

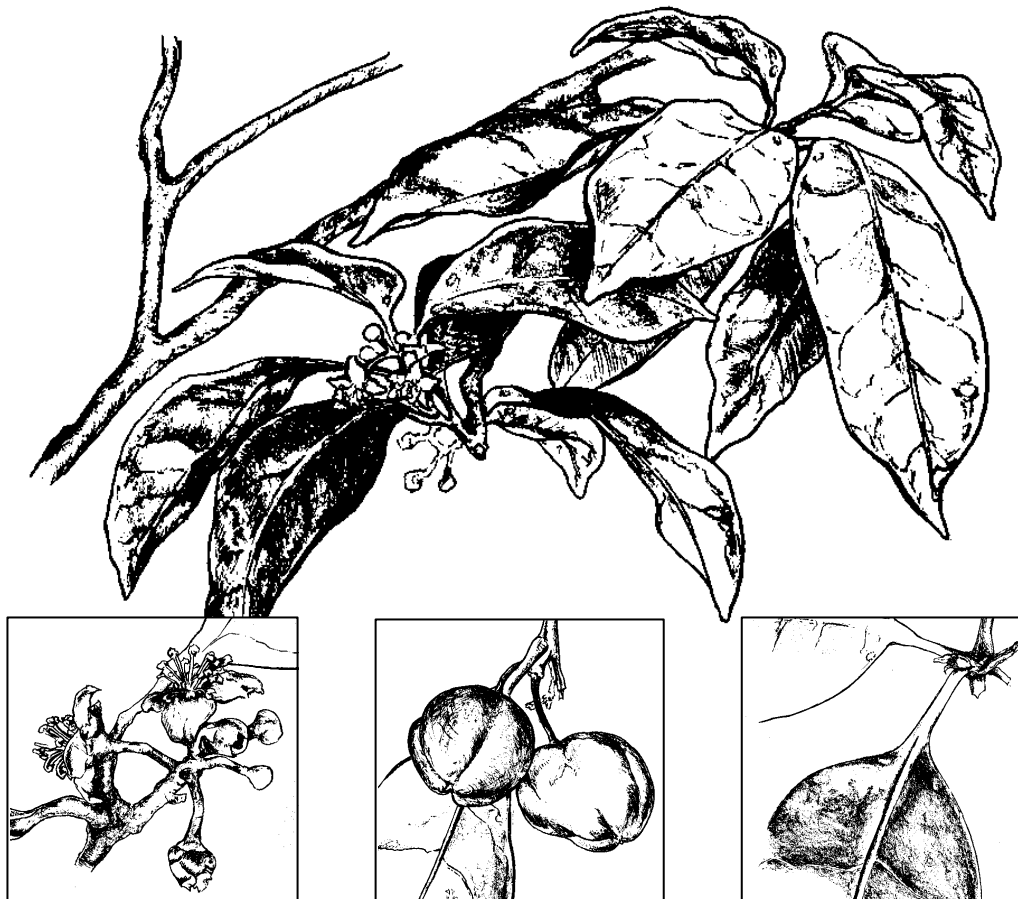
Draft NSW & National  
Recovery Plan

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*Fontainea oraria*  
(Coastal Fontainea)

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Draft for Public Comment  
January 2005



Department of  
Environment and Conservation (NSW)



Natural Heritage Trust  
Helping Communities Help Australia  
A Commonwealth Government Initiative

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**Cover illustration:** main—Coastal Fontainea (male plant);  
inset left to right—male flowers, fruit, leaf glands

**Cover illustrator:** Ann Sheppard from photographs by Hugh Nicholson, Laurie Jessup and Erika Birmingham

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# Draft Recovery Plan for *Fontainea oraria* (Coastal Fontainea)

## Foreword

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The New South Wales (NSW) 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 a draft of the formal National and NSW State Recovery Plan for *Fontainea oraria* (Coastal Fontainea) 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 species in nature and the parties who will undertake these actions.

The Coastal Fontainea is included as Endangered on both the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* and the NSW *Threatened Species Conservation Act 1995*. It is a rainforest tree that occurs in the littoral rainforest on krasnozem soil in the Lennox Head area and is only known from this area in far north-eastern NSW. The species has been recorded from a council reserve and freehold land.

The recovery actions detailed in this draft plan are directed toward: (i) protecting and managing the Coastal Fontainea population and its habitat; (ii) determining if further sub-populations of the Coastal Fontainea occur and collecting and managing baseline data; (iii) gaining a better understanding of the biology and ecology of the Coastal Fontainea; (iv) undertaking a translocation program for the Coastal Fontainea; (v) raising awareness and encouraging community involvement in the conservation of the Coastal Fontainea and its habitat; (vi) developing and implementing a contingency plan to ensure the long-term survival of the Coastal Fontainea; and (vii) ensuring the status of the Coastal Fontainea is appropriately reflected in relevant legislation and policy.

It is intended that the Recovery Plan will be implemented over a five-year period. The actions identified in this Recovery Plan will be undertaken by the DEC, in consultation with Ballina Shire Council, and a private landowner where three sub-populations of Coastal Fontainea occur.

This draft Recovery Plan will be on public exhibition for a period of six weeks. Following consideration of comments the Plan will be finalised by the DEC and made publicly available.



**Director-General**

## Acknowledgments

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## 1 Introduction

*Fontainea oraria* (Coastal Fontainea) (Jessup & Guymer) is one of Australia's rarest rainforest trees. The species was discovered in 1982 by Jessup and Guymer of the Queensland Herbarium (Jessup & Guymer 1985, Hunter *et al.* 1992) at Lennox Head in far northern New South Wales (NSW). Nearly twenty years later the Coastal Fontainea remains known from four small sub-populations in two remnants at Lennox Head.

This document, when finalised, will constitute the formal State and National Recovery Plan for the Coastal Fontainea. It identifies the actions to be taken to ensure the long-term viability of the Coastal Fontainea 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. It may also be necessary to review this plan in the event of new information.

This plan has been prepared by the NSW Department of Environment and Conservation (DEC) in consultation with relevant government authorities and private landholders.

## 2 Legislative Context

### 2.1 Conservation status

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

Using the International Union for the Conservation of Nature and Natural Resources (IUCN) Red List Criteria (IUCN 2001), the Coastal Fontainea warrants a listing of Critically Endangered (Appendix 1).

### 2.2 Responsibilities under the *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 Ecological Communities in NSW. Under this legislation the Director-General of the DEC 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 2 of the plan, at the DEC Threatened Species Unit, North East Branch, or on the DEC website [www.environment.nsw.gov.au](http://www.environment.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*, which 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 must 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 Coastal Fontainea in NSW are the responsibility of the DEC.

#### Consultation with indigenous people

Local Aboriginal Land Councils, Elders and other groups representing indigenous people in the areas where the Coastal Fontainea occurs have been identified and a copy of the draft Recovery Plan will be sent to them. Their comments on this draft will be 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 (SIS) is mandatory for all developments and activities proposed within Critical Habitat.

To date, Critical Habitat has not been declared for the Coastal Fontainea 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. However, an assessment of Critical Habitat will be undertaken as a recovery action in this plan.

### **Key Threatening Processes**

As of December 2004 there are 24 Key Threatening Processes listed on the TSC Act. Of these 'Clearing of Native Vegetation' (NSW Scientific Committee 2001) is considered to be relevant to the Coastal Fontainea and its habitat. In addition to this Key Threatening Process a range of other processes are recognised as threatening the survival of the species. These threats are discussed in Section 4.

### **Licensing**

Any proposed works not requiring development consent or activity approval under the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) or the NSW *Native Vegetation Act 2003* (NV Act), which is likely to pick Coastal Fontainea, or damage its habitat, requires a licence from the DEC under the provisions of the TSC Act or NSW *National Parks and Wildlife Act 1974* (NPW Act) as a defence against prosecution. 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 Coastal Fontainea and its habitat, including making 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. The Act imposes 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. Proposed actions within Critical Habitat on non-Commonwealth areas are likely to receive additional scrutiny by the Commonwealth Minister.

This Recovery Plan does not specifically identify habitat that is critical to the survival of the Coastal Fontainea. However, the distribution, habitat and ecological information included in this plan (Sections 3.4–3.5) will assist the Commonwealth Minister for the Environment and Heritage in identifying habitat that is critical to the survival of this Coastal Fontainea.

The DEC does not consider it appropriate that this Recovery Plan identifies or maps the occurrence of this species in the detail that would be required to define Critical Habitat.

As the Coastal Fontainea 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.

## **2.4 Relationship to other legislation**

Additional legislation relevant to the conservation and recovery of the Coastal Fontainea 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*;
- *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 Coastal Fontainea is varied. The most significant implications are described below.

#### ***Environmental Planning and Assessment Act 1979***

This Act provides for the consideration of the Coastal Fontainea in land use planning issues. Consent and determining authorities are required to consider potential impacts on the Coastal Fontainea and its habitat when considering an activity or development proposal under Part 4 or Part 5 of the EP&A Act. A species profile and Environmental Impact Assessment Guidelines are provided in Appendix 3. These are designed to assist consent and determining authorities and environmental consultants in undertaking assessments of significance.

#### ***Local Government Act 1993***

The NSW *Local Government Act 1993* (LG Act) also requires that Recovery Plans are taken into account when preparing management plans for community land. The northern sub-population of the Coastal Fontainea occurs in a council reserve that is included in Ballina Shire Council's Plan of Management for their community lands (Ballina Shire Council 2000).

### **3 Species Information**

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#### **3.1 Taxonomic background, description and significance**

##### **Taxonomic background**

The Coastal Fontainea belongs in the Family Euphorbiaceae. The genus *Fontainea* contains ten species that extend through northern NSW, south-east and north-east Queensland, New Guinea, New Caledonia and Vanuatu (Jessup & Guymer 1985).

Of the six species in the genus that occur in Australia, five are endemic and are considered as Rare, Vulnerable or Endangered on State and Commonwealth legislation.

##### **Taxonomic description**

The Coastal Fontainea is a small tree or large shrub that may grow to a height of 8–10 m. The lower trunk is fluted, twisted and commonly multi-stemmed. The bark varies from smooth to slightly scaly and from grey-brown when older to pea-green when younger.

The inner bark has no smell and a red exudate when damaged. It causes a delayed 'burning' in the mouth (Floyd 1989).

The branchlets are moderately thick, green but turning fawn where leafless. They are smooth but ridged below each leaf stalk (Floyd 1989).

The leaves of the Coastal Fontainea are alternate, simple, elliptic, discoloured, glabrous and glossy. They are 8–15 cm long. There are two small oval glands raised 0.5–4 mm from the leaf base. Leaf shoots are hairy (Floyd 1989; Harden 1991). The mid-ribs and lateral veins are distinct and raised on both leaf surfaces. The petioles (leaf stalks) are 1–2 cm long and swollen at the junction with the leaf base. The leaves are spirally arranged up the stem. The leaf stalks exude a clear watery sap (Floyd 1989; Hunter *et al.* 1992).

The Coastal Fontainea has small (1 cm diameter) whitish flowers with four or five petals with silky to velvety hairs (4–6 mm long). There are often 2–3 flowers on a female inflorescence occurring in the axils or at the ends of branches. The male flowers have 20–24 stamens joined into a tube at the base (Floyd 1989). The species is thought to have male and female flowers on separate plants. Figure 1 illustrates the male and female flowers.

The fruit of the Coastal Fontainea is a 3–6 grooved pink to red globose drupe, generally ripe around March–April. They are about 2.5 cm diameter and 2–3 cm long. Within the drupe, the endocarp is hard, wrinkled and grooved with 2–3 hard sharp ridges. There are 3–4 seeds per fruit (Jessup & Guymer 1985; Floyd 1989; Hunter *et al.* 1992).



**Figure 1.** Detail drawings of the Coastal Fontainea

Clockwise from top left: Female branch in flower; female flower detail; male branch in flower; male flower; fruit; leaves showing glands.

### Taxonomic significance

Genetic studies have been undertaken into the relationship of between the Coastal Fontainea and other species of *Fontainea* found in NSW and Queensland. These studies showed *Fontainea oraria* and *F. australis* as representing distinct genetic pools although they are more closely related to each other than to other *Fontainea* species (Rossetto & McNally 2000; Rossetto *et al.* 2000). *Fontainea oraria* differs from *Fontainea australis* in having a smooth endocarp, longer floral axes and more distal gland placement (Jessup & Guymer 1985). The Coastal Fontainea is considered as a distinct species and as such knowledge of this species is considered a significant part of understanding the evolutionary relationship and history of the genus.

### 3.2 Distribution and Abundance

#### Current and historical distribution

The Coastal Fontainea is known in the wild from four small sub-populations near Lennox Head on the far north coast of NSW (Figure 2). These sub-populations occur within a 600 m radius. The total population comprises ten adults and 45 seedlings and juveniles.

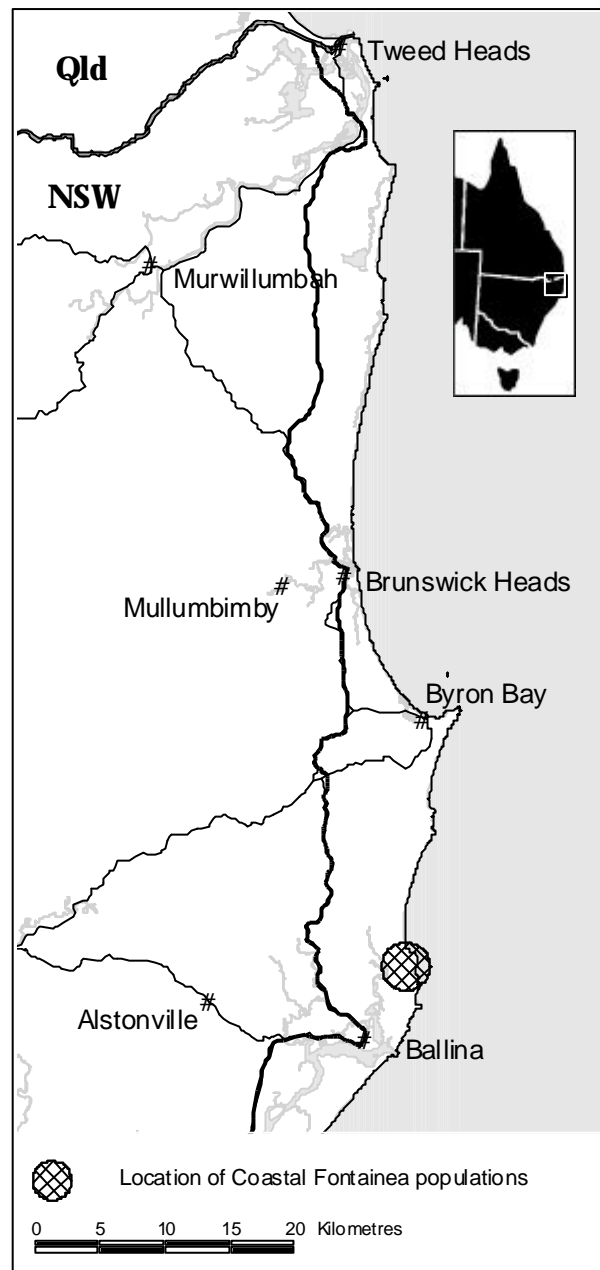
It is likely that the Coastal Fontainea was more widespread within the littoral rainforest on krasnozem soil at Lennox Head. The majority of this vegetation has been cleared in the area and presumably plants of the Coastal Fontainea were destroyed at the same time. Genetic research indicates that there was gene flow between these remnants prior to clearing (Rossetto & McNally 2000). It was likely that existing genotypes were connected once as a more or less continuous population. The Coastal Fontainea plants at the northern sub-population and the southern sub-populations form a reasonably homogenous group (Rossetto *et al.* 2000).

### 3.3 Land tenure and zoning

The northern sub-population of the Coastal Fontainea grows in a Ballina Shire Council Reserve. Under the Ballina Local Environment Plan 1987 (Ballina Shire Council 1995) this land is zoned 2(a) Residential but is managed as a reserve.

The southern sub-populations of the Coastal Fontainea occur on privately owned land. Under the Ballina Local Environment Plan 1987 this land is zoned 7(l) Environmental Protection (Habitat) (Ballina Shire Council 1995).

#### Figure 2. Location of the Coastal Fontainea sub-populations



### 3.4 Habitat

#### Vegetation

The known Coastal Fontainea grow in remnant stands of littoral rainforest dominated by *Guioa* (*Guioa semiglauca*). A list of species commonly associated with the Coastal Fontainea is provided in Appendix 4. Numerous exotic plant species have been recorded in the Coastal Fontainea remnants. A list of these weed species is provided in Appendix 5.

It appears the majority of the rainforest habitat where Coastal Fontainea occurs at Lennox Head is largely regrowth having been cleared pre-1950 (McKinley *et al.* 1999). Nonetheless, it has recovered with surprisingly high species diversity, similar to that of the Big Scrub rainforest (J. Hunter pers. comm.).

The Lennox Head littoral rainforest is highly fragmented and isolated by cattle pasture and residential development. Littoral rainforest is exposed to strong salt laden winds. Strong windshear has worn the outer edge of the canopy smooth and there is little recruitment of native species in areas along these edges. Within the remnants the canopy is low with recruitment of a diverse range of species. The mid-layer is relatively sparse. This may be related to a lack of favourable environmental conditions, competition from weeds or disturbance by cattle either through trampling or consuming palatable vegetation.

The habitat has an abundance of exotic plant species both in terms of species diversity and biomass. The NSW National Parks and Wildlife Service (NPWS - now part of the DEC) habitat restoration program has reduced the impacts of weed invasion on native plant regeneration in the vicinity of the Coastal Fontainea plants (further discussed in Section 3.5 and Section 4.2).

#### **Altitude, aspect and topographic preferences**

The Coastal Fontainea occurs on moderately steep upper hill slopes and crests of northerly and easterly facing hills about 50 m above sea level. The four sub-populations are within 1 km of the ocean.

#### **Geology and soil characteristics**

The Coastal Fontainea occurs on shallow red-brown krasnozem soil derived from basalt. Coastal Fontainea plants are growing in areas where this soil is limited to the inter-rock spaces between an abundance of basaltic rocks. The krasnozem soils are highly fertile.

Soil pH at the southern sub-populations varied from 3.3–5.4 (Hunter *et al.* 1992) while the pH at the northern sub-population was 5–6 in the upper horizon and 4.5 in the lower horizon. The upper horizon had a higher organic content while the lower horizon had a higher clay content (Bennetts 1999).

### **3.5 Life history and ecology**

The life history and ecology of the Coastal Fontainea is largely unknown. The following information is based on opportunistic field observations and the genetic research.

#### **Growth, development and longevity**

The Coastal Fontainea is presumed to be an obligate seed regenerator, which means it relies on seed production and seedling establishment for continued persistence. It doesn't appear to have other mechanisms, such as the ability to resprout or sucker, to recover from severe disturbance events. However, some adult specimens are multi-stemmed, demonstrating the species' ability to coppice.

The growth rate of the Coastal Fontainea appears to be slow. No stem diameter growth was recorded for any trees for the two-year period 1988–90. Eighteen new seedlings (less than 15 cm high) were recorded during this period. In 1997 several plants had grown to about 80 cm high, with little growth through until 1998. However, substantial rains over the 1998–99 summer appeared to stimulate a denser canopy and rapid seedling growth (L. Bennetts pers. comm.).

The known Coastal Fontainea trees are estimated to be between 40 years and 50 years old (J. Hunter pers. comm.).

Coastal Fontainea generally grows in areas of low light intensity beneath a continuous canopy of the rainforest. The female tree has been recorded as fruiting and seeds germinating in these conditions (M. Matthes pers. obs.; S. Horton pers. obs.).

Two individuals of the Coastal Fontainea were planted at Mount Warning Arboretum and at two years of age one was 3 m high and one was 1 m high.

#### **Reproductive biology**

##### Flowering and fruiting

The Coastal Fontainea flowers from spring to mid-summer although flowers have been observed during other seasons.

The Coastal Fontainea is thought to primarily have male and female flowers on separate plants (dioecious) and may also be capable of having separate male and female flowers on the one plant (monoecious) (A. Murray pers. comm.; M. Matthes pers. obs.). The degree to which this phenomena occurs in the species is unknown.

The Coastal Fontainea appears to have variable periods of fruiting, with ripe fruit being observed mainly in autumn (Floyd 1989; Hunter *et al.* 1992). However, fruit have also been observed during spring and summer (L. Bennetts pers. comm.).

