

Flora & Fauna Guarantee Action Statement

#75

This Action Statement was first published in 1996 and remains current. This version has been prepared for web publication. It retains the original text of the action statement, although contact information, the distribution map and the illustration may have been updated.

© The State of Victoria,
Department of
Sustainability and
Environment, 2003

Published by the
Department
of Sustainability and
Environment, Victoria.
8 Nicholson Street,
East Melbourne,
Victoria 3002 Australia

This publication may be of assistance to you but the State of Victoria and its employees do not guarantee that the publication is without flaw of any kind or is wholly appropriate for your particular purposes and therefore disclaims all liability for any error, loss or other consequence which may arise from you relying on any information in this publication.

ISSN 1448-9902



Northern Sandalwood *Santalum lanceolatum*

Preamble

This Action Statement forms a key step in the Flora and Fauna Guarantee program. It follows the listing of the Northern Sandalwood under the *Flora and Fauna Guarantee Act 1988*, and outlines action to be taken to ensure the long-term survival of the species.

Description and Distribution

Northern Sandalwood *Santalum lanceolatum* R. Br., also known as Plumbush (in South Australia) or Cherry Bush and Native Plum (in Queensland), is a tall shrub or small tree, 2-8 m high. It is noted for its highly aromatic wood and dark, furrowed bark, which is persistent to the smaller, pendulous branches. The thick grey-green leaves are 5-12 cm long, opposite, hairless and tapering to a short petiole. Flowering occurs throughout the year but is most prominent in spring and summer. The white-yellow flowers (7-10 mm long) are in short terminal or axillary panicles. The mature fruit is a 6-9 mm wide dark-blue drupe. The sweet flesh is edible, as is the central 'stone' (endocarp), which can be deeply pitted (Black 1963; Willis 1972 and Cheal 1980). In Australia, Northern Sandalwood is found in the interior of all mainland states and the Northern Territory (Willis 1972). The species is widespread, but not abundant, throughout arid and semi-arid Australia (Cheal 1980), and occurs in a wide range of woodland communities, ranging from sandhills to rocky hills (Cunningham *et al.* 1981).

Northern Victoria represents the southern edge of the species' range. Seven widely separated localities are known in Victoria.

Early authorities referred to only two localities - the Warby Range State Park east of Wangaratta, and Boundary Bend south-east of Robinvale (Cochrane *et al.* 1968; Willis 1972; Cheal 1980 and Costermans 1986).

However, Beauglehole (1986) recognised a third locality, on Murphy's Island near Torrumbarry, west of Echuca. Four additional localities have been recorded in recent times: one near Springhurst (about 30 km north-east of the Warby Range locality) in 1989, and the other three in the Mt Meg area (13 km south-west of the Warby Range population) in 1994-95.

The Warby Range, Springhurst and three Mt Meg populations are associated with rocky, generally northern slopes, which in the Warby Range case is particularly steep (30° or more). Outcropping granite boulders characterise the Springhurst site, while well-drained granite soils are a feature of all. Associated vegetation consists of low open-woodland dominated by Blakely's Red Gum (*Eucalyptus blakelyi*) and Red Stringybark (*Eucalyptus macrorhyncha*), and taller wattles, Lightwood (*Acacia implexa*) and Currawang (*Acacia doratoxylon*). The two remaining localities, at Boundary Bend and Torrumbarry, are associated with sandy alluvial soils and White Cypress-pine (*Callitris glaucophylla*) woodland on the Murray River floodplain. At Boundary Bend the associated vegetation consists of Hooked Needlewood (*Hakea tephrosperma*), Cooba (*Acacia ligulata*) and chenopod sub-shrubs (Sluiter *pers. comm.*), while Willow Wattle (*Acacia salicina*) is present at the Torrumbarry site.

Conservation Status

Current Status

CNR (1994) Endangered in Victoria

Northern Sandalwood has been listed as a threatened taxon under Schedule 2 of the *Flora and Fauna Guarantee Act 1988*.

Reasons for Conservation Status

Four of the seven known populations occur on Crown Land: Warby Range State Park and Mt. Meg Flora and Fauna Reserve (two populations) are managed primarily for nature conservation, while the Boundary Bend population occurs on 'River Murray Reserve' (LCC 1989), which is managed for a variety of public purposes. The three remaining populations occur on private land.

All known populations have, in the past, been represented by only a few individuals. Although a substantial increase in numbers has been recorded recently at three of the localities, the overall Victorian population size of 258 plants is still very small.

The Warby Range population has been documented for more than 30 years. Cochrane *et al.* (1968) and Garnet (1974) refer to only one old tree, with Garnet adding that, 10 years earlier, two ancient trees and two struggling seedlings were recorded. Cheal (1980) recorded nine individuals. The Warby Range population now totals 65 (1.5 ha), of which about half are 2 m or less in height. Although a real increase in the number of individuals is apparent, Cheal (*pers. comm.*) hypothesises that the majority, if not all, are likely to have progressively risen from root suckers originating from the oldest specimens.

Before the erection of protective fencing in June 1990, the Springhurst population consisted of nine mature to senescent individuals (3.5-6 m high). It now numbers 70 (0.3 ha). The additional plants, up to 2.5 m high have suckered vegetatively from roots of parent plants up to 20 m away.

Cheal (1980) refers to 'perhaps no more than two individuals' at the Boundary Bend locality. The population now numbers 40 (0.5 ha), including about 13 under 2.5 m high, the majority definitely being suckers (Pickering *pers. comm.*).

The Torrumbarry population consists of four individuals (1 ha): two mature plants and another under 2.5 m high.

Mt Meg Flora and Fauna Reserve supports two populations approximately 2 km apart, consisting of 60 (1 ha) and 3 (0.1 ha) plants. The private land locality, 1 km east of the smaller population, supports 16 plants (0.5 ha), consisting of three mature to old (but healthy) trees and the remainder young shrubs.

Historically, Northern Sandalwood was thought to be once more common throughout north central and north-eastern Victoria, and to be more widespread on rocky faces in the Warby Ranges. Much of the decline occurred late last century, after the gold rush, when out-of-work miners apparently exported consignments of the highly fragrant timber to Asia (Hall *pers. comm.*). Indeed, Brown (1953) refers to 'such large quantities being exported, principally

to China, that it became exterminated from many of its former Queensland haunts'.

By far the single most significant threat to the remaining Victorian populations is removal of plants under 1 m high and the inhibition of seedling and sucker recruitment through grazing. Cheal (1980) recognised that persistent grazing of seedlings across the species Australian range had, at that time, seriously hampered regeneration and resulted in the species becoming rare.

In its final recommendations, the Scientific Advisory Committee (SAC 1992) determined that the Northern Sandalwood is:

- significantly prone to future threats which are likely to result in extinction; and
- very rare in terms of abundance and distribution

Major Conservation Objectives

The major conservation objectives are to:

- protect and enhance all known Northern Sandalwood habitats;
- develop successful seed and cutting propagation techniques;
- establish four new stands in appropriate and secure public land sites by 1999; and
- increase the overall population from 258 to 450 within the next 10 years.

Management Issues

Ecological Issues Specific to the Taxon

Like all members of the Sandalwood family *Santalaceae*, Northern Sandalwood is parasitic on the roots of other plants (Cunningham *et al.* 1981, Costermans 1986). However, there is not enough knowledge of specific host relationships, and it is not known whether the species is an obligate parasite for all or only part of its life cycle.

Grazing of smaller plants and the associated inhibition of recruitment is the most significant ongoing threat to Northern Sandalwood. The impact of grazing is best documented for the Warby Range population. Garnet (1967) and (1974) indicated that rabbit and sheep grazing there had prevented all regeneration. Cheal (1980) noted an increase in Northern Sandalwood numbers after the phasing-out of sheep in the 1970s and their total removal in 1976. Feral goats preferentially grazed and caused significant damage to Northern Sandalwood until eradicated in 1982 (Hall *pers. comm.*). The further increase in the Warby Range Sandalwood population is attributed to the increased rabbit control within the Park.

At the Springhurst site, exclusion of stock and rabbit grazing through the erection of protective fencing has produced an eight-fold increase in Sandalwood numbers. However, grazing pressure has prevented regeneration at the Torrumbarry site (Woodward 1991). At the Warby Range site in particular, another potential (although minor) threat, is grazing by kangaroos and wallabies, which might be more pronounced in extended dry periods.

The apparent low rate or absence of sexual reproduction is a considerable threat to Northern Sandalwood. Although buds

and flowers form annually at all sites, fruit were not recorded at any of the known Victorian populations until May 1992, when considerable numbers were observed at the Warby Range site. Flower wasps (*Scolia* spp., family Scoliidae) have been observed feeding on Northern Sandalwood flowers (*pers. obs.*), but the role of invertebrate (or vertebrate) pollinators, and their possible absence due to low adult plant numbers, is unknown. Furthermore, although limited recruitment has been recorded at three sites, asexual reproduction (root-suckering) alone is presumed responsible for the recorded increase in numbers.

Past clearing of Northern Sandalwood for the production of essential oils is thought to have been widespread in northern Victoria (Hall *pers. comm.*) and elsewhere in Australia (Brown, 1953), and may be partly responsible for what is now a highly fragmented distribution. Inadequate genetic diversity within and genetic isolation between populations could predispose Northern Sandalwood to increased susceptibility to insect attack and disease. This view is supported by Cunningham *et al.* (1981), who note that Northern Sandalwood is often insect-ravaged.

Environmental weeds, namely Red-ink Weed (*Phytolacca octandra*) at the Springhurst locality, and Smilax Asparagus (*Myrsiphyllum asparagoides*), Asparagus (*Asparagus officinalis*), African Box-thorn (*Lycium ferocissimum*) and Horehound (*Marrubium vulgare*) at Boundary Bend are abundant, or have been so, and if unchecked may compete (to an unknown degree) with Northern Sandalwood. However, it is not known whether any of these plants are associated in host-parasite relationships.

The Boundary Bend population is further threatened by the Murray River, which is eroding the cliff face which supports the stand (Pickering *pers. comm.*). In addition, water seepage from a nearby private diverter's pump may pose a threat if further plantings are proposed at the site (Sluiter *pers. comm.*).

Visitor impact from groups inspecting the Warby Range population includes track formation, associated loss of native ground flora and subsequent weed invasion. Recreation pressure in the form of vehicular access to the river is causing an ongoing threat to the Boundary Bend population.

A fire originating from the nearby picnic area in 1979 was initially thought to have killed all Northern Sandalwoods at the Warby Range site, but all burnt individuals subsequently re-sprouted from dormant buds, and fire may have initiated some root-suckering. However, the species' life history is not well understood and its resilience to repeated burning is doubtful (Cheal 1980). It has been hypothesised that Northern Sandalwood was a flora component that was far more common in the south-eastern Australian landscape approximately 60,000 years BP - before the regime of frequent fires commenced. This might explain why Northern Sandalwood 'retreated' to less fire-prone rocky slopes, yet successfully grows on riparian sandy rises (Cheal, *pers. comm.*) Fire protection remains an important consideration.

Fleshy Mistletoe (*Amyema mirabilosum*) has been recorded on Northern Sandalwood in the Warby Range and at Boundary Bend. Fleshy Mistletoe occurs throughout northern Victoria and parasitises only members of the Santalaceae and Loranthaceae (Mistletoe) families. Jim Willis first recorded four plants of Fleshy Mistletoe on Northern Sandalwood in the Warby Range in 1971. At least seven mistletoe plants were recorded on the same tree in 1983, which raised concerns regarding their impact on the Sandalwoods. However, the culmination of the 1982-83 drought and associated stress on the host Sandalwood resulted in the death of all mistletoe plants (Hall *pers. comm.*). No further mistletoes were recorded until early in 1992, when one plant was found on the same old Northern Sandalwood. Fleshy Mistletoe's main host in the Warby Range is likely to be Drooping Mistletoe (*Amyema pendulum*) (Walsh *pers. comm.*), although it also forms a hyperparasitic relationship with Box Mistletoe (*Amyema miquelii*) (Race & Stelling 1987). The impact of mistletoe on Northern Sandalwood remains unclear.

Propagation from shoot-cuttings and seed germination trials, have to date, failed. However, new techniques are now available which may prove successful. