A Act. • Determining certain development proposals under Part 4 of the EP&A Act. • Approval of certain activities under Part 5 of EP&A Act.
State Forests of New South Wales	<ul style="list-style-type: none"> • Implementation of prescriptions detailed in IFOA terms of threatened species licence granted under Part 4 of the FNPE Act.
Rural Fire Service	<ul style="list-style-type: none"> • Preparation of Bush Fire Risk Management Plans and Plans of Operations. • Fire management.
Other State government agencies	<ul style="list-style-type: none"> • Management of public lands with potential habitat. • Approval authorities for activity proposals under Part 5 of EP&A Act.



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