Several possibilities exist for this variable fruiting:

- fruit may be held on the tree until conditions such as high moisture (rainfall) cause fruit to fall;
- sequential flowering periods may be triggered by rain or other events, with subsequent fruit development;
- fruit development may be arrested until appropriate conditions occur;
- pollinators may be active all year; or
- another as yet unidentified scenario.

The sex of the adult at the northern sub-population is unknown. The planted specimens are not yet mature.

One female is known at the main southern sub-population. A few male plants are contributing to future generations (Rossetto & McNally 2000; Rossetto *et al.* 2000). The sex of most plants has not been determined.

#### Pollination

The pollination of the Coastal Fontainea is not understood.

It is likely that the species is insect pollinated as it has small relatively insignificant flowers and unspectacular inflorescences (Williams & Adam 1999). The Coastal Fontainea may also be wind pollinated as discussed by Bullock (1994, in Williams & Adam 1999). Although, the genetic studies indicate this would only be over a short distance as pollen from plants 5 m from the female plant were not contributing to future generations (Rossetto & McNally 2000).

Given the Coastal Fontainea is dioecious, or may be monoecious, it is not surprising that no self-pollination was recorded (Rossetto & McNally 2000).

#### Seed production, predation and viability

The single female appears to produce a relatively small number of fruit (from observations of fruit on the ground). The reasons for this may be:

- lack of flower production;
- lack of pollinators;
- lack of pollinator activity at flowering time;
- flowering not synchronous (in that male and female flowers may not be fertile at same time);
- flowers damaged and/or fruit removed prior to observation (either human, bird, rat etc.); or
- time of observation is not peak fruiting season.

One fruit has been observed with a hole containing eggs (L. Bennetts pers. comm.). The identity of the insect is unknown and it is the only record of pre-dispersal seed predation.

Over the last ten years of observations, limited seedlings have established relative to the number of fruit produced. This may be related to low viability, although propagation from the collected seed indicates that some seed produced is viable. Like many species, seed viability may vary with timing of fruit within fruiting season. Early and late fruit apparently germinate less easily than mid-season fruit. *Ex situ* seed germination took between 3–4 months after sowing (L. Bennetts pers. comm.).

#### Seed dispersal, germination and seedling establishment

Seed of the Coastal Fontainea is most likely dispersed locally by wind over short distances, gravity or ballistic methods (Hunter *et al.* 1992). Short distance dispersal may also be assisted by birds or rats. Seedlings and seed observed on the ground are all within 5 m from the female parent tree.

It is expected that the seed will germinate within 12 months of production. Germinated seed was observed when fruit had just completed falling. Some short-term dormancy mechanism may be operating that extends this period slightly.

Hunter *et al.* (1992) suggests that the large cotyledon leaf pair may assist the establishment and persistence of the Coastal Fontainea beneath the forest canopy.

During 1989, 33 seedlings were recorded near the female tree. By 1991, the number of seedlings had increased to 51. During 1999, 45 seedlings/juveniles were located.

The dynamics of seedling establishment is poorly understood. A degree of seedling mortality is expected. Disappearance of seedlings may be because:

- a series of dry years;
- trampling or grazing by cattle;
- death by leaf fungus or other disease or both;
- salt dieback;
- insect defoliation;
- theft; or
- other unknown factors.

#### **Population structure**

The current population structure<sup>1</sup> of the Coastal Fontainea comprises four sub-populations: the main sub-population of seven adults and 45 seedlings and juveniles; and three sub-populations each with one adult. The northern sub-population also has eight planted seedling-juveniles grown from seed from the main sub-population.

The three southern sub-populations occur in the same rainforest remnant. Two sub-populations occur as single specimens, isolated from the main clump by about 80 m and 200 m respectively.

Two adults originally existed at the northern sub-population, however one specimen died in 1996. The sub-population now persists as one adult and

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<sup>1</sup> The following definitions of “population”, “sub-population”, and “mature individuals” are consistent with the IUCN (2001) (Appendix 1).

eight individuals that were planted in 1995 from seed collected from the main sub-population.

Given that the Coastal Fontainea is dioecious or that some plants may be monoecious, it is not surprising that no clonality was detected (Rossetto & McNally 2000). Reasonable levels of genetic diversity were detected within the Coastal Fontainea population with all parental trees belonging to the same genetic provenance and therefore contain equally valuable genetic resources. However, substantial over-contribution from one individual (the female) and a few males was detected (Rossetto & McNally 2000; Rossetto *et al.* 2000). This is a likely result due to their proximity to the female plant. The genetic studies show that seedlings are obviously related to the known adult plants and it is therefore unlikely that an unknown specimen is contributing to the current progeny (Rossetto & McNally 2000; Rossetto *et al.* 2000). The genetic diversity recorded for the Coastal Fontainea was similar to values recorded for other rare outcrossing species (Rossetto *et al.* 1995).

The genetic research showed that the two southern single specimen sub-populations are not currently contributing to the future generation of plants at the main southern sub-population, nor is the northern sub-population. Therefore, each of the four discrete locations where the Coastal Fontainea occurs constitutes a sub-population.

Understanding the genetic variability in, and population structure of, the Coastal Fontainea as important for the following reasons (Rossetto *et al.* 2000):

- defining more accurately the boundaries of sub-populations, which has practical consequences for habitat management and decision making;
- understanding the genetic significance of small sub-units;
- ensuring that appropriate source material is used to adequately represent the genetic diversity of the species, for the proposed translocation and *ex-situ* programs; and
- understanding and managing the species' long term evolutionary potential.

### Disturbance ecology

The response of the Coastal Fontainea to disturbance is poorly understood.

The Lennox Head area was cleared and burnt for pasture development and banana plantations early in the twentieth century, although pockets of forest probably remained and other trees coppiced or regrew. Some patches were left as windbreaks on the steeper slopes. The persistence of the Coastal Fontainea is probably quite remarkable. It is thought to either have coppiced (resulting in the multi-stems

present in many specimens) or that the large basaltic rocks protected fallen seeds, thereby allowing the recolonisation following clearing.

All habitat where the Coastal Fontainea sub-populations occur have a long history of cattle grazing. It is possible that the multi-stems are also a response to cattle grazing or trampling of seedling or juvenile plants.

The Coastal Fontainea also appears to coppice and may resprout after mild fire (Hunter *et al.* 1992). However, although resprouting after mild fire may be possible, recovery from more intense fires is not expected due to the thin bark on the trunks.

Several specimens of the Coastal Fontainea exhibited signs of being affected by a Cerambycidae insect, *Mesolita lineolata*. The species was recorded in dead branches. Cerambycidae eat live wood, but only when the plant is already under stress, and it is therefore more likely that they moved in after the death rather than being responsible for it (G. Williams pers. comm.; P. Gillespie pers. comm.). Live larvae were observed in autumn and adults in late spring (L. Bennetts pers. comm.).

Hunter *et al.* (1992) recorded leaf rust on some seedlings. This rust has not been identified.

### Propagation

The Coastal Fontainea is easily propagated from fresh seed. Propagation success from stored seed is unknown. The use of vegetative material for cuttings and marcotting propagation techniques has also been successful (S. Walker pers. comm.; J. Cook pers. comm.; A. Bofeldt pers. comm.).

Seeds appear to germinate readily in 75% shade with warm conditions (L. Bennetts pers. comm.). Ballina Shire Council has propagated plants from cuttings. The specimens took nine months to strike with 10% success rate. Wollongong Botanic Gardens have had greater success at getting material to strike, almost 100%, although the quality of the material used to propagate determined the success rate (A. Bofeldt pers. comm.).

Furthermore, cutting material from juveniles was relatively more successful at establishing plants than material from adult plants (J. Cook pers. comm.).

Provided there is wind protection, established cultivated plants can tolerate high light levels (Bennetts 1999; S. Walker pers. comm.; J. Cook pers. comm.; A. Bofeldt pers. comm.). Regularly applied fertiliser to potted plants and repotting six-monthly with new soil is best to maintain healthy specimens (A. Bofeldt pers. comm.).

## 4 Threats and Management Issues

Current threats and management issues affecting the Coastal Fontainea sub-populations and their habitat include habitat destruction, habitat fragmentation and isolation, habitat degradation (exotic weed infestation, weed control activities, stormwater management and erosion control, cattle grazing, ocean wind shear, increased pressure from adjacent developments), lack of knowledge of biological and ecological requirements of the Coastal Fontainea, inbreeding, dieback, fire, physical and mechanical damage and collection for propagation. The degree of the impact of these on the Coastal Fontainea and its habitat varies according to their intensity and proximity to the Coastal Fontainea plants.

For the purposes of this Recovery Plan, threats have been prioritised following the classification developed by Keith *et al.* (1997). This classification prioritises threats according to the following criteria:

- Class I threat is a process capable of causing sudden, substantial, and possibly irreversible loss of individuals or habitat; and
- Class II threat is a process capable of causing gradual, substantial and possibly irreversible loss of individuals or habitat; which may be reversible, however, mitigation may be technically difficult or expensive to achieve.

The actions developed to mitigate the threats will be prioritised according to the class of the threat and the basis for that status being applied. A discussion of the identified threatening processes is presented below.

### 4.1 Identified threatening processes

#### Habitat destruction

Habitat destruction is a major cause of loss of biological diversity. For species of restricted distribution, clearing of native vegetation may result in total extinction (NSW Scientific Committee 2001). In the case of the Coastal Fontainea it is possible that areas of its habitat may be destroyed. In the last 5 years there has been some unauthorised clearing at the southern Coastal Fontainea remnant (without the permission of the landowner), and the local power authority undertook maintenance works on one end of this remnant.

Clearing of littoral rainforest in Lennox Head in areas known to contain the Coastal Fontainea, is considered to be a Class I threat. Clearing of littoral rainforest containing unknown specimens of the Coastal Fontainea is a possibility given the increasing urban expansion and pressure in the Lennox Head area. For this reason, the clearing of

littoral rainforest in Lennox Head may also be considered as a Class II threat.

#### Habitat fragmentation and isolation

Habitat fragmentation has separated the northern sub-population from the southern sub-populations of the Coastal Fontainea. It is presumed that these remnants may formerly have been part of a system of patches in more-or-less continuous habitat (Rossetto & McNally 2000). The species is currently showing signs of inbreeding. Present ecological understanding is sufficient to predict that further adverse effects of fragmentation on the Coastal Fontainea sub-populations are likely to include inbreeding and the interruption to the function of pollinators. This may have consequences for fruit production and seed dispersal and therefore the recolonisation of adjacent remnants.

The northern Coastal Fontainea remnant is less than 1 ha in size. The southern Coastal Fontainea remnant is about 18.5 ha in size and is believed to be the largest remnant of littoral rainforest in Lennox Head (McKinley *et al.* 1999). These remnants are highly exposed to edge effects, including impacts of weed invasion and from salt laden winds.

Habitat fragmentation is considered a Class II threat to this species.

#### Habitat degradation

Small areas of fragmented habitat are particularly prone to a suite of habitat degradation processes, especially when relatively close to human habitation. These areas of fragmented habitat at Lennox Head also occur at the interface of an agricultural-natural landscape. A discussion of the processes identified as degrading the habitat of the Coastal Fontainea is presented below.

Habitat degradation may be considered as a Class I or Class II threat to the Coastal Fontainea depending on the intensity, frequency and duration of the process causing the degradation.

#### Exotic weed infestation

The Coastal Fontainea occurs in vegetation that is particularly prone to exotic weed competition, due to highly fertile soils, disturbance and increased edge effects. Some of the potential impacts of weed invasion on the Coastal Fontainea include smothering or strangling plants, competing for space, nutrients and light, and altering soil structure and composition.

Over forty exotic weed species have been recorded in the habitat of the Coastal Fontainea sub-populations (Appendix 5). The most common weed species are Lantana (*Lantana camara*), Ground Asparagus (*Asparagus aethiopicus*) and Camphor Laurel (*Cinnamomum camphora*).

Exotic weed invasion is currently considered a Class II threat as the progress achieved by the habitat restoration program has removed any immediate threat to the species. Should weeds be allowed to reinfest the habitat then it may be reconsidered as a Class I threat.

#### Weed control activities

The Coastal Fontainea plants may be damaged or destroyed if bush regenerators working at the Coastal Fontainea sites are not considerate of the presence of the species when undertaking weed control. Potential impacts include:

- trampling of seedlings;
- herbicide use within close proximity to the Coastal Fontainea plants that may lead to spray drift or absorption by plants; and
- over-removal of Camphor Laurel plants providing shade and shelter to the Coastal Fontainea.

The damage of plants either directly or indirectly is considered a Class II threat. It is anticipated that through appropriate guidance, weed control activities would not become a Class I threat to the species.

#### Cattle grazing

The possible impacts of cattle grazing in the vicinity of the Coastal Fontainea sub-populations include:

- trampling of habitat leading to compaction of soil, limiting regeneration of seedlings, and possibly damaging or destroying individuals; and
- introduction of weed propagules and increased nutrients through leaving manure.

The northern sub-population is fenced from adjacent agricultural activities. Low numbers of cattle have been grazing sporadically in the habitat of the Coastal Fontainea at the southern sub-populations. However there is no direct evidence to suggest they graze on this species.

Cattle grazing is considered as a Class II threat at this stage as cattle within the remnant are limited and the landowner intends to fence the site. However, should cattle grazing pressure increase and evidence suggest adverse impacts were occurring to the Coastal Fontainea then it may be reconsidered as a Class I threat.

#### Ocean wind sheer

Ocean wind sheer is reducing the health of rainforest plants on the edge of the remnants. The Coastal Fontainea is within close proximity to the edge of both remnants. Wind sheer may be an additional pressure to the plants already exhibiting signs of stress.

This process is considered to be a Class I threat for plants that are already under stress. Should the habitat edge continue to erode, the Coastal Fontainea could be placed at the frontline to ocean winds.

Ocean wind sheer is considered a Class II threat for plants that do not appear to be stressed at present.

#### Increased pressure from adjacent developments

Residential developments, adjacent to the habitat of the Coastal Fontainea sub-populations, generate varying uses of the remnant littoral rainforest by, and impacts from, adjacent occupants including recreational use, garden refuse dumping and stormwater run off.

Within the fenced area at the northern sub-population a mature Guioa was observed felled (A. Murray pers. comm.), a makeshift tree-house was constructed near the Coastal Fontainea (Gross 1994) and garden rubbish was dumped on *Macadamia* seedlings next to the Coastal Fontainea (Bennetts 1999). Evidence of garden refuse and rubbish are regularly observed at this remnant.

Where inappropriate stormwater management occurs, remnant vegetation often becomes degraded. There is a stormwater outlet on the western side of the northern sub-population, immediately upslope of the Coastal Fontainea plants. This drain has facilitated vigorous weed growth at the end of the pipe where the water disperses.

A drain also runs into the littoral rainforest in the southern Coastal Fontainea remnant from an adjacent residential subdivision (S. Fay pers. comm.).

Increased pressure from adjacent developments is considered a Class II threat as the habitat of the Coastal Fontainea is slowly degrading. However, stormwater management could be considered as a Class I threat should the stormwater contain substances that are toxic to the Coastal Fontainea.

#### **Lack of knowledge of biological and ecological requirements to apply to managing the species**

In the absence of relevant information about a species' biological and ecological requirements, management is based on generalised assumptions. Where small populations occur, such as with the Coastal Fontainea, poor management decisions may be made. In some cases, such decisions may have dire consequences for the long term conservation of the species.

Current knowledge of all aspects of the biology and ecology of Coastal Fontainea is described in Section 3. Further knowledge, particularly in relation to the causes of the observed breakdown in ecological and evolutionary processes, is considered to be essential to the effective management of the Coastal



Fontainea. The information required is identified in Actions 3.1–3.3.

The lack of knowledge about the species is currently considered a Class II threat. However, should no action be taken to increase the understanding of the species while the existing adult plants are still alive then it would be considered a Class I threat.

### **Inbreeding**

The genetic research has revealed that the population of the Coastal Fontainea consists of individually distinct genetic individuals. The reduced genetic variability in the new generations of the Coastal Fontainea, with its inability to colonise new areas, may represent a reduced ability to respond to alterations in its environment, including climate change. Therefore, the evolutionary potential of the species is limited and the evident inbreeding is likely to continue to future generations if appropriate action is not undertaken.

Inbreeding is considered a Class II threat to this species. Recovery actions proposed are designed to maintain the genetic diversity in the species. However, should no action be taken to improve genetic diversity in the sub-populations while the existing adult plants are still alive then it would be considered a Class I threat.

### **Dieback**

The remaining adult plant at northern sub-population was approximately 5 m high before dieback occurred. After the dead wood was removed it was 2 m high (Bennetts 1999). The Cerambycidae insect (*Mesolita lineolata*) may be contributing to the dieback, although another organism is likely to be responsible for the mortality of some branches (see Section 3.5 Disturbance ecology).

The presence of the Cerambycidae insect on the plant is considered to be Class II threat to the Coastal Fontainea.

### **Leaf rust**

Hunter *et al* (1992) noted leaf rust on seedlings of the Coastal Fontainea. The impact on, and response of, the Coastal Fontainea to the rust is unknown. In the absence of knowing the species of rust, the presumed impact can only be inferred from known rust species. Rust species are a fungus that reduce the photosynthetic ability of the plant, which can have follow-on effects, such as reduced seed set, size of seed and seed viability (B. Summerall pers. comm.). Therefore, the rust is unlikely to cause plant mortality but may weaken the health of a plant and increase its susceptibility to additional stresses.

Given that all the individuals of the Coastal Fontainea are considered important to the long term health of the species any process that causes the loss

of any individual can be considered a Class I threat that requires management.

The presence of the rust on the plant is considered to be a Class II threat to the Coastal Fontainea.

### **Fire**

Fire is considered an inappropriate management tool for conservation and management of rainforest. It is possible that the Coastal Fontainea will recover from infrequent and low intensity fires but moderate to high intensity fires are likely to destroy plants and the littoral rainforest habitat in which they occur. These types of fires could certainly lead to the species extinction in the wild. Hunter *et al.* (1992) assume that moderate intensity fires would be possible in the Coastal Fontainea habitat for various reasons.

The potential fire source is most likely to be arson, although during extremely prolonged dry periods glass or lightning strike may be potential sources of ignition.

Fire in the habitat of the Coastal Fontainea is considered a Class I threat.

### **Collection for the nursery industry**

The Coastal Fontainea fruit has allegedly been collected from the main sub-population for the nursery industry (L. Bennetts pers. comm.). Fruit collection may damage or destroy the Coastal Fontainea plants. This could be catastrophic if the only known female Coastal Fontainea were to be irreversibly damaged or destroyed during the collection. Additionally, the unauthorised collection could introduce pathogens, such as *Phytophthora* species, to the Coastal Fontainea habitat. This would particularly be an issue where secateurs and footwear are not properly cleaned prior to entering remnant vegetation.

Collection for the nursery industry is considered a Class II threat because the landowner of the main sub-population has erected signs warning against trespassing, thus the likelihood of illegal collections and the introduction of pathogens in the future are likely to have been reduced.

## **4.2 Reasons for decline and species ability to recover**

Habitat clearing and fragmentation are believed to be the primary causes of decline in the Coastal Fontainea population, followed by habitat degradation. The major consequence of the breakdown of these landscape processes has been the evidence of inbreeding in the Coastal Fontainea, also expected to be operating in many of the more common species in the remnants. The likelihood of recovery will be influenced by whether the long-term consequences of reduced genetic variation can

be reversed or reduced. This is likely to be a difficult, expensive and slow process to repair, if not impossible to reverse.

In the absence of seed production at the northern sub-population, and due to poor dispersal mechanisms, new habitat patches can only be established with artificial assistance. Apart from the location of new sub-populations, the management of exotic weeds in the Coastal Fontainea habitat and the success of the translocation program are the most critical factors in this species' recovery.

The recovery of the Coastal Fontainea will require a long-term commitment, beyond the life of this Plan, from the DEC and Ballina Shire Council, and will be dependent on the continued support of the landowner of the southern sub-populations. The Recovery Plan provides a series of actions directed at mitigating or removing threats and improving knowledge required to effectively manage this species.

## 5 Previous Actions Undertaken

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### 5.1 Survey

Hunter *et al.* (1992) surveyed approximately 25 ha of suitable habitat and did not locate any new sub-populations. Surveys of littoral rainforest on krasnozem soil between the Richmond River and the Queensland border were undertaken in the known habitat, and a limited part of the potential habitat of the Coastal Fontainea (McKinley *et al.* 1999). They did not locate additional Coastal Fontainea specimens.

Limited surveys in littoral rainforest have also been undertaken as part of the environmental assessments for the numerous developments in the Lennox Head area without locating the Coastal Fontainea.

### 5.2 On-ground management

Since 1994 the NPWS (now part of the DEC) was implementing a habitat restoration program at the remnants where the Coastal Fontainea occurs. This program included primary and secondary weed control and planting local rainforest species. The success of the program was evidenced by recruitment of native species and a significant reduction of weed regeneration. However continued weed control is required to maintain and improve upon works completed thus far.

A preliminary draft Plan of Management for bush regeneration has been prepared for the northern remnant owned by Ballina Shire Council (Bennetts 1999).

In 1997 actions were undertaken at both the northern and the main southern sub-populations to manage the insect related dieback. All dead branches were removed to prevent the loss of further branches (Bennetts 1999).

In 1988 Ballina Shire Council undertook works at the northern Coastal Fontainea sub-population. A fence (20 m x 30 m), was constructed to protect the plants from interference. A 'no rubbish dumping' sign was also erected to discourage dumping of industrial, household and garden refuse.

### 5.3 Biological research

Research on this species has been limited to opportunistic observations and genetic research.

Preliminary genetic research was undertaken by Peakall (1994). This work identified the need for further genetic studies. Subsequently, detailed genetic research has been carried out on the Coastal Fontainea (Rossetto & McNally 2000; Rossetto *et al.* 2000). Seventy-four plants were sampled. This comprised all known plants in the wild, including the planted specimens, and some cultivated plants.

### 5.4 Translocation

In 1995, eight plants were planted in an effort to increase population numbers. Seed used for the propagated material used in the translocation was collected from the main sub-population.

### 5.5 Community awareness

Various newspaper articles have been published in the local newspaper (The Northern Star), and the Australian Network for Plant Conservation's newsletter *Danthonia* (now *Australasian Plant Conservation*).

### 5.6 Propagation

A number of people have successfully propagated plants of the Coastal Fontainea since its discovery. Propagation of the species is discussed in Section 3.5.

## 6 Proposed Recovery Objectives, Actions and Performance Criteria

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The overall objective of this Recovery Plan is to arrest the decline of the Coastal Fontainea and to move the species and its habitat towards a position of viability in nature. This is expected to be beyond the five-year life of this plan, although this remains the overall objective of the recovery effort in the long term. The Coastal Fontainea is a highly Endangered plant that without appropriate action is

likely to become extinct in the wild. Therefore, specific objectives and respective recovery actions have been developed for the Coastal Fontainea.

**Objective 1: To protect and manage the population of the Coastal Fontainea and its habitat.**

The actions below were developed to assist in the protection and management of the Coastal Fontainea and to address the threats outlined in Section 4 that are, or may be, impeding achievement of this objective.

*Action 1.1*

*The DEC will distribute the Species Profile and Survey and Environmental Impact Assessment guidelines for the Coastal Fontainea (Appendix 3) to relevant local government, consultants and any other relevant land managers.*

Determining and consent authorities should ensure the survey methodology and minimum survey effort described in the guidelines is undertaken when assessing development applications or activity proposals. Using this survey method and minimum survey effort will assist in determining whether the Coastal Fontainea is present in, or near, an area of potential development.

The guidelines should also be used by determining, consent and concurrence authorities, in their assessment of the development or activity, to ensure the Coastal Fontainea is appropriately considered.

The guidelines should also be used by land managers, such as local government, the DEC and the Rural Fire Service (RFS), when preparing and implementing environmental planning instruments, and making decisions about strategic land-use planning.

The presence of the Coastal Fontainea or its habitat at a proposed development or activity site should require the preparation and implementation of effective mitigation measures, to reduce the impact of the proposed development or activity. Where new sub-populations are detected, appropriate conservation measures should be developed and applied to the management of the site.

**Justification:**

The Coastal Fontainea is one of the rarest rainforest trees in Australia. Without appropriate protection and management of the species and its habitat, it is likely to become extinct in nature.

**Performance criteria:**

Over the life of this Recovery Plan, determining, consenting and concurrence authorities:

- use the Species Profile, Survey and Environmental Impact Assessment guidelines

(Appendix 3) to assist in assessing development applications and activity proposals for areas containing littoral rainforest.

- take a precautionary approach to the assessment of developments and activities that may impact on the known populations of the Coastal Fontainea and areas of suitable habitat for the species.
- apply appropriate protective and mitigating measures are applied to consents or approvals where any new locations of the Coastal Fontainea were recorded during flora and fauna studies.
- do not approve developments or activities where translocation is proposed as a mitigating measure or where the development proposes to destroy individuals of the species or to degrade its habitat.

*Action 1.2*

*The DEC will liaise with landholders to seek long term protection of the Coastal Fontainea and its habitat.*

Details of the proposed site-specific management actions are provided in Action 1.4.

Relevant landholders or land managers are to be provided information on the conservation significance of the species and to allow informed decisions to be made regarding the long-term protection measures available, and the benefits associated with entering conservation agreements. Options available for facilitating long-term protection include:

- a Voluntary Conservation Agreement (VCA) under the NPW Act;
- a Joint Management Agreement under the TSC Act; and
- a Property Agreement under the NV Act.

All protective measures applied to sub-populations of the Coastal Fontainea will only be developed in conjunction with, and require the consent of, appropriate landowners or managers. The DEC will assist landowners interested in entering a Property Agreement with the Department of Infrastructure, Planning and Natural Resources (DIPNR).

**Justification:**

The DEC can offer its experience with managing threatened species and their habitats and assist landowners to manage their lands when they request assistance. It is through fostering good relationships with landowners whose property supports significant vegetation that the conservation benefits of such long-term protection measures are appreciated and implemented.

The DEC should provide landowners with information about the financial benefits, such as those associated with the above-mentioned long term conservation options, particularly where the landholder is currently bearing the full cost of conserving the vegetation on their land.

Performance criteria:

- Within the first year of implementing this plan, landowners and managers of habitat where sub-populations of the Coastal Fontainea occur are aware of long term protection measures, such as VCA, Joint Management Agreement or Property Agreement.
- Over the life of this Recovery Plan, where a landowner or manager (in the case of Ballina Shire Council) wishes to enter into an agreement, the relevant agreement is established.

#### Action 1.3

*The DEC will make available specific location information to relevant persons at Ballina Shire Council, environmental planners and managers, DIPNR and RFS, and the landowners. The DEC will ensure agencies are notified of any new occurrences of the Coastal Fontainea.*

Specific locality maps and location details have not been included in the Recovery Plan and will not be made publicly available.

Justification:

There is a need for confidentiality of locations to be maintained to respect the privacy of the landowners and managers; limit and manage the potential threat of illegal seed collection; reduce opportunities for the introduction of pathogens to the sites; and minimise damage to plants and seedlings.

Performance criteria:

- Over the life of this Recovery Plan, the sub-populations are not damaged or destroyed by people going to the site.
- Over the life of this Recovery Plan, no illegal collection of the Coastal Fontainea occurs.
- Over the life of this Recovery Plan, landowners and managers do not have people trespassing looking for the Coastal Fontainea on their property.

#### Action 1.4

*Preparation and implementation of site management plans*

##### Action 1.4.1

*The DEC will ensure site management plans are prepared for both the northern and southern sub-populations of the Coastal Fontainea and its habitat, in conjunction with Ballina Shire Council and the landowner.*

The plans are to include identification and delineation of weed management zones and the weed species present in each zone. A prioritised course of action with the timing and techniques to be applied to remove, control or manage the weed species, and the relevant zone to which it applies are also to be provided.

Habitat expansion to repair the effects of fragmentation and increased edge effects will be considered where opportunities are presented. For example, the landowner of the southern sub-populations is supportive of some planting in the buffer area with rainforest species, including some for commercial use.

The site management plans will address the actions required to carry out threat abatement at each of these sites and adjacent areas. Strategies to be included in management plans for the species will consider:

- stormwater management;
- protection from livestock;
- the provision of a walking track through the southern remnant;
- pest management, including *Mesolita lineolata* and leaf rust;
- garden refuse and rubbish dumping; and
- fire management.

##### Action 1.4.2

*The DEC will ensure the site management plans are implemented for both the northern and southern sub-populations of the Coastal Fontainea and its habitat, in conjunction with Ballina Shire Council and the landowner.*

The support of the landowners and managers will be critical to the successful implementation of these plans. The management of weeds in, and adjacent to, the habitat of the Coastal Fontainea will require the combination of targeted bush regeneration efforts and broader regional solutions to reducing the sources of weed propagules in the surroundings. Both short and long term actions need to be implemented.

Justification:

Weed invasion has been identified as a major threat to the Coastal Fontainea and its habitat. The effects of weed invasion are discussed in Section 4.

Control and removal of weeds will facilitate recruitment of the Coastal Fontainea by reducing competition and improving the health of the ecosystem.

Performance criteria:

- Within the first six months of implementing this plan, management plans are endorsed as

suitable for implementation by the Recovery Plan Co-ordinator;

- The improved health of the habitat for the Coastal Fontainea can be observed;
- Weeds species identified in the site management plans as being of major concern are controlled in the habitat of the Coastal Fontainea; and
- The threat to the Coastal Fontainea from weed invasion is reduced or eliminated and the threat from inappropriate regeneration techniques is avoided. Within the third year of implementing the Plan, the drains entering both the northern and southern sub-populations are managed to ensure that the direct and indirect impacts of stormwater to the Coastal Fontainea and its habitat are removed.
- Within the second year of implementing this Plan, there is no evidence of cattle impacting on the Coastal Fontainea or its habitat.
- If requested by the landowner, the walking track at the southern remnant is constructed with no impact to the Coastal Fontainea and minimal impact to its surrounding habitat.
- Over the life of this Recovery Plan, *Mesolita lineolata* is appropriately considered and managed if it is detected in any Coastal Fontainea plants.
- Over the life of this Recovery Plan, the unidentified leaf rust is appropriately considered and managed if it is detected on any Coastal Fontainea plants.

#### Action 1.4.3

*The DEC will liaise with the landowners, managers and the RFS to ensure that the “no fire in rainforest” principle is maintained in the Bush Fire Risk Management Plans.*

The Bushfire Risk Management Plans should also include an approach to containing fire, when and if, it does occur in the Coastal Fontainea remnants.

#### Justification:

It is possible that the Coastal Fontainea will recover from infrequent and low intensity fires, but moderate to high intensity fires are likely to destroy the plants and their habitat.

#### Performance criterion:

- Over the life of the Plan, the Coastal Fontainea is not impacted or threatened by wildfire or arson-lit fire in the remnant and that any fire is contained without damage to the Coastal Fontainea.

### **Objective 2: To determine if further populations of Coastal Fontainea occur and to collect and manage baseline data.**

#### Action 2.1

*The DEC will identify priority areas of potential habitat for targeted surveys of the Coastal Fontainea to be undertaken.*

Survey effort for the Coastal Fontainea will be designed to investigate:

- a) the full distribution of the Coastal Fontainea within its existing known range to clarify existing distribution for management purposes; and
- b) whether there are any new sub-populations in suitable habitat in adjacent catchments.

A suitably qualified person is required to co-ordinate and supervise survey efforts in suitable habitat for further populations of this species. Surveys are only to be undertaken on lands where the permission of the landowner has first been obtained. Guidelines for survey of the Coastal Fontainea are provided in Appendix 3.

Community groups may be involved in surveys. Community groups, such as Landcare, would target areas not covered by previous surveys. All participants are to be provided with sufficient instruction for the identification of the Coastal Fontainea during the implementation of this action.

#### Justification:

It is essential for managers of the Coastal Fontainea habitat to have a clear understanding of the actual and potential distribution of this species to make appropriate land-management decisions.

As the species is inbreeding, additional “new” genetic material may be highly important for success of the translocation program and ultimately, the recovery of the species.

#### Performance criterion:

- Over the life of the Plan, survey efforts for the Coastal Fontainea are undertaken in suitable habitat in accordance with the survey guidelines (Appendix 3).

#### Action 2.2

*The DEC will ensure census and population structure data are recorded for new sub-populations of the Coastal Fontainea, as soon as is practicable following their discovery.*

The site assessment form in Appendix 6 is to be completed at each new location where Coastal Fontainea is found to occur.

A sample of any new plants is to be taken for genetic analysis and sent to the Botanic Gardens Trust to

determine the relationship of the new sub-population to the known Coastal Fontainea. Another sample should be taken as a herbarium record and also sent to the Botanic Gardens Trust for their collections.

Justification:

The information gained from the samples will assist in the understanding of the relationship between existing and new populations. New information will inform future management of the species.

Performance criteria:

- Over the life of this Recovery Plan, a site assessment form is completed for any new Coastal Fontainea sub-populations.
- As required, results of genetic samples collected are used to make management recommendations.
- Over the life of this Recovery Plan, appropriate management of any new Coastal Fontainea and its habitat is recommended and provided to the relevant landowner.

### Action 2.3

*Effective data management including data organisation, data entry and data dissemination.*

#### Action 2.3.1

*The DEC will ensure that consistent data are collected for each sub-population and recorded on an appropriate database.*

The following information should be considered as the minimum data to be maintained:

- locations of known Coastal Fontainea sub-populations;
- size and approximate maturity of sub-populations;
- health of individuals;
- habitat and threatening process details;
- disturbance and management history of sub-populations, including previous weed control programs; and
- date of last site inspection.

#### Action 2.3.2

*The DEC will ensure public authorities are aware of these data and will be encouraged to provide details of any new records made of the species for inclusion in the data set.*

#### Action 2.3.3

*The DEC will ensure that all records on the Atlas of NSW Wildlife of the Coastal Fontainea correlate with known records of the species.*

Quality control of data is considered to be important, particularly for environmental assessment. Any inaccurate data will be corrected.

Justification:

There are numerous consequences of poor data management for natural resource management, including re-doing work that was done previously, making inappropriate decisions about a course of action and overlooking threats that require action to be taken.

Performance criterion:

- Over the life of this Recovery Plan, data about the Coastal Fontainea and its habitat are managed in such a way that it has contributed to the effectiveness and efficiency of the recovery program.

### **Objective 3: To gain a better understanding of the biology and ecology of the Coastal Fontainea.**

Future biological research and monitoring actions should aim to:

- investigate biological attributes which are relevant to the practical management of the Coastal Fontainea and its habitat, or which increase our understanding of the evolutionary potential of the species;
- involve scientists and post-graduate students;
- investigate new techniques which might be applied to the management of other threatened flora; and
- keep the DEC, Ballina Shire Council, the landowner and the conservation community informed of major research outcomes.

#### Action 3.1

*The DEC will ensure site assessment forms are completed for each known site of the Coastal Fontainea.*

The site assessment form is provided in Appendix 6.

Justification:

Recording of relevant site data is essential to provide baseline data from which the monitoring program identified in Action 3.4 can be properly evaluated. This information also provides the baseline information to assist in deciding the suitability of sites for the translocation program identified in Objective 4.

Performance criterion:

- Prior to beginning Actions 3.2–3.4, baseline data are gathered that can direct management and research.

#### Action 3.2

*The DEC will ensure a research plan is developed for the Coastal Fontainea and its habitat.*

This research plan will:

- address the priorities for research to improve and assist management of the Coastal Fontainea and its habitat;
- include monitoring, quasi-experimental research and experimental research;
- provide enough details of the methodologies required to carry out the research identified in Actions 3.3 and 3.4;
- provide details of the data analyses and data presentation required;
- provide details of the research reporting requirements;
- identify which of those projects are suitable to be undertaken by contract scientist or post-graduate university students or community groups; and
- provide guidance for community groups to undertake research studies.

Hypotheses will be developed for testing in later stages of a research program, possibly as part of student projects.

The research plan is to include: repeated monitoring of fixed parameters (to understand what is occurring, for example, with growth and flower and fruit production); and monitoring of parameters that are to be evaluated against pre-determined criteria (to determine whether actions taken have succeeded or failed, e.g. whether watering transplants assists their survival).

Monitoring forms need to be included in the Research Plan.

Justification:

If a research project on threatened species is not properly designed and subjective measurements recorded, the data collected can be misleading and statistically meaningless. In some cases an adverse change to the population may be missed. For Coastal Fontainea a missed detrimental change, could lead to the extinction of the species or an increase in the cost of recovery.

In addition, research not properly designed, with poor data collection, poor presentation of data and a lack of interpretation of the data for its application to the management of the species or its habitat is often useless to recovery efforts.

Performance criteria:

- Within the first year of implementing this Recovery Plan, a research plan will have been prepared.

- Within the second year of implementing this Recovery Plan, the DEC will seek interest from community groups and students to contribute to the research on Coastal Fontainea and its habitat.

*Action 3.3*

*The DEC will support quasi-experimental and experimental research in the areas where it has been determined that there is a lack of biological and ecological knowledge necessary for the species' management.*

The DEC will support the following research on the Coastal Fontainea:

1. pollination ecology of the species;
  - the biology of the pollinator(s),
  - the pollination mechanisms of the male and female plants,
  - whether the lack of contribution from all males is related to a lack of pollinators,
  - the degree to which insects, wind or other mechanisms pollinate flowers.
2. seed biology;
  - germination and dormancy mechanisms,
  - viability and longevity,
  - dispersal and predation.
3. recruitment and establishment;
  - recruitment including the survival of seedlings and cause(s) of mortality,
  - quantification of the significance of the loss of seedlings to the long term persistence of the Coastal Fontainea,
  - growth and development of individuals.
4. translocation program (discussed further in Objective 4 and Appendix 7);
  - appropriate combinations for planting trials and full-scale translocation,
  - determining the sex of plants prior to producing fruit, ideally through monitoring or further genetic studies,
  - treatments to enhance survival of transplants.
5. insect pests;
  - identify the pest species – pre and post seed dispersal predators,
  - determine and assess the impact potential of the leaf rust and other possible pests,
  - understand the biology of *Mesolita lineolata* to determine when it may be a management issue for the Coastal Fontainea.

**Justification:**

Key attributes of the biology and ecology of the Coastal Fontainea are currently unknown. A program of biological research, combined with low-impact *in situ* measurement and observation is required to systematically collect and analyse biological information concerning the Coastal Fontainea and its habitat.

**Performance criteria:****Over the life of the Plan:**

- a greater understanding of the biology and ecology of Coastal Fontainea is achieved and applied to management; and
- research is undertaken in accordance with the research plan.

**Action 3.4**

*The DEC will co-ordinate in situ monitoring of the Coastal Fontainea sub-populations to detect changes in size, distribution and age structure and to understand the reproductive biology.*

The DEC will contract the monitoring program to a successful tender with relevant qualifications and experience in plant ecology. Monitoring will be conducted monthly for the first two years. Monitoring frequency for future years will be identified in the research plan.

**The biological attributes to be investigated include:**

1. the breeding system of the species;
  - whether the species is monoecious or dioecious.
2. flowering and fruiting biology;
  - flower and fruit production,
  - age to reproductive maturity,
  - identification of male and female plants,
  - ratio of dioecious:monoecious individuals,
  - synchronicity of flowering and variation in flowering times.
3. pollination ecology of the species;
  - identification of the pollen vectors.
4. seedling/juvenile survival;
5. rate of growth;
6. health of individuals;
7. evidence of pest species.

Monitoring will be conducted annually to investigate the following ecological attributes of the Coastal Fontainea habitat:

- the degree to which competition for space and

resources is impacting on the Littoral Rainforest habitat where Coastal Fontainea occur, and whether any species are displacing other species;

- whether pathogens or insect pests are affecting the species in the habitat;
- an assessment of the size of the common species in the habitat and their position in the landscape;
- impacts of disturbances; and
- whether the amelioration and control of threats has been effective.

This is to include an initial assessment of the abundance and health of all species present in the remnants to provide baseline data. A monitoring scale should be devised for measuring the health and condition of the remnant. Any score less than a pre-determined threshold should indicate that action is required.

**Justification:**

Observation of change in the sub-population will be a preliminary step towards identifying factors that control demographic processes in the Coastal Fontainea. This should enable appropriate and timely action if a serious threat is observed that either appears to be, or is, affecting the Coastal Fontainea or its habitat.

Appropriate management of the small population of the Coastal Fontainea will be crucial to the long term survival of the species. Factors affecting reproduction such as synchronous flowering, ratio of dioecious:monoecious individuals, pollinator activity and pollen dispersal will be critical in determining gene flow within the population and thus genetic structure (Rossetto & McNally 2000).

The monitoring of habitat is essential to identify any factors that may impact on the success of the habitat restoration. For example, it may identify species that may need to be planted for effective gene flow and pollen transfer; species that may need to be controlled, such as vines smothering seedlings; and any additional restoration works required.

**Performance criteria:****Over the life of this Recovery Plan:**

- a greater understanding of the biology and ecology of Coastal Fontainea is achieved and applied to management; and
- monitoring of the Coastal Fontainea and its habitat is undertaken in accordance with the approved monitoring program.

**Objective 4: To undertake a translocation program for the Coastal Fontainea.****Action 4.1**



*The DEC will ensure the information identified in the translocation proposal (Appendix 7) is finalised and approved by the DEC prior to the commencement of the translocation plantings.*

The translocation proposal has been prepared for the Coastal Fontainea with consideration to the *Translocation Guidelines for Australian Threatened Plants* (Vallee *et al.* 2004) and includes justification for the action, consequences of not translocating the Coastal Fontainea, relevant species information, pre-translocation assessment, pre-translocation preparation, translocation, post-translocation actions and post-translocation monitoring.

Items requiring completion in the translocation proposal include: final design of the experimental treatments; additional consideration of the level of care of plants, such as fertiliser, mulch and soil wetting agents; preparation of monitoring and recording forms; and, final site selection.

The finalised experimental treatments will consider using the most genetically distinct adult trees in the population which may be able to contribute more to the translocation program (Rossetto & McNally 1999). Cutting material will be used from known parents and seedlings, and material selected for propagation will consider equal contributions of these plants for the new translocated populations. Any “new” plants located should have their usefulness to the translocation program determined.

The planted specimens at the northern sub-population do not need to be removed to avoid any issues associated with weakening the genepool, as they are of appropriate genetic stock. However, they are not enough to maintain a viable population. Further enhancement of this population will be required.

Justification:

A commitment to translocation is required for the Coastal Fontainea because the genetic results clearly identify that the species is inbreeding. The amount of diversity in the ten adults (parent plants) is higher than that recorded for the sixty-three seedling and juveniles sampled. There is a decrease in the genetic diversity recorded in the progeny and this is likely to be the result of over-contribution from a few individuals to the production of offspring. As a result it is likely that if this process is continued, the genetic pool available to the Coastal Fontainea will be slowly depleted (Rossetto & McNally 2000; Rossetto *et al.* 2000).

Performance criterion:

- Prior to beginning Action 4.2, all the relevant designs, proposals and forms for the translocation have been prepared.

#### *Action 4.2*

*The DEC will implement the approved translocation proposal (Appendix 7).*

The aim of this action is to establish at least five experimental trials: two introductions (at sites to be determined) and three enhancements (at the two southern single specimen sub-populations and at the northern sub-population) as identified in the translocation proposal (Appendix 7). Preparation for the full-scale translocations will be planned for in the review of this Recovery Plan (Section 10).

Justification:

During the life of this plan it will only be appropriate and feasible to establish and undertake the translocations to the experimental trial stage.

Due to the long-lived nature of many rainforest plants, such as Coastal Fontainea, at least eight years will be required to determine the first stages of success of the program. Implementation of an appropriate translocation proposal will increase chances of success.

Performance criteria:

- During the first three years of implementing this Recovery Plan, the experimental trial translocations are planted.
- Over the life of this Recovery Plan the translocation is monitored and maintained accordingly.

#### *Action 4.3*

*The DEC will monitor and evaluate the experimental trials in preparation for the full-scale translocations.*

This monitoring and evaluation will include a rigorous examination of the trials to determine their success or failure when measured against the criteria for determining the success in the translocation proposal.

Justification:

To reduce the risk of extinction to the Coastal Fontainea in nature, it is considered appropriate to have at least five viable sub-populations in nature. The three enhancement projects are designed to increase the number of individuals of the Coastal Fontainea at the sites where single plants currently occur. The creation of two new populations at alternative sites is intended to reduce the risk of stochastic events destroying the known sites.

The trials will also determine any limitations or problems with translocating the species to the site that require rectifying prior to committing and using resources for the full-scale translocation.

Performance criteria:

Over the life of this Recovery Plan:

- the experimental translocations are undertaken in accordance with the approved translocation proposal;
- monitoring and evaluation identify any limitations or problems with translocation of the species; and
- relevant changes are made to the experimental trials to improve chances of success (should the trials be evaluated to fail).

**Objective 5: To raise awareness and encourage community involvement in the conservation of the Coastal Fontainea and its habitat.**

*Action 5.1*

*The DEC will ensure targeted community awareness. Information packages will be developed to provide details on the identification of the species, its conservation status, the threats affecting the conservation of the species and its habitat, and recommendations for management.*

Distribution of these packages is to target relevant community groups, land management agencies, approval authorities and management committees and boards.

The information packages will include pamphlets targeting threat abatement issues such as impacts of stormwater, fruit collection and licensing, garden refuse and rubbish dumping, and community involvement (Action 5.2).

Justification:

Among the threats to the Coastal Fontainea are unauthorised collection of fruit, habitat degradation and rubbish dumping. Through increased awareness in the community, the impacts to the Coastal Fontainea and its habitat may be subsequently minimised.

Performance criteria:

Over the life of this Recovery Plan:

- community respect for the littoral rainforest in Lennox Head appears to improve. This would be evidenced by no reports of indiscriminate clearing of littoral rainforest, management of stormwater entering remnants has reduced weed propagules and pollutants, and rubbish and garden refuse are no longer being dumped in littoral rainforest remnants;
- all the Coastal Fontainea fruit collected from the natural sub-populations is licensed and contributing toward the implementation of the Recovery Plan.

*Action 5.2*

*The community will be encouraged to be involved in the targeted survey (Action 2), the site specific management (Action 1.4) and translocation programs (Action 4).*

Community members participating in Coastal Fontainea recovery will be trained. Community members and/or groups will not be permitted to work in the habitat of the Coastal Fontainea without the permission of the landowners.

Justification:

The conservation of biodiversity is the responsibility of the whole community and to this end the DEC supports and encourages such involvement. The recovery of the Coastal Fontainea will rely on such support and involvement from the community.

Performance criterion:

- Over the life of this Recovery Plan, the recovery program for the Coastal Fontainea has benefited by community involvement, such as landcare groups, in survey, restoration and translocation programs.

**Objective 6: To develop and implement a contingency plan to ensure the long-term survival of the Coastal Fontainea.**

*Action 6.1*

*The DEC will ensure an ex situ collection is established and maintained for the security of the population and the translocation program (Appendix 7).*

*Action 6.1.1*

*The DEC will liaise with Ballina Shire Council and an appropriate nursery facility to ensure an appropriate ex situ collection is established in accordance with the translocation proposal (Appendix 7).*

Ballina Shire Council has offered the use of their nursery facilities and grounds to hold a living collection of the Coastal Fontainea *ex situ*.

*Action 6.1.2*

*The DEC will liaise with appropriate people to ensure the Coastal Fontainea individuals currently growing in local, regional and State botanic gardens are maintained.*

Plants of Coastal Fontainea are known to be held at Mount Warning Arboretum, Mount Annan Botanic Garden and at North Coast Regional Botanic Garden.

*Action 6.1.3*

*The DEC will identify locations where specimens of the Coastal Fontainea are growing and, where appropriate, will incorporate this material into the ex situ collection.*

Ballina Shire Council, local rainforest nurseries and private individuals are known to have specimens of Coastal Fontainea. It is possible that other people also have specimens of the species.

*Action 6.1.4*

*The DEC will ensure maintenance of the ex situ collection is undertaken in accordance with the translocation proposal (Appendix 7).*

It is important that the *ex situ* collection is maintained under strict protocols to minimise the potential for compromising the success of the project. This should include the maintenance of information on the location, status, use, and origin of the *ex situ* Coastal Fontainea individuals and material used (e.g. seed, cuttings).

#### *Action 6.1.5*

*The DEC will facilitate the collation of information on the progress and success of the known ex situ collection.*

In addition to collecting *ex situ* data, the data will need to be evaluated to determine the most effective methods of *ex situ* propagation, and identify problems with propagating the species.

#### Justification:

The DEC considers that the establishment of a living collection, and properly maintained *ex situ* collection, for the Coastal Fontainea may safeguard the population from extinction.

It is important that appropriate *ex situ* data are collected and managed to ensure that the most effective techniques are applied. This is required to avoid and minimise wasting resources on ineffective techniques, and to also avoid increasing the potential for further inbreeding in Coastal Fontainea.

This system should also ensure that specimens are maintained in such a way as to avoid inappropriate mixing of specimens in the collection during their time at the nursery facilities.

This contingency *ex situ* collection would aim to provide representative material for both the translocation project as well as providing a safeguard of the genetic material of the Coastal Fontainea population should the translocation project not be successful.

#### Performance criteria:

Over the life of this Recovery Plan:

- existing *ex situ* individuals are maintained in the collection, and contingency arrangements implemented where appropriate;
- a living collection is established at Ballina Nursery;
- an *ex situ* program is established and maintained for the translocation program, should the translocation project not be successful; and
- any problems with the establishment or maintenance of the *ex situ* collection are documented and rectified.

#### *Action 6.2*

*The Director-General of the DEC will assess the identification of Critical Habitat as a conservation option for this species where current management arrangements are unlikely to adequately conserve the Coastal Fontainea.*

An assessment will be undertaken by the DEC to investigate the need for, and feasibility of, declaring Critical Habitat for Coastal Fontainea. The assessment will include the likelihood of Critical Habitat achieving additional protection for the Coastal Fontainea population. If considered appropriate, the DEC will propose the identification of Critical Habitat.

#### Justification:

The DEC considers that, as a contingency plan, the declaration of Critical Habitat for the Coastal Fontainea may safeguard the population from extinction.

#### Performance criteria:

- Areas of suitable land at Lennox Head are assessed for their relevance as Critical Habitat, including potential benefits to the Coastal Fontainea from listing areas as Critical Habitat.
- If the DEC considers it appropriate, these areas of Critical Habitat are submitted to the Minister for the Environment to be declared for the Coastal Fontainea.

### **Objective 7: To prepare relevant material to assist the review of the status of the Coastal Fontainea.**

#### *Action 7.1*

*The DEC will prepare recommendations to the Commonwealth Department of Environment and Heritage and the IUCN, that on the basis of current knowledge, the Coastal Fontainea warrants listing as a Critically Endangered Species on the EPBC Act.*

The assessment of data available about the Coastal Fontainea and its habitat has been undertaken and suggests that a review of its status is warranted.

#### Justification:

In preparing this Recovery Plan, the Coastal Fontainea was assessed under the IUCN Red List Categories and Criteria Version 3.1 (IUCN 2001). The species has been determined to meet the criteria for reclassification as a Critically Endangered Species under the Commonwealth legislation criteria. Details of the criteria and assessment are in Appendix 1.

#### Performance criteria:

- By the end of the second year, recommendations have been made to the Commonwealth Government and the IUCN.

- By the end of the life of this Recovery Plan, the conservation status of Coastal Fontainea is appropriately reflected in relevant legislation and policy.

## 7 Implementation

Table 1 outlines the estimated cost and schedule for implementation of recovery actions specified in this plan. The DEC is the only party identified for implementation of the actions.

## 8 Consideration of Social and Economic Consequences

### 8.1 Consideration of economic costs and benefits

The total cost of implementing the recovery actions is estimated at \$306 600 (\$146 000 in cash) over the five-year period covered by this plan (Table 1). Approximately \$25 000 from existing resources within the DEC will be provided. The balance of the cost is unsecured (\$111 000) and funding will be sought to implement the associated actions. The costings for implementation of the recovery actions are itemised in Table 1.

It is necessary to consider the economic benefits of the proposed recovery program in order to determine the net economic cost or benefit to society. The following effects, although difficult to quantify in financial terms, are likely economic benefits to society as a result of implementation of the Recovery Plan:

- provision of protected habitat for threatened and other significant flora and fauna species in protected Coastal Fontainea habitat;
- increased value of the protected land through habitat enhancement and intrinsic value of the threatened plant community; and
- meeting the government's commitment to biodiversity conservation.

However, this draft Recovery Plan acknowledges that the presence of the Coastal Fontainea and its habitat may lead to decreased value of the private property. This is largely due to the land value at Lennox Head and the constraints on development as a result of habitat protection for Coastal Fontainea.

### 8.2 Consideration of social costs and benefits

The Recovery Plan may have social benefits for local communities, through increasing general public

awareness of natural heritage values of the areas in which it occurs.

The community will benefit from the conservation of the Coastal Fontainea through opportunities to enjoy the rare scenic beauty of the rural landscape with remnant vegetation overlooking the ocean, a sight becoming more valued and appreciated by the community.

The proposed involvement of the community in the recovery of the Coastal Fontainea will provide participants with a sense of contributing their time to a valuable cause.

## 9 Biodiversity Benefits

The appropriate ecological management of the Coastal Fontainea and its habitat will contribute to the conservation of several other threatened and rare flora species which have been recorded in the habitat of the known sub-populations. Species include *Macadamia tetraphylla* (Rough-leaved Macadamia), *Tinospora tinosporoides* (Arrow-head Vine), *Archidendron hendersonii* (White Lace Flower) (also at its southern limit), *Rhodamnia maideniana*, *Archidendron muellerianum* (Veiny Lace Flower), *Quassia* sp. 2, *Trichosanthes subvelutina* (Silky Cucumber) and *Sterculia quadrifida* (Peanut Tree) (also at its southern limit).

The littoral rainforests where the Coastal Fontainea is found are also habitat to fauna species of conservation significance. Threatened fauna species include *Monarcha leucotis* (White-eared Monarch), *Ptilinopus magnificus* (Wompoo Fruit-Dove), *Ptilinopus superbus* (Superb Fruit-Dove), *Ptilinopus regina* (Rose-crowned Fruit-Dove), *Pteropus poliocephalus* (Grey-headed Flying-fox), *Miniopterus australis* (Little Bentwing-bat), *Nyctophilus bifax* (Eastern Long-eared Bat), *Chalinolobus nigrogriseus* (Hoary Watted Bat), *Scoteanax rueppellii* (Greater Broad-nosed Bat) and *Syconycteris australis* (Common Blossom-bat) (McKinley *et al.* 1999). In addition, conservation of littoral rainforest assists in providing winter food source for the rainforest pigeons, flying foxes and migratory birds (McKinley *et al.* 1999).

Littoral rainforest was listed as an Endangered Ecological Community on the TSC Act in 2004 (NSW Scientific Committee 2004). Littoral rainforest is one of Australia's rarest rainforest types and probably the most threatened due to continuing pressures of urban expansion on the coastal zone. The remaining littoral rainforest occurs as scattered, and increasingly isolated, degraded stands within the influence of salty onshore sea winds. Protection of the Coastal Fontainea and its habitat will contribute to the conservation of littoral rainforest.

## 10 Preparation of the Recovery Plan

This Recovery Plan was prepared for the DEC by Maria Matthes, Threatened Species (North East Branch), DEC, with assistance from Stephanie Horton (environmental consultant).

## 11 Review of the Recovery Plan

A review of this Recovery Plan will occur within five years of the date of its publication. This review will include an evaluation of the translocation trials and is to be aimed at establishing self-sustaining populations in nature.

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**13 List of Abbreviations**

<b>DEC</b>	Department of Environment and Conservation	<b>NPW Act</b>	NSW <i>National Parks and Wildlife Act</i> 1974
<b>DIPNR</b>	Department of Infrastructure, Planning and Natural Resources	<b>NPWS</b>	NSW National Parks and Wildlife Service
<b>EP&amp;A Act</b>	NSW <i>Environmental Planning and Assessment Act</i> 1979	<b>NSW</b>	New South Wales
<b>EPBC Act</b>	Commonwealth <i>Environment Protection and Biodiversity Conservation Act</i> 1999	<b>NV Act</b>	NSW <i>Native Vegetation Act</i> 2003
<b>IUCN</b>	International Union for the Conservation of Nature and Natural Resources	<b>RFS</b>	Rural Fire Service
<b>LG Act</b>	NSW <i>Local Government Act</i> 1993	<b>SIS</b>	Species Impact Statement
		<b>TSC Act</b>	NSW <i>Threatened Species Conservation Act</i> 1995
		<b>VCA</b>	Voluntary Conservation Agreement

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

Action No.	Action Title	Priority	Estimated Cost/Year					Total Cost	Responsible Party/Funding Source	In-Kind	Cash
			Year 1	Year 2	Year 3	Year 4	Year 5				
<b>1.0</b>	<b>Protect and manage populations and habitat</b>										
1.1	Environmental planning and impact assessment	1	1 500					1 500	DEC	1 000	500
1.2	Liaison with landowners and managers	1	4 000	2 000	2 000	1 000	1 000	10 000	DEC	10 000	
1.3	Security of populations	1	200	200	200	200	200	1 000	DEC	1 000	
1.4	Site specific management	1									
1.4.1	Preparation of site plans	1	6 500					6 500	DEC	2 500	4 000
1.4.2	Implementation of site plans >	1	30 400	15 400	15 400	15 400	6 500	83 100	DEC	61 600	21 500
1.4.3	Fire management	2	500					500	DEC	500	
<b>2.0</b>	<b>Surveys and data collection and management</b>										
2.1	Survey	1		5 000				5 000	DEC	1 000	4 000
2.2	Data collection #	1	2 000					2 000	DEC	2 000	
2.3	Data management	1									
2.3.1	Record management	1	2 000	1 000	1 000	1 000	1 000	6 000	DEC	6 000	
2.3.2	Data dissemination	1	1 000					1 000	DEC	1 000	
2.3.3	Data quality control	1	500					500	DEC	500	
<b>3.0</b>	<b>Improving knowledge</b>										
3.1	Site assessment	1	2 500					2 500	DEC	1 000	1 500
3.2	Research plan	1	6 000					6 000	DEC	1 500	4 500
3.3	Experimental research	1	10 000	10 000	10 000	6 000	6 000	42 000	DEC	8 000	34 000
3.4	Monitoring	1	10 000	10 000	10 000	10 000	10 000	50 000	DEC	10 000	40 000

<b>4.0</b>	<b>Translocation</b>										
4.1	Translocation proposal =	1	4 000					4 000	DEC	4 000	
4.2	Implementation of translocation proposal =	1	11 000	5 000				16 000	DEC	13 000	3 000
4.3	Evaluation of trial translocation	1					5 000	5 000	DEC	5 000	
<b>5.0</b>	<b>Community awareness and involvement program</b>										
5.1	Targeted information packages	1	5 500	500				6 000	DEC	5 000	1 000
5.2	Community involvement =	1	1 000					1 000	DEC	1 000	
<b>6.0</b>	<b>Contingency actions</b>										
6.1	Establishment and maintenance of <i>ex situ</i> collections >	1									
6.1.1	Establishing <i>ex situ</i> collection	1	6 000	4 000				10 000	DEC	3 000	7 000
6.1.2	Liaison with collection managers										
6.1.3	Catalogue existing <i>ex situ</i> collections	1	2 000					2 000	DEC	2 000	
6.1.4	Maintenance of <i>ex situ</i> collection	1	5 000	5 000	5 000	5 000	5 000	25 000	DEC	5 000	20 000
6.1.5	<i>Ex situ</i> data collation and evaluation	1	3 000	2 000	2 000	2 000	4 000	13 000	DEC	8 000	5 000
6.2	Assess Critical Habitat #	3					3 000	3 000	DEC	3 000	
<b>7.0</b>	<b>Conservation status review</b>										
7.1	Documentation		2 000	2 000				4 000	DEC	4 000	
<b>Total</b>			116 600	62 100	45 600	40 600	41 700	<b>306 600</b>		160 600	146 000

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. The in-kind contribution for Action 1.5 includes predicted volunteer labour, such as Landcare. This work would otherwise need to be funded.

'Cash' funds represent the salary component for temporary staff, contractors and other costs such as the purchasing of survey and laboratory equipment.

> = Cash funds for this action may increase pending assessment and recommendations from implementation of other actions.

# = Priority and costing of these actions will depend on the identified need for the action and would require "emergency" funding. The cost borne to identify the need is met in other actions.

= = Costs incorporated into other actions

Costs do not include administration on-costs and will be subject to funding source and purpose of expenditure.



## Appendix 1: IUCN Red List Categories and Criteria - Assessment of the Coastal Fontainea (*Fontainea oraria*)

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In preparing this draft Recovery Plan, the Coastal Fontainea was assessed under the IUCN Red List Categories and Criteria Version 3.1 (2001). The species has been determined to meet the criteria for a conservation status of Critically Endangered under Criteria B1, B2, C and D.

### IUCN Definitions

A taxon is **Critically Endangered** when the best available evidence indicates that it meets any of the criteria A-E for Critically Endangered, and it is therefore considered to be facing an extremely high risk of extinction in the wild.

A **population** is defined as the total number of individuals of the taxon and for functional reasons is measured as numbers of mature individuals only.

**Sub-populations** are defined as geographically or otherwise distinct groups in the population between which there is little demographic or genetic exchange (one successful migrant individual or gamete per year or less).

**Mature individuals** are the number of individuals known, estimated or inferred to be capable of reproduction. The following IUCN (2001) points are considered relevant to estimate the quantity of mature Coastal Fontainea:

- mature individuals that will never produce new recruits should not be counted (e.g. densities are too low for fertilisation).
- in the case of populations with biased adult or breeding sex ratios, it is appropriate to use lower estimates for the number of mature individuals, which takes this into account.
- re-introduced individuals must have produced viable offspring before they are counted as mature individuals.

**Severely Fragmented** refers to a situation in which increased extinction risk to the taxon results from the fact that most of its individuals are found in small and relatively isolated sub-populations. These small sub-populations may go extinct, with a reduced probability of recolonisation.

**Extent of Occurrence** is defined as the area contained within the shortest continuous imaginary boundary which can be drawn to encompass all the known, inferred or projected sites of present occurrences of a taxon.

**Area of Occupancy** is defined as the area with its 'extent of occurrence' which is occupied by a taxon. The measure reflects the fact that a taxon will not usually occur throughout the area of its extent of occurrence, which may contain unsuitable or unoccupied habitats.

**Location** defines a geographically or ecologically distinct area in which a single threatening event can rapidly affect all individuals of the taxon present. The size of the location depends on the area covered by the threatening event and may include part of one or many sub-populations.

### *Fontainea oraria* (Coastal Fontainea) Assessment

#### Criterion B1

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**Extent of occurrence is estimated to be less than 100 km<sup>2</sup>, and estimates indicate the species is:**

- severely fragmented or is known to exist at a single location, and continuing decline observed, inferred or projected,
  - in extent of occurrence or area of occupancy or area, extent and/or quality of habitat or number of sub-populations or number of mature individuals.

The extent of occurrence of the Coastal Fontainea is estimated to be less than 1 km<sup>2</sup>. The population is considered severely fragmented (with no sub-population having more than 50 mature individuals) and three of the four sub-populations have only one individual (that are not considered to be mature).

All the sub-populations occur within a single location such that random stochastic events in the locality could reduce or destroy the population.

A continuing decline in the Coastal Fontainea may occur:

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- in the area of occupancy or extent of occurrence if any of the single individual sub-populations were to become extinct. This may be a substantial decline given the overall rarity of the species.
- if the quality of the Coastal Fontainea habitat continues to be exposed to degrading processes by the nature of its location, to urban subdivision and the current level of degradation.
- as the chance of a reduction in the number of mature individuals or number of sub-populations is relatively high, given the threats and pressure on the Coastal Fontainea, and most plants have been affected by the insect pests (increased vulnerability).

### **Criterion B2**

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#### **Area of occupancy estimated to be less than 10 km<sup>2</sup> and estimates indicate the species is:**

- severely fragmented or is known to exist at a single location, and continuing decline observed, inferred or projected
  - in extent of occurrence or area of occupancy or area, extent and/or quality of habitat or number of sub-populations or number of mature individuals.

The area of occupancy of the Coastal Fontainea is estimated to be less than 500 m<sup>2</sup>.

The population is considered severely fragmented (with no sub-population having more than 50 mature individuals) and three of the four sub-populations have only one individual (that are not considered to be mature).

All the sub-populations of the Coastal Fontainea occur within a single location such that random stochastic events in the locality could reduce or destroy the population.

A continuing decline in the Coastal Fontainea may occur:

- in the area of occupancy or extent of occurrence if any of the single individual sub-populations were to become extinct. This may be a substantial decline given the overall rarity of the species.
- if the quality of the Coastal Fontainea habitat continues to be exposed to degrading processes by the nature of its location, to urban subdivision and the current level of degradation.
- as the chance of a reduction in the number of mature individuals or number of sub-populations is relatively high, given the threats and pressure on the Coastal Fontainea, and most plants have been affected by the insect pests (increased vulnerability).

### **Criterion C**

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#### **Population size estimated to number fewer than 250 mature individuals, and**

- a continuing decline observed, inferred or projected in the number of mature individuals, and
- the population structure is in the form of
  - severely fragmented (no sub-populations contain more than 50 mature individuals), and
  - at least 90% of mature individuals in one sub-population.

The Coastal Fontainea population is generously estimated to be less than seven individuals (the number of adult plants at the main sub-population). However, the effective population size is estimated at less than four mature individuals based on the dioecious nature of the species and the number of males in the sub-population that were found to be contributing to future generations.

A continuing decline in the Coastal Fontainea may occur:

- in the area of occupancy, or extent of occurrence, if any of the single individual sub-populations were to become extinct. This may be a substantial decline given the overall rarity of the species.
- if the quality of the Coastal Fontainea habitat continues to be exposed to degrading processes by the nature of its location, to urban subdivision and the current level of degradation.
- as the chance of a reduction in the number of mature individuals or number of sub-populations is relatively high, given the threats and pressure on the Coastal Fontainea, and most plants have been affected by the insect pests (increased vulnerability).

It is considered to be severely fragmented (with no sub-population having more than 50 mature individuals) and three of the four sub-populations have only one individual (that are not considered to be mature). All the mature individuals of the Coastal Fontainea occur in the one sub-population.

#### **Criterion D**

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##### **Population size estimated to number fewer than 50 mature individuals.**

The Coastal Fontainea population is estimated to be less than seven individuals (the number of adult plants at the main sub-population). However, the effective population size is estimated at less than four mature individuals based on the dioecious nature of the species and the number of males in the sub-population that were found to be contributing to future generations.

## Appendix 2: Submission

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### Recovery Plan Submission

Name Individual/  
Organisation:

Postal Address:

Postcode:

Contact Number(s):

Date:

#### **Draft Recovery Plan: *Fontainea oraria* (Coastal Fontainea)**

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 for a period of up to 2 years from the closing date. The submission of personal information is voluntary. Copies of submissions will be available on request, 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, please indicate below why you wish your personal details to remain confidential to the DEC. Please note that access to the details may be requested under the *Freedom of Information Act 1989*. You will be consulted if this happens.

Further information on the *Privacy and Personal Information Protection Act 1998* and the *Freedom of Information Act 1989* may be obtained from the DEC FOI/Privacy Contact Officer or the DEC website: [www.environment.nsw.gov.au](http://www.environment.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  
C/- Coastal Fontainea Recovery Plan Co-ordinator  
DEC Environment Protection and Regulation Division  
Threatened Species Unit – North East Branch  
Locked Bag 914  
Coffs Harbour NSW 2450



### Appendix 3: Species Profile and Environmental Impact Assessment Guidelines for the Coastal Fontainea (*Fontainea oraria*)

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## 1 Background

Coastal Fontainea is known in the wild from four small sub-populations near Lennox Head on the far north coast of New South Wales (NSW). These sub-populations occur within a 600 m radius. The total population comprises ten adults and 45 seedlings and juveniles.

The three southern sub-populations occur in the same rainforest remnant. Two of these sub-populations occur as single specimens, isolated from the main clump by about 80 m and 200 m respectively. The main sub-population is comprised of seven adults and all the seedling and juvenile plants. The northern sub-population also occurs as a single specimen.

### 1.1 Conservation Status

The Coastal Fontainea is listed as Endangered on the Commonwealth's *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and on the NSW *Threatened Species Conservation Act 1995* (TSC Act). Using the IUCN Red Book criteria, the Coastal Fontainea warrants a listing of Critically Endangered.

## 2 Species Information

### 2.1 Description

The Coastal Fontainea is a small tree or large shrub that may grow to a height of 8–10 m. Its lower trunk is fluted, twisted and commonly multi-stemmed. The bark varies from smooth to slightly scaly and from grey-brown when older to pea-green when younger.

The leaves of the Coastal Fontainea are alternate, simple, elliptic, discolorous, glabrous and glossy. They are 8–15 cm long. There are two small oval glands raised 0.5–4 mm from the leaf base. Leaf shoots are hairy (Floyd 1989; Harden 1991). The mid-ribs and lateral veins are distinct and raised on both leaf surfaces. The petioles (leaf stalks) are 1–2 cm long and swollen at the junction with the leaf base. The leaves are spirally arranged up the stem. The leaf stalks exude a clear watery sap (Floyd 1989; Hunter *et al.* 1992).

The Coastal Fontainea has small (1 cm diameter) whitish flowers with four or five petals with silky to velvety hairs (4–6 mm long). There are often 2–3 flowers on a female inflorescence occurring in the axils or at the ends of branches. The male flowers have 20–24 stamens joined into a tube at the base

(Floyd 1989). The species is thought to have male and female flowers on separate plants. The draft Recovery Plan provides an illustration of the male and female flowers.

The fruit of the Coastal Fontainea is a 3–6 grooved pink to red globose drupe, generally ripe around March–April. They are about 2.5 cm diameter and 2–3 cm long. Within the drupe, the endocarp is hard, wrinkled and grooved with 2–3 hard sharp ridges. There are 3–4 seeds per fruit (Jessup & Guymer 1985; Floyd 1989; Hunter *et al.* 1992).

## 2.2 Habitat

The known Coastal Fontainea grow in remnant stands of littoral rainforest dominated by *Guioa* (*Guioa semiglauca*). Over forty exotic species have been recorded in the Coastal Fontainea habitat. A list of native and exotic species commonly associated with the Coastal Fontainea is provided in the draft Recovery Plan.

The Coastal Fontainea occurs on moderately steep upper hill slopes and crests of northerly and easterly facing hills about 50 m above sea level. The four known sub-populations are within 1 km of the ocean.

The Coastal Fontainea occurs on highly fertile, shallow red-brown krasnozem soil derived from basalt. The Coastal Fontainea plants are growing in areas where this soil is limited to the inter-rock spaces between an abundance of basaltic rocks.

## 2.3 Biology and Ecology

The life history and ecology of the Coastal Fontainea is largely unknown. The following information is based on opportunistic field observations and the genetic research. Further information is provided in the draft Recovery Plan for the species.

The Coastal Fontainea is an obligate seed regenerator, which means it relies on seed production and seedling establishment for continued persistence. It doesn't have other mechanisms, such as the ability to resprout or sucker, to recover from severe disturbance events. However, some adult specimens are multi-stemmed, demonstrating the species ability to coppice.

The Coastal Fontainea flowers spring to mid-summer although flowers have been observed during other seasons. The Coastal Fontainea appears to have variable periods of fruiting, with ripe fruit being observed mainly in autumn (Floyd 1989; Hunter *et al.* 1992). However, fruit have also been observed during spring and summer (L. Bennetts pers. comm.).

The sex of the adult at the northern sub-population is unknown. The planted specimens are not yet mature. One female is known at the main southern sub-population. A few male plants are contributing

to future generations (Rossetto & McNally 2000; Rossetto *et al.* 2000). The sex of most plants has not been determined. There is some evidence to suggest the species is capable of having both male and female flowers on the one plant (Andrew Murray pers. comm.; M. Matthes pers. obs.). The degree to which this phenomena occurs in the species is unknown.

It is likely that the species is probably insect pollinated as it has small relatively insignificant flowers and unspectacular inflorescences (Williams & Adam 1999). The Coastal Fontainea may also be wind pollinated as discussed by Bullock (1994, in Williams & Adam 1999). Although, the genetic studies indicate this would only be over a short distance as pollen from plants 5 m from the female plant were not contributing to future generations (Rossetto & McNally 2000).

One fruit has been observed with a hole containing eggs (Bennetts, pers. comm.). The identity of the insect is unknown and it is the only record of pre-dispersal seed predation.

Seed of the Coastal Fontainea is most likely dispersed locally by wind over short distances, gravity or ballistic methods (Hunter *et al.* 1992). Short distance dispersal of seed may also be assisted by birds or rats. Seedlings and seed observed on the ground are all within close proximity, less than 5 m, from the female parent tree.

It is expected that the seed will germinate within 12 months of production. Germinated seed was observed when fruit had just completed falling. Although, some short-term dormancy mechanism may be operating that extends this period slightly.

Recruitment of the Coastal Fontainea away from the parent tree is limited by poor seed dispersal mechanisms.

Reasonable levels of genetic diversity were detected within the Coastal Fontainea population with all parental trees belonging to the same genetic provenance and therefore contain equally valuable genetic resources. However, substantial over-contribution from one individual (the female) and a few males was detected (Rossetto & McNally 2000; Rossetto *et al.* 2000). This is a likely result due to the proximity to the female plant. The genetic studies show that seedlings are obviously related to the known adult plants and it is therefore unlikely that an unknown specimen is contributing to the current progeny (Rossetto & McNally 2000; Rossetto *et al.* 2000). The genetic diversity recorded for the Coastal Fontainea was similar to values recorded for other rare outcrossing species (Rossetto *et al.* 1995).

### 3 Threats and Management Issues

#### 3.1 Threats

Current threats and management issues operating at the Coastal Fontainea sub-populations and affecting their habitat include habitat destruction, habitat fragmentation and isolation, habitat degradation (exotic weed infestation, weed control activities, stormwater management and erosion control, cattle grazing, ocean wind shear, increased pressure from adjacent developments), lack of knowledge of biological and ecological requirements of the Coastal Fontainea, inbreeding, dieback, potential fire events, physical and mechanical damage and collection for propagation. The degree of the impact of these on the Coastal Fontainea and its habitat varies according to their intensity and proximity to the Coastal Fontainea plants.

The draft Recovery Plan has classified threats according to the potential impact of the threat and a discussion is provided of each threat.

#### 3.2 Recovery Plan

A draft Recovery Plan has been prepared for the Coastal Fontainea that will be exhibited during 2005. This draft Recovery Plan identifies the actions required to protect and maintain known and potential sub-populations and habitat of the Coastal Fontainea and to give direction to research to assist future management.

### 4 Survey

*Fontainea oraria* (Coastal Fontainea) is a relatively indistinctive plant, easily blending into its surrounding rainforest habitat. There are no seasonal survey constraints for this plant. However, it is more easily detected and identified during the flowering period and when fruit are on the ground.

Surveys should have two objectives:

- to determine presence/absence; and where the plant is present; and
- to determine the abundance and size structure of sub-populations.

Surveyors should be familiar with the identifying characteristics of the species as described in the description sections of the Species Profile and the Recovery Plan.

Survey for the Coastal Fontainea should not be limited to areas within the existing distributional limits. The recommended area to target this species is littoral rainforest on krasnozem soil between the Queensland–NSW border and the Richmond River, particularly from Byron Bay to Ballina inclusively. The majority of these remnants are identified in McKinley *et al.* (1999).

Targeted survey for this plant should be conducted in suitable habitat by a small team of 2–4 people. The random meander technique should be undertaken so that all areas of potential habitat are sighted. It is also recommended transects 10 m apart are also undertaken so that all large shrubs and trees are visible. Any trees sighted with trunks of similar appearance (as described in the Species Profile and draft Recovery Plan) to the Coastal Fontainea should be more closely investigated.

Where the Coastal Fontainea is present, the site assessment form in the draft Recovery Plan should be completed. Any potential or confirmed new locations should be reported to the Department of Environment and Conservation (DEC) at the earliest opportunity.

### 5 Licensing

Any proposed works not requiring development consent or activity approval under the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) or the NSW *Native Vegetation Act 2003* (NV Act), which is likely to pick Coastal Fontainea, or damage its habitat, requires a licence from the DEC under the provisions of the TSC Act or 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 (SIS) is required.

'Pick' as defined by the TSC Act includes gather, pluck, cut, pull up, destroy, poison, take, dig up, remove or injure the plant or any part of the plant. If a person is likely to or would like to 'pick' the Coastal Fontainea they should contact the DEC to determine what authorisation is required.

### 6 Environmental Impact Assessment Guidelines

The following information is provided to assist authors of Species Impact Statements, development and activity proponents, and determining and consent authorities, who are required to prepare or review assessments of likely impacts on threatened species pursuant to the provisions of the EP&A Act. These guidelines should be read in conjunction with the *NPWS Information Circular No. 2: Threatened Species Assessment under the EP&A Act: The '8 Part Test' of Significance* (November 1996) and any revisions to the assessment of significance, the draft Coastal Fontainea Recovery Plan and the Species Profile.

#### 6.1 Land Tenure and Zoning

The northern sub-population of the Coastal Fontainea grows in a Ballina Shire Council Reserve. Under the Ballina Local Environment Plan 1987



(Ballina Shire Council 1995) this land is zoned 2(a) Residential but is managed as a reserve.

The southern sub-populations of the Coastal Fontainea occur on privately owned land. Under the Ballina Local Environment Plan 1987 this land is zoned 7(l) Environmental Protection (Habitat) (Ballina Shire Council 1995). Development that is permissible with consent under this zoning includes: agriculture, bushfire hazard reduction, camping grounds, community buildings, dwelling-houses, environmental educational facilities, environmental protection works, forestry, home industries, open space, roads and utility installations. However, the objective of this zoning is to protect lands of particular significance and any development consent granted is not to conflict with this objective.

The buffer area is zoned 7(d) Environmental Protection (Scenic/Escarpment). Within this area any purposes other than the following (which are prohibited) are permissible with consent: bulk stores, caravan parks for permanent occupation, industries, mineral sand mining, mines, motor showrooms, recreational vehicle areas, residential buildings (other than dwelling-houses or dwellings), shops (other than general stores) and warehouses.

## 6.2 Legislation

### ***Environmental Planning and Assessment Act 1979***

This Act provides for the consideration of the Coastal Fontainea in land use planning issues. Areas providing important habitat for the Coastal Fontainea can be protected under appropriate environmental zoning in Local Environmental Plans prepared under Part 3 of the EP&A Act. Certain State Environmental Planning Policy Policies (SEPPs) (Part 3 EP&A Act) also afford a level of protection to some areas of the Coastal Fontainea habitat. These SEPPs include SEPP 26 Littoral Rainforest and SEPP 71 Coastal Protection.

Consent and determining authorities are required to consider potential impacts on the Coastal Fontainea and its habitat when considering an activity or development proposal under Part 4 or Part 5 of the EP&A Act. When considering any development or activity that may affect the Coastal Fontainea, the relevant authorities should consider the strategy outlined in the draft Recovery Plan, including these guidelines.

Where a consent or determining authority considers that a proposed development or activity may result in a significant effect on the Coastal Fontainea or its habitat, a Species Impact Statement is required to be provided with the application or proposal, and consent or approval cannot be granted without the concurrence of the Director-General of the DEC.

### **State Environmental Planning Policy No. 26 – Littoral Rainforest (SEPP 26)**

The aim of SEPP 26 is to provide a mechanism for the consideration of applications for development that is likely to damage or destroy littoral rainforest areas with a view to preservation of these areas in their natural state.

The SEPP 26 identifies and maps discrete areas of littoral rainforest along the NSW coast.

In the case of Coastal Fontainea, it is Ballina Shire Council that is required to consider whether the SEPP 26 is relevant to development applications and council activities. Other public authorities may have requirements under the SEPP 26. Applications that trigger the SEPP 26 require the concurrence of the NSW Minister for Infrastructure and Planning. Where the concurrence of the NSW Minister for Infrastructure and Planning is required, the Director-General of the Department of Infrastructure, Planning and Natural Resources (DIPNR) and the Minister shall consider any representation made by or on behalf of the Director-General of the DEC about the likely impacts of the proposal on the environment.

Both areas of habitat where the Coastal Fontainea occurs in Littoral Rainforest are mapped under the SEPP 26. They occur in SEPP 26 remnant number 37 and remnant number 36. The SEPP 26 remnants have a 100 m buffer from the edge or boundary of the vegetation.

Any proposal to erect a building, carry out work, use the land for any purpose or subdivide it, disturb, change or alter any landform, or disturb, remove damage or destroy any native flora, or dispose of or dump any liquid, gaseous or solid matter within the boundary of these SEPP 26 remnants requires consent from council and the concurrence of the NSW Minister for Infrastructure and Planning. Any proposal to erect a building, disturb, change or alter any landform or disturb, remove damage or destroy any native flora, or dispose of or dump any liquid, gaseous or solid matter within the 100 m buffers of these SEPP remnants also requires consent from council and the concurrence of the NSW Minister for Infrastructure and Planning.

### **State Environmental Planning Policy No. 71 – Coastal Protection (SEPP 71)**

The aim of SEPP 71 is to protect and manage the natural, cultural, recreational and economic attributes of the NSW coast and includes a mechanism for the consideration of development applications that may impact on the coastal environment.

The SEPP 71 applies to the coastal zone as mapped by the Department of Urban Affairs and Planning's (now part of DIPNR) Coastal Zone Maps. Both areas

of habitat containing the Coastal Fontainea occur in the mapped coastal zone under the SEPP 71.

The local government is required to consider whether the SEPP 71 is relevant to development applications and council activities. Other public authorities may also have assessment requirements under the SEPP 71. Where a development or activity is determined to be a State Significant Development, as defined by the SEPP 71, the NSW Minister for Infrastructure and Planning becomes the consent authority. Where a development is determined to be a Significant Coastal Development, as defined by the SEPP 71, the application must be referred to the Director-General of DIPNR for comment.

The SEPP 71 defines state significant development, sensitive coastal development and sensitive coastal locations, and also provides the parameters that trigger the SEPP 71.

For some developments proposed within the coastal zone a Master Plan, adopted by the NSW Minister for Infrastructure and Planning, is required.

#### **Rural Fires Act 1997**

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

#### **Rural Fires and Environmental Assessment Legislation Amendment Act 2002**

The NSW *Rural Fires and Environmental Assessment Legislation Amendment Act 2002* amends the *Rural Fires Act 1997* and several environmental assessment-related Acts. This Act provides for mapping bush fire prone lands and the development of a Bush Fire Environmental Assessment Code. This code is aimed at streamlining the assessment process for hazard reduction works. To this end, the Code includes general ameliorative prescriptions and, in some cases, species specific prescriptions. Threatened species and their habitats are one of the items considered in the code.

### **6.3 Consideration in Strategic Planning**

In considering Coastal Fontainea in strategic planning, such as in the preparation of Local Environment Plans, Local Environment Studies or Regional Vegetation Management Plans, where possible, the threats to Coastal Fontainea identified in the Recovery Plan should be addressed. Efforts should be made in the design of these plans to ensure

that the threats are avoided, minimised or improved upon by appropriately considering them in the planning. Examples include:

- Provision of appropriate Asset Protection Zone (APZ) setbacks that provide adequate safety to life and property whilst not requiring the loss of Coastal Fontainea or its habitat;
- Provision of appropriate buffers that reduce the effects of adjacent development;
- Provision for corridor connections that may contribute to the repair of impacts caused by fragmentation; and
- Ensuring appropriate zoning of 7(l) Environment Protection (Habitat) over land with Coastal Fontainea.

### **6.4 Consideration of Developments and Activities**

Certain developments and activities may be inconsistent with the conservation of the Coastal Fontainea. Therefore, development or activity within the core that would not compromise the conservation of the Coastal Fontainea would be limited to sensitively constructed and located walking tracks and fencing, habitat rehabilitation and weed removal. Within the 100 m buffer of the SEPP 26 remnants in Lennox Head, development and activities that would not compromise the conservation of the Coastal Fontainea would be limited to:

- those that do not adversely impact on the core, including provision of hygiene precautions;
- low impact and environmentally sensitive developments or activities;
- those where all components of the development or activity are situated as far from the core as possible and located downslope of the core;
- developments and activities that include rehabilitation of the core and as much of the buffer as possible; and
- those that incorporate long-term conservation and management of Coastal Fontainea and its habitat into the development or activity.

#### **Mitigating and compensatory measures**

Ameliorative, mitigating and compensatory measures, or a combination of these measures are often proposed to avoid, or reduce, the impacts of the proposed development or activity to threatened species and their habitat. These measures often include, but are not limited to habitat restoration, fire management, water management, translocation, and compensatory habitat.

Habitat restoration includes the control and removal of weeds, habitat rehabilitation, habitat enhancement and habitat creation. Where restoration is proposed in the habitat of Coastal Fontainea, as part of a development or activity, the DEC checklist for bush regeneration in the habitat of threatened species and ecological communities should be adhered to by all people involved in the works.

Fire management includes planning for asset protection. The habitat of the Coastal Fontainea is littoral rainforest and is unlikely to burn except in extremely prolonged dry conditions. The DEC supports the Ballina Bush Fire Risk Management Plan (Rural Fire Service 1999) recommendation that fire be excluded from areas containing rainforest. This includes the areas of littoral rainforest in Lennox Head and is particularly relevant for the remnants known to contain the Coastal Fontainea. Coastal Fontainea occurs near the edges of the remnants it occurs in. Therefore, the DEC recommends that where APZs are required for a development or activity adjacent to habitat of Coastal Fontainea that proposed APZ:

- are consistent with the Planning for Bushfire Guidelines (2001); and
- provide adequate safety to life and property whilst not requiring the loss of Coastal Fontainea or its habitat.

Measures are often undertaken, in association with ancillary works, to maintain water quality (stormwater pollution and sedimentation) and water quantity. Although the primary purpose of these works is often other than for the protection of threatened species, they may have secondary benefits to threatened species and their habitat, e.g. sedimentation fences placed at appropriate locations and maintained accordingly may benefit Coastal Fontainea and its habitat. Any proposed ancillary works should be designed and located to benefit Coastal Fontainea and its habitat.

Baseline data of the water quality (including pH, oxygen levels etc.), water quantity and natural flow regimes should be provided. Identified thresholds for water quality and water quantity should be determined and maintained. The thresholds should be justified in terms of maintaining the habitat for Coastal Fontainea. Water quantity to adjacent habitats is to be maintained. There should be no reduction in the amount of water entering the Coastal Fontainea habitat as a result of stormwater or sediment management, or road design. Stormwater flows should mimic, as closely as possible, natural pre-development patterns in terms of frequency, quantity and quality.

In a development context, translocation is not considered an appropriate mitigating measure to

compensate for the loss of any natural specimens of the Coastal Fontainea. *In situ* conservation is the most effective management option for the Coastal Fontainea and inappropriate planting of the Coastal Fontainea may detrimentally affect the lifecycle of the species and compromise recovery efforts. All individuals of the Coastal Fontainea are considered important and should be considered for their role in assisting the species move to a position of self-sustainability in nature. Translocation is an action in the draft Recovery Plan. Any translocation proposal for Coastal Fontainea is to be prepared and implemented in accordance with Action 4 and the translocation proposal (Appendix 7) of the draft Recovery Plan.

In general, compensatory habitat is considered as an option where the impacts to threatened species and their habitat cannot be avoided, or significantly reduced, by ameliorative or other compensatory measures. The extent and cost of compensatory habitat usually reflects the extent and conservation status of those habitat(s) being impacted and the level of degradation or destruction of the habitats being compensated for. Compensatory habitat options are likely to be limited for Coastal Fontainea due to: land value in Lennox Head; the small size of remaining littoral rainforest remnants in Lennox Head; and that these remnants are subject to the same, or similar, threats as the remnants known to contain Coastal Fontainea.

All proposed avoidance, ameliorative, mitigating and compensatory actions or measures are to have an associated monitoring program to evaluate the effectiveness of the actions or measures. The monitoring program should provide details of each action or measure, the objectives of the monitoring, the method of the monitoring, the reporting framework, the duration and frequency, and a feedback loop to refine and improve management actions.

## 6.5 Assessment of Significance

This section is designed to assist with the assessment of developments, activities or actions that may impact on Coastal Fontainea, particularly with assessments under Section 5A of the EP&A Act. Any guidelines, prepared by the DEC, to assist with consideration of the factors to be considered when determining whether the proposal is likely to significantly affect a threatened species, population or ecological community, or its habitat.

### Limit of known distribution

The distribution of the Coastal Fontainea is highly restricted, with four sub-populations distributed less than 1 km apart near Lennox Head in northern NSW. The population occurs within 1 km of the coast.

The species is likely to have always had a restricted distribution. However, its rarity within potential habitat is likely to be the result of large-scale clearing of its “littoral rainforest on krasnozem soil” habitat, and its inability to colonise potential habitat. The remaining habitat is fragmented and degraded.

### **Life cycle of the species**

The limited understanding of the biology and ecology of the Coastal Fontainea is described in the draft Recovery Plan and summarised in the Species Profile. The lifecycle of the Coastal Fontainea is already disrupted such that the species has been placed at risk of extinction. Any action that further disrupts the lifecycle of the species should be considered significant, as it will increase the existing risk to the species. The lifecycle of the Coastal Fontainea is likely to be disrupted should any of the following occur:

#### Physical destruction

The physical destruction of plants is considered as the removal of, at least the above ground portion of, the plant. On current knowledge, the Coastal Fontainea reproduces vegetatively, only by way of coppicing after disturbance. The degree (frequency, duration, intensity, season) of disturbance from which it is capable of responding is unknown. The species primarily relies on seed to regenerate. Viable seeds are produced when a reproductively mature male and female plant occur within close proximity and both are fecund at the same time. The plant's persistence is likely to depend on the appropriate management of its habitat at known locations.

#### Physical damage

Physical damage to plants may result from trampling by humans or stock, or inadvertently during the removal of exotic weeds such as lantana from the habitat of the Coastal Fontainea, or during the removal of branches to undertake integrated pest management.

Generally, the significance of a particular action which physically destroys individual plants will require (i) an examination of the number of plants to be destroyed in relation to the proportion of the relevant sub-unit/sub-population sizes<sup>2</sup>; and (ii) a discussion of the possibility of recovery from the disturbance. However, given the situation of the Coastal Fontainea, the loss of any individuals is considered to be significant in maintaining the species genetic diversity and for its long-term persistence.

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<sup>2</sup> A description of sub-populations, including estimates of numbers of individuals is provided in the draft Recovery Plan.

### **Habitat modification**

Habitat modification may affect the lifecycle of the Coastal Fontainea by altering the ecological processes that underpin the fitness of suitable habitat. Habitat modification may include: fire events, weed invasion, alteration to drainage, and soil compaction. The effects of habitat modification are further discussed in the draft Recovery Plan.

### **Threatening processes**

The Key Threatening Process listed in the TSC Act that has been identified as likely to affect the Coastal Fontainea is “Clearing of Native Vegetation”. Additional threats to sub-populations of the Coastal Fontainea have been identified in the Species Profile and are further discussed in the draft Recovery Plan.

The main threat to the long-term viability of the Coastal Fontainea is reduced genetic variation due to low numbers of small sub-populations and lack of genetic exchange within and between sub-populations.

### **Viable local population**

The minimum size of a viable local population of the Coastal Fontainea is unknown. However, given that the species is exhibiting signs of inbreeding, any reduction in local population size should be avoided as a precautionary measure. All known individuals, including those in cultivation, are considered to be part of the local population and contribute to the genetic diversity within, and viability of, the species.

### **Significant area of habitat**

In assessing whether a significant area of habitat is to be modified or removed, the focus of the assessment should be with reference to the areas of known habitat within the current distribution (that is, whether the area of habitat is significant in relation to the existing distribution). The following factors should be considered in relation to determining whether a significant area of the Coastal Fontainea habitat exists:

- whether suitable Coastal Fontainea habitat is present and the area (dimensions) of habitat present;
- whether the habitat in question is located within or outside of the current distributional limits<sup>3</sup>;
- whether the habitat in question supports an apparent Coastal Fontainea sub-population, and

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<sup>3</sup> Generally, if a species is located outside of the current distributional limits, it is likely that such habitat would be considered significant. However, in the case of Coastal Fontainea all areas where the species is detected must be considered as a significant area of habitat.

the number, density and age structure of the individuals occurring there;

- the proximity of the habitat in question to existing Coastal Fontainea sub-populations;
- whether the habitat in question is continuous between existing Coastal Fontainea individuals /sub-populations, and facilitates pollinator movement; and
- whether the habitat in question will be permanently or temporarily, modified or removed or both.

The effects of habitat modification and removal are discussed in the draft Recovery Plan for Coastal Fontainea.

### Isolation and fragmentation

Four sub-populations of the Coastal Fontainea have been described. Habitat fragmentation has separated the northern sub-population from the southern sub-populations of the Coastal Fontainea. It is presumed that these remnants may formerly have been part of a system of patches in more-or-less continuous habitat (Rossetto & McNally 2000). The southern sub-populations are not demonstrating any evidence of interaction. The species is currently showing signs of inbreeding.

Fragmentation also leads to increases in the edges to core ratio and the subsequent effects are experienced by the Coastal Fontainea remnants, including impacts of weed invasion and windshear from salt laden winds.

Present ecological understanding is sufficient to predict that further adverse effects of fragmentation and isolation on the Coastal Fontainea sub-populations are likely to include inbreeding and the interruption to the function of pollinators and herbivores. To this end, fragmentation effects may have consequences for fruit production, seed dispersal and therefore recolonisation of adjacent remnants.

### Regional distribution of the habitat

The Coastal Fontainea habitat is littoral rainforest on krasnozem soil. This vegetation community is extremely scarce within the range of the Coastal Fontainea, having largely been cleared for agriculture and development. All littoral rainforest, including regrowth, on land which formerly supported this community, within and surrounding the range of the Coastal Fontainea should be regarded as potential and suitable habitat. The potential regional distribution of the Coastal Fontainea is considered to be consistent with the distribution of littoral rainforest on krasnozem soils between the Richmond River and the Queensland border (McKinley *et al.* 1999). Littoral Rainforest in the NSW North Coast, Sydney Basin and South East Corner Bioregions was listed as an Endangered Ecological Community on the TSC Act in 2004 (NSW Scientific Committee 2004).

### Adequacy of representation in conservation reserves

The Coastal Fontainea is not known from any conservation reserves. The northern most sub-population occurs as a single plant in a council reserve. The other sub-populations are on private land. Therefore, the Coastal Fontainea is not considered to be adequately represented in conservation reserves and, given the lack of available habitat in the conservation reserve system, it is unlikely it will ever be considered so.

### Critical Habitat

Critical Habitat has not been declared for the Coastal Fontainea. Although, all areas where the species is known to occur or where it is located should be considered vital to ensuring the species persistence in nature.

### 7 For further information contact:

Coastal Fontainea Species Co-ordinator, Threatened Species – North East Branch, Department of Environment and Conservation, Locked Bag 914, Coffs Harbour NSW 2450.

#### IMPORTANT DISCLAIMER

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**Appendix 4: Native Plant Species Commonly Associated with the Coastal Fontainea**

<b>Common Name</b>	<b>Scientific Name</b>
<b>Trees</b>	
Coastal Tuckeroo	<i>Cupaniopsis anarcarioides</i>
Red Kamala	<i>Mallotus philippensis</i>
Yellow Kamala	<i>Mallotus discolor</i>
Rough-leaved Macadamia	<i>Macadamia tetraphylla</i>
Red-fruited Laurel	<i>Cryptocarya laevigata</i> var. <i>bowei</i>
Three-veined Laurel	<i>Cryptocarya triplinervis</i>
Jackwood	<i>Cryptocarya glaucescens</i>
Red Olive-Plum	<i>Cassine australis</i>
Beach Alectryon	<i>Alectryon coriaceus</i>
Coogera	<i>Arytera divaricata</i>
Two-leaved Coogera	<i>A. distylis</i>
White Bolly Gum	<i>Neolitsea dealbata</i>
Smooth-bark Bolly Gum	<i>N. australiensis</i>
Sandpaper Fig	<i>Ficus coronata</i>
Sweet Pittosporum	<i>Pittosporum undulatum</i>
Variable Muttonwood	<i>Rapanea variabilis</i>
Foambark Tree	<i>Jagera pseuderhus</i>
Native Pomegranate	<i>Capparis arborea</i>
Hairy Walnut	<i>Endiandra pubens</i>
White Bean	<i>Ailanthus triphysa</i>
<b>Shrubs, Climbers, Herbs</b>	
Actephila	<i>Actephila lindleyi</i>
Small Bolwarra	<i>Eupomatia bennettii</i>
Palm Lily	<i>Cordyline rubra</i>
Veiny Wilkea	<i>Wilkea huegeliana</i>
Coffee Bush	<i>Breynia oblongifolia</i>
Wikstroemia	<i>Wikstroemia indica</i>
Hedraianthera	<i>Hedraianthera porphyropetala</i>
Basket Grass	<i>Oplismenus</i> species
Filmy Maidenhair	<i>Adiantum diaphanum</i>
Harsh Ground Fern	<i>Hypolepis muelleri</i>
Native Ginger	<i>Alpinia caerulea</i>
Cockspur Thorn	<i>Maclura cochinchinensis</i>
Burny Vine	<i>Malaisia scandens</i>
Water Vine	<i>Cissus antarctica</i>
Whip Vine	<i>Flagellaria indica</i>
Scrambling Lily	<i>Geitenoplesium cymosum</i>
White Supplejack	<i>Ripogonum album</i>
Austral Sarsaparilla	<i>Smilax australis</i>

### Appendix 5: Exotic Plant Species Recorded at the Coastal Fontainea Habitat (modified from Bennetts 1999)

Common Name	Scientific Name
<b>Trees</b>	
Cocos Palm	<i>Syagrus romanzoffianum</i>
Umbrella Tree	<i>Schleffera actinophylla</i>
Cherry Guava	<i>Psidium guajava</i>
Large-leaved Privet	<i>Ligustrum lucidum</i>
Camphor Laurel	<i>Cinnamomum camphora</i>
African Olive	<i>Olea africana</i>
Avocado	<i>Persea</i> sp.
<b>Shrubs</b>	
Groundsel Bush	<i>Baccharis halimifolia</i>
Smooth Cassia	<i>Senna x floribunda</i>
Winter Senna	<i>S. pendula</i> var. <i>glabrata</i>
Coral Berry	<i>Ardisia crenata</i>
Ochna	<i>Ochna serrulata</i>
Inkweed	<i>Phytolacca octandra</i>
Orange Jessamine	<i>Murraya paniculata</i>
African Boxthorn	<i>Lycium ferocissimum</i>
Cape Gooseberry	<i>Physalis peruviana</i>
Lantana	<i>Lantana camara</i>
Tobacco Bush	<i>Solanum mauritianum</i>
<b>Herbs</b>	
Crofton Weed	<i>Ageratina adenophora</i>
Mist Weed	<i>A. riparia</i>
Thickhead	<i>Crassocephelum crepidioides</i>
Busy Lizzie	<i>Impatiens walleriana</i>
Wandering Jew	<i>Tradescantia fluminescens</i>
Striped Wandering Jew	<i>T. zebrina</i>
Nut Grass	<i>Cyperus rotundus</i>
Fishbone Fern	<i>Nephrolepis cordifolia</i>
Large Fishbone Fern	<i>N. hirsutula</i>
Red Salvia	<i>Salvia coccinea</i>
Ground Asparagus	<i>Asparagus aethiopicus</i>
Paddy's Lucerne	<i>Sida rhombifolia</i>
Kikuyu	<i>Pennisetum clandestina</i>
Turkey Rhubarb	<i>Acetosa sagittata</i>
Tomato	<i>Lycopersicon esculentum</i>
Black Nightshade	<i>Solanum nigrum</i>
Fern	<i>Pellaea viridis</i>
<b>Vines</b>	
Madeira Vine	<i>Anredera cordifolia</i>
Siratro	<i>Macroptilium atropurpureum</i>
Corky Passionfruit	<i>Passiflora suberosa</i>
White Passionflower	<i>P. subpeltata</i>
Climbing Nightshade	<i>Solanum seaforthianum</i>



**Appendix 6: Threatened Flora Site Assessment**

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**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 10 m 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** ..... meters long ..... meters 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.	notes
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 (provide details)

**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)

Notes .....

.....

.....

.....

.....

## Appendix 7: Threatened Plant Translocation Proposal

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### BACKGROUND INFORMATION

#### Species

*Fontainea oraria* Coastal Fontainea

#### Threatened Status

Commonwealth Endangered

NSW State Endangered

IUCN Critically Endangered

#### Proponent

(party(ies) responsible for the translocation proposal)

#### NSW Department of Environment and Conservation

(Translocation Team)

Maria Matthes – Department of Environment and Conservation

Maurizio Rossetto – Botanic Gardens Trust

Kristine Newton – Landowner

Ian Gaskell – Ballina Shire Council

Landcare and Envite groups – various

Bush regenerator – to be appointed

Propagator – to be appointed

Ecologist – to be appointed

The translocation team will ensure that all people involved in any aspect of the translocation will be sufficiently trained (see the next sections), including having an understanding of data collection and management. These people will be required to sign an agreement that they will undertake their tasks in accordance with this proposal and any approved documents to be prepared subsequent to this proposal.

#### Species Summary

The Coastal Fontainea is known in the wild from four small sub-populations near Lennox Head on the far north coast of NSW. These sub-populations are actually four locations of the Coastal Fontainea within a single population. They occur within a 600 m radius. The total population comprises ten adults and 45 seedlings and juveniles.

The three southern sub-populations occur in the same rainforest remnant. Two sub-populations occur as single specimens, isolated from the main clump by about 80 m and 200 m respectively. The main sub-population is comprised of seven adults and all the seedling and juvenile plants. Two adults originally existed at the northern sub-population, however one specimen died in 1996. The sub-population now persists as one adult and eight individuals that were planted in 1995 from seed collected from the main sub-population.

The genetic research showed that the two southern single specimen sub-populations are not likely to be contributing to the future generation of plants at the main sub-population, nor is the northern population. Therefore, each of the four discrete locations where the Coastal Fontainea occurs constitutes a sub-population.

It is likely that the Coastal Fontainea was more widespread within the littoral rainforest on krasnozem soil at Lennox Head. The majority of this vegetation has been cleared in the area and presumably plants of the Coastal Fontainea were destroyed at the same time. The genetic research indicates that there was gene flow between these remnants prior to clearing (Rossetto & McNally 2000).

#### Rationale for translocation

(Part of recovery program or emergency transfer)

This Translocation Proposal is part of the recovery program for the Coastal Fontainea. The Australian Network for Plant Conservation's Guidelines for the Translocation of Threatened Plants was considered in the preparation of this proposal. Translocation is considered to be an essential recovery action for the Coastal Fontainea because the total population is critically small (under IUCN criteria less than four effective mature individuals exist in nature), resulting in inbreeding due to only a few individuals contributing to future generations.

### **Consequences of not translocating the Coastal Fontainea**

The consequences of not undertaking the proposed translocation are:

- the total population of the Coastal Fontainea is not likely to be self-sustaining as not all current individuals are contributing to future generations;
- the population will continue to suffer the effects of inbreeding, therefore is likely to be incapable of adapting to evolutionary and environmental changes; and
- in the long term the population is highly likely to become extinct due to stochastic and genetic events.

### **Objectives of translocating the Coastal Fontainea**

The objectives of the translocation proposal are to:

- increase the number of individuals and populations of the species in natural habitat and maximise the effective population size of a single population;
- investigate different techniques that will enhance establishment and survival of translocated the Coastal Fontainea plants;
- understand the problems and limitations of translocating the Coastal Fontainea; and
- have at least five self-sustaining populations in nature following the success of the full-scale translocation of the Coastal Fontainea.

### **Translocation – targets and timeframes**

#### Stage 1 (Year 1)

- Preparation and implementation of experimental trials:
  - propagation and maintenance of plants (*ex situ*),
  - site preparation – weed control, fencing etc.,
  - training,
  - monitoring – biological and ecological.

#### Stage 2 (Year 2-10)

- Implementation of experimental trials:
  - maintenance of plants (*ex situ*),
  - on-going site maintenance.
- Evaluation of trial translocations:
  - debrief and additional training,
  - preparation of a full-scale translocation proposal,
  - monitoring.

#### Stage 3 (Year 10-unspecified period)

- Maintenance of *ex situ* collection:
- Implementation of full-scale translocation:
  - propagation of additional specimens.
- Monitoring.



- Evaluation of full-scale translocation(s).
- Further work, monitoring and evaluation as required.

### **Type of translocation proposed and considerations for options**

(Success of previous or analogous species)

Seven plants that were planted in 1995 have survived at the northern sub-population. However, these plants have not matured nor have they established second generation seedlings. Therefore, these plants cannot be considered as established at this stage.

#### Restocking

(Considerations include: impact to source and proposed translocation site and species, identification of threats and reason for restocking, whether the threats are removed)

The two southern single plant sub-populations (not the main sub-population) and the northern sub-population have been chosen as suitable for restocking sites. This is because they are sub-populations with single plants that are unlikely to be capable of reproducing without appropriate enhancement. Therefore, these sub-populations will eventually become extinct once the plant at the site dies. The planting of the Coastal Fontainea at these sites is not considered likely to impact on the source or natural sub-populations.

Although the main sub-population is inbreeding, it is not considered appropriate to plant additional specimens at that site until the success of the enhancement and introduction trials are fully evaluated, including the ability to maintain genetic diversity through generations.

Additional consideration, most important to the success of the translocation is the clarification of the sexual status of all existing plants, including those in cultivation.

Usually an issue requiring consideration in conservation introduction type translocations, once identified and assessed, the pollinator(s) may also need to be introduced to the translocation sites. This would be considered necessary if the limited gene flow between plants is determined to be a result of the loss of the pollinator. Prior to any introduction of a pollinator further investigations would be required to determine the identity of the pollinator(s), potential source(s) of pollinator(s) and whether the introduction of such organisms would have deleterious impacts upon the ecosystem.

#### Reintroduction

(Considerations include: impact to source and proposed translocation site and species, identification of threats and reason for reintroduction, whether the threats are removed, whether the habitat has changed since the species demise at the site)

Not Applicable. There are no opportunities for reintroduction translocations as no sub-populations are known to be extinct. However, new sites chosen for introductions (i.e. where the species is not known to occur) may be where the Coastal Fontainea once occurred and hence by default would constitute a reintroduction. The areas around the proposed introduction sites will be thoroughly searched to ensure no unknown Coastal Fontainea occur within proximity to the proposed planting area.

#### Introduction

(Considerations include: impact to source site, new site/s, species, habitat and ecosystem, threat assessment, species habitat requirements satisfied, probability of becoming a weed, alien species, clearly defined benefits)

The translocation proposal includes the introduction of the Coastal Fontainea to at least two new sites. A preliminary investigation has been undertaken at several sites to determine their suitability as introduction sites. A short list of five sites has been created. Two of these sites are on public land (Lennox Point and Tara Downs). The other three sites are on private land and permission from the owners and site security would need to be resolved prior to further consideration. The potential carrying capacity of some sites may limit the final choice. These sites will be finalised as part of the Recovery Plan implementation.

#### Conservation introduction

(Considerations include: impact to source site, new site/s, species, habitat and ecosystem, threat assessment, pollinator present, probability of species becoming a weed)

There may be opportunities to undertake a conservation introduction. However, it is considered unnecessary at this stage. Further assessment will be required, should the enhancement and introduction

translocations fail, or the carrying capacity of the site(s) are not sufficient to support a translocated population.

## **PRE-TRANSLOCATION ASSESSMENT**

### **Biological Assessment**

(taxon's distribution – historic and present, systematic survey, understanding of species distribution)

Numerous surveys have been undertaken in suitable habitat in the Lennox Head area and failed to locate further specimens of the Coastal Fontainea. It is possible that scattered individuals occur that have not been detected. Therefore, thorough surveys will be undertaken, within 50 m of the boundaries of the proposed planting area, prior to any planting of the Coastal Fontainea. Should any specimens be found within proximity to the proposed translocation sites an assessment will be made as to its suitability in the translocation project and an assessment of the likelihood of the proposed translocation to impact on the natural specimens. The appropriate course of action will be taken that avoids adverse impacts to the natural populations and enhances the species chance of surviving.

(taxonomic assessment - taxon distinctiveness, distinct spatial groupings, distinct variants)

The genetic study has revealed that the Coastal Fontainea is a distinct species and that all known sub-populations are similar. This means there is no distinct spatial groupings or variants. Therefore, all known adult plants are suitable for use in the translocation project without any concern about mixing material from different sites.

(population biology - reproductive biology, flower fruit production, seed viability, seed germination rates (proportion and frequency i.e. dormancy), seed longevity and seed bank size, breeding system (selfing/monoecious/dioecious etc.), mode of pollination)

The reproductive biology of the Coastal Fontainea is poorly known and understood. Many aspects of the species biology will be monitored over the next three years to gain baseline data that will be used to evaluate the success of the translocation program. The species is thought to be dioecious although there is some evidence to suggest that some plants may be monoecious. The sex of the individual clones must be determined prior to any planting arrangements being finalised.

The pollinator is unknown but thought to be an insect. The results of the genetics indicates that individuals at a distance greater than 5 m from the known female are not contributing to future generations. The possible reasons for this are varied, including the pollinator no longer exists and that pollination is currently limited to wind pollination; plants not contributing are not yet mature; or that the male plants are not flowering synchronously with the known female plant. Monitoring is required to determine this factor. The evaluation of the translocation trials will need to consider and possibly act on these potential limitations to the project's success.

(population dynamics -mode of regeneration – seed or vegetatively, recruitment potential, average growth rates)

Seed regeneration is evident at the main sub-population. The growth rate of the species is slow. Therefore, it is expected that the translocated populations, over time, will be capable of producing seedlings. However, determining the success of the Coastal Fontainea translocations will not be a short process.

(genetic assessment - techniques used, general results, recommendations for future)

The genetic study undertaken by Maurizio Rossetto (Southern Cross University Centre for Plant Conservation Genetics, now at Botanic Gardens Trust) is considered to be of very high quality and standard. The technique used to determine the genetic variation within the species was RAPD analysis. The results detected inbreeding in the seedlings as a result of few adults contributing to the future generations.

Future genetic research will be required to determine that future generations from the planted seedlings are maintaining adequate levels of genetic diversity.

(propagation potential - seed germination, clump separation, cuttings, micro-propagation, germination requirements, establishment requirements (eg mycorrhizal fungi association))

All propagation techniques trialed, (seed germination, cuttings, marcotting) have been successful methods of propagating the Coastal Fontainea. The success of cuttings and marcots taking root is largely dependent upon the quality of the material collected and the time of year it is collected. Cuttings from Qld DPI took 6–8

months before striking. Material taken during the flush of new growth in autumn by Cutting Edge Natives Pty Ltd was extremely successful at striking roots. Cuttings from each adult plant will be taken during the spring or autumn flush of new growth. Cuttings will be used to establish *ex situ* plants for a living collection and the translocation trials. Tissue culture may be used, if deemed to be a successful and suitable technique, if there is not enough material to get the required number of plants directly from cuttings.

#### Source of individual plants

Plants used for the translocation will be sourced from cuttings of all the adult clones, where suitable and sufficient material is available. Plants will be propagated and grown in nursery conditions. Genetics indicate that mixing material from all sub-populations will not be deleterious to the gene pool of the Coastal Fontainea and that it is likely to be of benefit in the long term. Plant material will be collected, raised and maintained using strict hygiene protocols.

The total number of plants that will be required will be determined by the final design of the translocation plantings and will also be dependent on the sex of the various individuals.

#### Assessment of impact of removal of propagation material from source site

The translocation will use vegetative material rather than sexual reproductive material for propagating plants. At this stage, seedlings will not be used as there is evidence they have less genetic diversity than the adults (inbreeding). The use of vegetative material will allow for control over the maintenance of genetic integrity in the translocated populations.

The material will be collected using high standard hygiene protocols to avoid damage to the plants or their habitat. This includes cleaning secateurs, cleaning footwear prior to collecting samples, clean bags etc. for material. Care will be taken not to trample any of the Coastal Fontainea plants.

#### **Ecological assessment of known sites**

Abiotic factors (soil type and profile, water quality/water table depth, drainage characteristics, slope, landform, elevation, climate)

Details of the abiotic environment are provided in the Recovery Plan. All the proposed translocation sites will have the same or similar abiotic characteristics as the known Coastal Fontainea habitat.

Biotic factors (co-occurring flora, pollination mechanism and pollinator, habitat exposure – closed canopy, open areas, exposed to salt or particular winds, life history (short/long lived, disturbance opportunist, specific seral stage), disease susceptibility, resilience to weeds, resilience to other disturbances or management techniques)

Details of the biotic environment are provided in the Recovery Plan. However, issues considered to be relevant to the Coastal Fontainea translocation proposal are the possible absence of the pollinator(s), exposure to salt-laden winds, habitat degradation and disease and pest susceptibility.

With careful management of pests, the Coastal Fontainea, appears to recover from any ill-effects. Adult plants also appear tolerant of most weed species present, however, seedlings and juveniles are not so resilient and will require active weed removal.

#### **Ecological and environmental assessment of proposed translocation (host site/s)**

##### 1. Identification of potential sites.

- consideration of potential/alternative host sites (within range or not).

##### 2. Suitability of a site (this is to be completed for each potential site).

- whether the biological and ecological requirements identified in the above sections will be satisfied at the selected site:
  - within known historic distribution,
  - critical requirements of lifecycle can be met,
  - similarity of associated vegetation type and structure, soil type etc.,
  - symbiotic, host pollinator species present,
  - habitat size with the carrying capacity to establish self sustaining population(s).
- threat assessment:

- probability of becoming a weed in translocation site and/or adjacent habitat,
- closeness to natural populations - potential for cross pollination between sites and for hybridisation to occur, thus potentially affecting the genetics of it and other species,
- whether the species is a known or likely to host disease or pathogens,
- whether the species is likely to compete/outcompete other species for resources,
- degree of disturbance (and whether it can be remediated), natural or semi-natural habitat, whether rehabilitation is required before translocation,
- identification of threats and whether they can be fixed, managed, or controlled,
- security of land/site tenure,
- adjacent land use(s).
- whether the site(s) have suitable road access to undertake tasks simply.
- additional considerations:
  - restocking – consider affecting genetics of local source population,
  - reintroduction and introduction – additional consideration includes the potential for plants or seedbank or both to be present and the potential to impact deleteriously on the genetics of the species if it is unknowingly present nearby.

#### Selection and suitability of sites

Several sites have been assessed for their suitability as a translocation site. The proposed sites for the enhancement translocations were chosen because it is considered they meet the biological and ecological requirements, as the species is known to occur there. The exception to the chosen sites' suitability may be the lack of pollinator (which requires further investigation).

The sites considered to be the most suitable of those sites available are subject to weed invasion and impacts from stormwater runoff. These have the potential to impact on the translocations. It is believed that the identified threats at the proposed enhancement sites can be managed through the implementation of the habitat management plan, including the habitat restoration program.

Two or three sites are to be chosen as trial introduction sites. The final selection of these sites is part of the Recovery Plan implementation for the species. Sites will primarily be chosen on the basis of whether:

- the site is located within 2 km of the coast at Lennox Head;
- the site is littoral rainforest on krasnozems soils;
- the carrying capacity of the site is able to support a translocated population;
- the landholder supports the proposal; and
- there is, or is likely to be, long term security of the land.

#### **Logistical assessment**

(Staffing, training, financial assessment and commitment, resource assessment and commitment)

##### Staffing

(Staff for various components, including administration, horticulturist(s), taxonomist, ecologist, community, bush regenerators, volunteers)

The DEC is accountable and responsible for the overall translocation, although the translocation team will also be responsible for the work being done. Staff may change throughout the life of the project but it is important that the translocation team ensure staff changes do not interrupt the continuity of the project.

Administration will be the responsibility of the DEC. However, relevant data and record management will be the responsibility of each party as they are trained for.

Initial propagation will be undertaken by a suitably experienced and qualified propagator.

A taxonomist is not considered necessary for this project as the genetic research has resolved any taxonomic issues that may have needed to be understood. Despite this, Laurie Jessup of the Qld Herbarium is available to answer any unforeseen questions.

Two ecologists will be required for this project. The DEC will contract a suitably qualified ecologist to undertake monitoring and some of the research. A conservation geneticist, Maurizio Rossetto of the Botanic Gardens Trust, will also be available for discussions and to undertake genetics of any “new” specimens.

The local community will assist, through Landcare and Envite, to rehabilitate the proposed enhancement and introduction sites. A qualified bush regenerator will be on-site to ensure works are being undertaken in a sensitive manner with consideration to threatened species and their habitat.

### Training

(skills required, training needed and the experience of trainers)

The DEC will ensure that training in the general aspects of translocation is provided to all people involved in the translocations. The trainers must be familiar with the critical issues of translocating threatened species and must also be familiar with the ANPC translocation training. Particular emphasis will be on monitoring, *ex situ* management (i.e. not mixing plants, removing flowers etc.), record management, hygiene (phytosanitary) issues and habitat restoration for threatened species.

### Financial assessment and commitment

Financial commitment is required for the life of the project for propagation and maintenance, habitat restoration, monitoring and genetics. The DEC will commit funds for the first year of implementing the Recovery Plan and translocation proposal. Further short to long-term funding and commitment is required.

### Resource assessment and commitment

(facilities, location of laboratory, appropriate laboratory, sterile propagation and growing facilities, adequate holding facilities)

Ballina Shire Council has verbally agreed to the use of its nursery facilities to hold a living collection of the population and to hold *ex situ* plants in preparation for planting. Facilities will need to be able to hold up to 1000 plants for at least 18 months. The nursery area is to be set up to minimise the potential for pathogens to flourish and thus to ensure the greatest success rates of plants.

## PRE-TRANSLOCATION PREPARATION

### Translocation Design

#### Proposed experimental treatments

The following treatments are to be included in the translocation trials so the reason(s) contributing to the success or failure of the translocation may be demonstrated. This will enable the most appropriate and successful treatments to be applied to the full-scale translocation for its success.

Additional variables that may be included in the design, but require further consideration and planning, are the age of the propagated plants at planting (9 and 18 months), the use of fertiliser, the use of mulch and the use of soil wetting agents. The degree to which these variables will be used will be dependent on the carrying capacity of the sites and ability to have the required number of plants available at the proposed planting time.

**Table 1: Description of Proposed Experimental Treatments**

Treatment	Description of Treatment
Control	Plants not given any treatment
Watered	Plants given water
Shaded	Plants grown in shade
Gro-cone	A gro-cone is placed around the plant

#### Determining the level of care

The following parameters are to be applied to each proposed treatment. These parameters are considered as suitable to determine the appropriate and necessary level of care to be applied to the full-scale translocation.

Watering will be applied to half the plants in each age group assigned to the watered treatment whilst remaining plants will not be watered. Two litres of water is to be applied to the base of each plant once a week from August to March. This is to test whether watering over the first summer assists survival of the Coastal Fontainea plantings.

Half the plants in each age group assigned to the shaded treatment will be planted where there is shade of 70% cover. The remaining plants will be planted in the open. This is to test whether protection against sun and wind increase chances of survival.

Gro-cones will be placed around half the plants in each age group assigned to the gro-cone treatment whilst the remaining plants will be planted in without. This is to test whether the use of gro-cones enhances survival of the planted specimens.

Each plot will be fenced. The fence will need to deter herbivores and to ensure plants do not get trampled. Each plot will also be weeded to ensure plants do not have high levels of competition for space and that they do not get smothered or strangled.

The use of fertiliser, mulch and soil wetting agents may improve the success of plants establishing, although the degree to which their use may lead to the plants adapting to such assistance is not known. This could lead to plants that are unable to cope with natural fluctuations in environmental conditions. Therefore, further consideration is required before these treatments are included in the experimental trials. Consideration will also be given to using fertiliser, mulch and soil wetting agents as a standard level of care, such as fencing and weed control. For the full-scale translocations, the level of care will be designed and applied based on the monitoring results.

#### Layout

(Consider the layout within the site, the distance between planted plants will be determined by the size the adults will be at maturity. For experimental trials ensure correct replications are applied.)

#### Experimental trials

The number and size of plots will be determined following the final decision on treatments and experimental design. The location of each translocation site will then be selected and measured out. Sites will not be

cleared of native vegetation and plants will be planted in gaps in the vegetation, adhering as close as possible to the final grid pattern.

Within each plot a grid will be established with groups of plants (one of each male clone and representative number of the female clone) planted 1.5–2 m apart for each treatment. An additional 1 m border will be left between the grid and the outside as a control. The proposed treatments include watering plants, planting in the shade and in the open, and the use of gro-cones.

The number of seedlings to be assigned to each treatment will be established in the final experimental design. The same number of seedlings will be planted in each plot and the control and each treatment will also have the same number of plants. Each of the treatments will be assigned to an area of grid in the plot.

Various density plantings will also be trialed to determine what ratios of plants are required to maintain genetic diversity. Selective hand pollination is also to be trialed to improve knowledge of the genetics of the species. The same numbers of each cross will be made to maximise diversity. A detailed experimental design will be prepared for this research.

Once the information needed from the experimental trials has been obtained, a decision of whether to remove the experimental plants or to use them for the final phase will need to be made. Should the plants be considered appropriate for the full-scale translocation, then the plants will be left in the ground and used. However, if the plants are thought to be inappropriate for the translocation, then they would be removed. It may be that there is no concern over leaving some plants but for others there is likely to be concern. For example, where one genotype is expected to take over all other genotypes in future generations then it would need to be removed. This will be determined further along the process.

#### Full-scale translocation

The final design of the full-scale translocations will be dependent upon the evaluation of data gathered at the experimental stages and the results of the monitoring.

#### **Propagation of plants**

(Decide on the most appropriate method of propagating the plants. Determine the number of plants required. If using cuttings, determine the number of clones of each parent plant required. Ensure plants are of appropriate genetic make-up can be grown (not genetically impoverished or clones not planted together to avoid genetic homogeneity). The importance of maximising survival throughout the nursery and planting phases to maintain the integrity of the gene pool of the taxon. It may be necessary to augment populations that incur the greatest losses.)

#### Methods of propagule collection

Plants used in the experimental trials are to be the same stock as those proposed to be used in the full-scale translocation. The source cuttings are to be from all the adult clones in the natural sub-populations, where suitable and sufficient material is available. The ratio of each clone used will depend on the sex of the individuals. For example, additional clones of the known female are likely to be required to assist gene flow, particularly if the pollinator(s) is absent.

The *ex situ* collection must adhere to the appropriate and necessary levels of hygienic care for the collection of material, including cleaning the secateurs with methylated spirits between collecting samples and wearing clean sterilised footwear to the collection sites. All vegetative material will be collected above the rain-splash level to reduce the risk of soil-borne contaminants.

Propagators will also be required to keep detailed records of the collection and to keep clonal samples separate to avoid accidentally mixing plants. The tag code of the plant in the wild is to be recorded on each collection bag. Each bag is to only contain a single clone. The tag code for the clone corresponds with the genetic data for each individual and therefore will determine where each clone will be planted in the translocation trials.

At least 15 cuttings will be taken from each adult plant in the wild. Less cutting material will be taken if it is thought that taking this amount will cause stress to the plant. The collection of material will be timed to when there is a good flush of new growth to increase the opportunities for successful propagation from the collection. An assessment will be made of the health of the plants prior to taking the cutting material.

The use of tissue culture for the initial propagation is still being investigated. It is not likely to be considered appropriate for maintaining the *ex situ* collection due to the high cost of maintaining a tissue culture collection in the long term.

### Raising plants

A schedule will be prepared that identifies the proposed timing of plant propagation, the number of each clone required, the age plants will be grown to, the sex-ratio required for planting and the relevant genetic information.

Once the cuttings collected from the wild have struck roots they will be maintained to provide additional cutting material. When the plants are a suitable size, additional cuttings will be taken and grown. This procedure will be followed until the required number of plants is obtained.

The number of plants of each clone required will be determined by the final design. Sufficient time will be allowed to collect and grow plants on to a suitable age for planting (approximately 12 month old plants). Following the initial monitoring to determine the sex of the individual plants, should the currently known female plant actually be the only female plant, then it is likely that one of the female clones will be required for three plants of different male clones. Should any plants in the wild or in cultivation be determined to be female then these clone(s) will also need to be propagated.

Seedlings are to be raised in nursery conditions. All plants and soil used will be treated to the same high standard to maximise pathogen and parasite free pots and plants. All equipment used during seedling maintenance and planting will be maintained under strict hygiene protocols.

Hygiene concerns must be met at the nursery, ensuring:

- the pots to be used will be sterile and “new” previously unused pots will be used as an added precaution;
- the potting mix medium to be used will be treated (soaked) with a fungicide mix (Fongarid) or pasteurised (minimum 1 hour steaming to reach 60°C and a further 30 minutes at 60°C);
- there is good airflow to and drainage in pots to manage fungi;
- all benches are disinfected with Phenosol (2% solution) or a similar solution;
- clean gloves will be used for all works;
- clean water will be used for all works;
- additional spraying will be undertaken if considered necessary as an added precaution; and
- any plants showing evidence of pathogens or rust will be separated from healthy plants and treated accordingly.

Plants will be labelled effectively to avoid confusing clonal collections. It is essential to record the origin of the plant material, including the clone tag code. The plant details will be carefully transferred from the collection bag to both the pot and a tag on the plant. Every time plants are repotted this information will be carefully transferred onto the new pots. The tag on the plant and code on the pots corresponds with the clone code, the date of collection, date of propagation, date of repotting etc. and the method of propagation.

### Maintenance of plants and germplasm tissue

The careful maintenance of plants and *ex situ* material in nursery conditions can be critical to the difference between success and failure of the propagation stage. The following considerations will be applied to the *ex situ* collection for the Coastal Fontainea translocations.

Any flowers present on plants in the *ex situ* collection will be removed. No fruit will be allowed to mature on the plants. Planting is to occur outside the reproductive period. This is to ensure no contamination of genetics prior to the plantings and this could lead to data error and inaccurate management decisions being made.

Plants will be maintained under strict hygiene controls as for raising plants above.

Warning note: Over-replication could lead to genetic changes. If propagating numerous cycles (i.e. cuttings taken from cuttings taken from cuttings etc. taken from an original cutting) then plants may need to have their genetics retested to reduce risk of unwanted soma-clonal variation being introduced to the collection. This concern is more relevant for plants propagated by tissue culture.

### Transfer to host site

Prior to transporting plants to the translocation sites the plants will be moved to Ballina Council Nursery shade house for 2–3 months to begin adjusting to the more coastal environment. Plants will then be moved



into the open environment, with 50–60% shade throughout the average day, for 1 month to harden-off the plants. This is to assist the plants to adjust to the planting out conditions.

A final treatment will be applied to pots to ensure plants, soil and pots are free of pathogens.

### Recording

(Detailed records documenting every step of the propagation process. Essential and adequate documentation to enable assessment of why the project failed or succeeded.)

Recording forms are to be prepared and completed for the collection, propagation and maintenance stages of the *ex situ* collection.

The propagation (collection of material) form is to include the following details:

- the clone code;
- the origin of the plant material;
- the date of the collection;
- who did the collection;
- the amount of cutting material taken from the clone;
- an assessment of the quality of the material for propagating from; and
- the climatic conditions at the time of the collection.

The propagation (raising plants) form is to include the following details:

- the clone code – the parent material of each individual plant is to be recorded;
- the plant code;
- date cutting material put into hormone solution;
- date cutting material put into soil;
- the method by which the plants were raised;
  - the potting media used for plantlet establishment,
  - the hormone type and ratio used,
  - the percentage strike of cuttings,
  - cultural details such as plant nutrition, trace elements that may be species and site specific,
  - type, amount and date of fungal treatments, fertiliser use etc.,
  - temperature(s) of propagating area,
- growth rate of cuttings;
- amount of water given to the plant;
- the time required for propagating;
- time for plants to get to suitable planting out size; and
- identification of particular clones that are easily propagated and clones that are more resistant.

The propagation (maintenance of plants) form is to include the following details:

- the clone code – the parent material of each individual plant is to be maintained;
- the plant code;
- date cutting material put into hormone solution;
- date cutting material put into soil;
- date plant is repotted;
- type, amount and date of fertiliser use;
- type, amount and date of herbicide-insecticide-fungicide use; and

- removal of flowers and fruit.

### **Habitat rehabilitation**

Any threats identified at the assessment stage are to be controlled or managed prior to planting the plants for the experimental trial. Of relevance to the Coastal Fontainea translocation sites, the following major works to be undertaken prior to planting the Coastal Fontainea are:

- 1 fencing the southern remnant and the proposed translocation sites;
- 2 drainage issues require appropriate stormwater management to be implemented;
- 3 weed management; and
- 4 planting of buffers and potential creation of corridors.

The area within and 50 m around the location of the translocation plots is to have all weed species and virtually all specimens of these species removed. Weed control will be on-going and specimens will be removed in this area prior to producing and dispersing seed or propagules. Additional weed control works are to be undertaken adjacent to these areas to minimise reinfestation of the areas already worked. All habitat restoration will be undertaken in accordance with the DEC bush regeneration guidelines for working in the habitat of threatened species and endangered ecological communities.

### **Training**

Training will be undertaken in accordance with the training guidance addressed in the logistical assessment of the pre-translocation assessment.

### **Experimental Trials**

Experimental trials are designed to identify institutional, infrastructure and procedural problems that may need to be addressed prior to embarking on the full-scale translocation. The trials are to be rigorously and experimentally designed.

## **TRANSLOCATION**

The following protocols are to be applied to all translocation of Coastal Fontainea, including the experimental trials and the full-scale translocation:

- Plants used in the translocation will be healthy and in peak condition.
- Prior to moving plants from one destination to another all plants will be tagged with a metal tag (including the details on the pot such as the clone code and the plant code). The plant code will relate to the clone code, the date of collection, the date of propagation, the date of repotting, date of planting, propagation methods etc.
- Prior to transporting plants a final check of plants will be undertaken to ensure no flowers or fruit are present on the plants. Planting is to be done outside the reproductive period.
- Site preparation may need to be done prior to planting, considering the rocky nature of the sites and the difficulty in planting in such conditions.
- Plants will be secure in transit and not capable of falling over.
- Plants will be taken to the translocation sites as soon as loaded.
- Prior to planting many of the leaves on the plants are to be removed to reduce transpiration. This may also be done prior to transporting plants.
- The timing of the planting will be undertaken when the environmental conditions at the site of the translocation are optimal for the plants survival. This is likely to be in autumn and spring and at cooler times of the day. Planting will not be undertaken in drought conditions, in the heat of the day, or when there are frosts on the ground.
- A site map showing the location of the plots at each site will be prepared.
- A map of the plant locations is also to be prepared. All plants are to be tagged (inconspicuously to avoid vandalism) in the ground. The location of these plants is to be plotted on a map with the tag code indicating the plant's location.

- The level of care applied to the plants (watering, shading, use of gro-cones, mulching, fertiliser, soil wetting agents, weeding etc.) will be in accordance with the experimental treatments and additional considerations.
- Planting will be in accordance with the layout and treatments in the translocation preparation above.
- Planting will also consider the “tips” in the ANPC guidelines that assist in survival of planted individuals.

The data to be recorded at the time of planting is to include the people involved in the planting, the tag code, the height of the plant, the width of the plant (as two measurements taken at right angles). Any obvious or likely threats are to be noted and acted on.

## **POST-TRANSLOCATION ACTIONS**

(Assessment of the successes and failures/limitations/problems with the trial, apply pre-determined level of care, develop a full-scale translocation proposal)

### **Level of care**

Aftercare in the short term is to be minimised to improve the chances of establishing a self-sustaining population. The level of care is to be consistent with the pre-determined level of care in the pre-translocation preparation section and the evaluation of the monitoring results. Continued, long term site management will be required including the control and management of weeds.

### **Post-translocation monitoring**

(Provide details of short and long term monitoring for new, enhanced and natural sub-populations. Measure the same parameters at all sites.)

Morgan (1999) identified that the demise of translocated populations often occurred beyond the first four years following planting, with some populations persisting for 12 years before the population finally senesces. If there are flaws in the design of the monitoring program, results may be misleading and statistically meaningless. Therefore, to assist the long term success of the translocation, the DEC will prepare a rigorously designed monitoring program and will not assume populations have successfully established until the monitoring shows the performance criteria for success are met. Determining the success of the Coastal Fontainea translocation is likely to be greater than 50 years.

Monitoring will be undertaken at the main sub-population (as the control), the three enhanced sub-populations and the introduction sub-populations (once approved). Monitoring should be designed to (Sutter 1996):

- detect real changes in the population with an acceptable level of precision;
- use data collection techniques that can be used by different people;
- collect data over a long enough period to detect long-term trends; and
- be cost effective and uncomplicated so that it can continue over a long period.

### Monitoring Process

Short term monitoring is to be undertaken monthly for the first six months (6 visits) and then 2 monthly for 12 months (6 visits) and then six monthly for a further 2 years (4 visits). Long-term monitoring is to be undertaken on an annual basis until criteria for determining success are considered to have been met. Annual monitoring will be undertaken during the peak flowering period.

### Monitoring Environmental Factors

The following environmental factors will be monitored:

- The effectiveness of threat management of degrading processes;
  - habitat restoration, including weed removal,
  - stormwater run-off and drain management,
  - pest management – insect and pathogens,
- Whether there has been minimal damage to other native species at the site due to the translocation;
- Changes to the site in relation to community composition and structure and the seral stage.

A fixed photo monitoring point will be established at each translocation plot.

#### Monitoring the *ex situ* collection

The following data are to be recorded in monitoring the *ex situ* collection:

- Details of the provenance origins of the collection;
- Appropriate clones are available that are suitable for supplementary planting, if necessary;
- Review records of initial establishment and survival of each clone (5 strike rate of cuttings, 5 germination of seed, growth rates); and
- Details and assessment of techniques used or trialed (potting media, hormone treatments, temperature of propagation area, dormancy breaking mechanisms applies) and the type of material used (seed, cutting, marcot, tissue culture).

#### Monitoring the translocations

The following data are to be recorded in monitoring the translocated plants:

- Survival of individuals over time
  - Count the number of surviving plants;
  - Assess each plant's general health. The health assessment is to use the following codes: 1= alive 2= dead 3= plant withering 4= new growth 5= plant gone 6= tag missing. For code 3 (= plant withering), four sub-codes are to be used a) < 25% of plant, b) 25-50% of plant and c) 50-75% of plant d) > 75% of plant;
  - Relative importance in survivorship of factors such as competition, herbivory, pests and pathogens. Identify any reasons for poor health of individuals eg insect attack; and
  - Additional notes will be taken of relevant details eg colouring of dead leaves, degree of leaf fall, leaf burn etc.
- Biology
  - Growth measurements will be taken and compared to naturally occurring plants. The height of the plants and the width of the crown (in two directions) are to be measured.
  - Assessment of the reproductive status is required, including the time taken for plants to mature and set seed. (The number of flowers and fruit are to be counted).
  - An assessment of seed viability and germinability will be undertaken in controlled conditions if sufficient numbers of seed are produced, otherwise a general assessment will be made based on seed production and seedlings appeared.
  - Evidence of pollinator activity.
  - Evidence of seedling recruitment. Any seedlings observed are to be tagged and survival monitored on subsequent visits.
  - New seedlings are also to have their reproductive status monitored to determine the age the plants begin producing flowers and fruit. This should be compared to both naturally occurring plants and the translocated plants.
  - Assessment of geneflow is to be undertaken using genetic analysis.

#### Long-term monitoring

Long term monitoring is required to look at the following factors:

- longevity of individuals;
- the rate of recruitment of new individuals (seedlings) into the population equals or exceeds mortality over a substantial period;
- whether any second generation plants are present and self-perpetuating populations are established over a long period of time;
- whether genetic variation is maintained in progeny; and

- whether maintenance of genetic variation (gene flow) is sufficient to reverse inbreeding occurring at the main sub-population.

#### Monitoring sheets

The translocation team will prepare and complete monitoring sheets as part of implementing the Recovery Plan.

#### **Criteria for determining success or failure**

The criteria proposed to determine the success, or failure, of the translocation project are based on the limited biological knowledge of the species. Therefore, as ecological data is collected as part of the translocation program and the implementation of the Recovery Plan these criteria may need to be modified.

#### Criteria for determining biological success

The following criteria will be used to determine the biological success of the experimental trials:

##### *Short Term Criteria*

- greater than 70% of transplants survive the first 3 years, with representation from the range of genetic individuals planted; and
- the new and enhanced populations have similar characteristics as the main sub-population, such as survival and growth of translocated individuals.

##### *Medium-Long Term Criteria*

- transplants have established;
- survival of transplants to reproductive stage (producing flowers and fruit);
- the production of flowers and fruit at levels consistent with naturally occurring plants;
- seed viability is consistent with naturally occurring plants;
- if plants are mature, new seedlings have established; and
- if recruiting, after one generation (juvenile transplants to seed producing adult plants) the number of individuals is being sustained or increased by natural recruitment.

##### *Long Term Criteria*

- new populations are self-sustaining;
- adequate levels of biodiversity, particularly genetic variation, are maintained through generations;
- seedlings are established;
- if recruiting, after one generation (juvenile transplants to seed producing adult plants) the number of individuals is being sustained or increased by natural recruitment; and
- if recruiting, after two or more generations Seedlings from the transplants to seed producing adults, the number of individuals is sustained by natural recruitment.

#### Criteria for determining biological failure

The following criteria will be used to determine the biological failure of the experimental trials:

##### *Short Term Criteria*

- failure of transplants to establish such that a significant decline in population size is experienced;
- failure of transplants to survive to reproductive age; and
- if reproductive, failure to produce viable seeds.

##### *Long Term Criteria*

- significant decline in population size due to a lack of natural recruitment;
- flower and fruit production is significantly less than that of the main sub-population;
- failure of genetic variation to be maintained throughout generations;
- failure of seedlings to survive to reproductive age;

- if reproductive, failure to produce viable seeds;
- if recruiting, after one generation (juvenile transplants to seed producing adult plants) the number of individuals is being sustained or increased by natural recruitment; and
- if recruiting, after two or more generations seedlings from the transplants to seed producing adults, the number of individuals is sustained by natural recruitment.

#### Criteria for determining *ex situ* success

The following criteria will be used to determine the *ex situ* success of the experimental trials:

- the *ex situ* component of the translocation followed the translocated proposal for the taxon;
- survival of material collected for establishing the *ex situ* collection;
- the required number of transplants are available for the translocation proposal;
- plants are not mixed up in the nursery facilities;
- techniques for successful propagation of the taxon are understood;
- correct labelling maintained through the repotting stages; and
- a representative collection is maintained for back-up use in the translocation.

#### Criteria for determining *ex situ* failure

The following criteria will be used to determine the *ex situ* failure of the experimental trials:

- failure of plants to be propagated and establish in *ex situ*;
- the required number of plants are not available for the translocation;
- the identity of *ex situ* plants is unknown or cannot be confirmed; and
- failed techniques cannot be rectified.

### **Translocation evaluation**

Minor project evaluations will be undertaken annually, with a major evaluation in the fifth year of the project. Each evaluation will include:

- the date the next evaluation will be performed;
- an analysis of the post-translocation monitoring results;
- identification of the causes of plant mortality;
- an assessment of the success or failure of the translocation against the selected criteria;
- an assessment of the methodology and cost-effectiveness of the translocation strategy; and
- recommendations for future work, including:
  - an assessment of whether to continue, repeat, revise, reschedule or discontinue the original strategy,
  - options for ongoing monitoring, maintenance and management of the translocation site, and
  - timeframes, and date(s) proposed, for subsequent post-translocation assessment(s).

The following direction will be undertaken pending the evaluation of each experimental trial and full-scale translocation:

- If the experimental trials meet the criteria that determines they have been a success in the short term, the outstanding knowledge to determining the long-term success of the project is required. It may be apt to begin the preparation for the full-scale translocation or to wait for the success of the trials.
- If the experimental trials meet the criteria that determines they have been a success in the long term, then it would be appropriate to prepare and plant the full-scale translocation.
- If the experimental trials meet the criteria that determines they have been a failure in the short term, then the reasons for the failure need to be investigated and future attempts are to be designed to rectify the reason for failure. Full-scale translocations are not to be implemented until the reasons for failure have been addressed.

- If the experimental trials meet the criteria that determines they have been a failure in the long term, then the conservation strategy may need to be revisited. A conservation introduction may need to be considered.
- If the full-scale translocations are considered to be successful, then on-going monitoring at five year intervals should be continued to ensure that the translocation population has not regressed.
- If the full-scale translocations are considered to be a failure, then the reasons for the failure need to be investigated and future attempts are to be designed to rectify the reason for failure.



Department of  
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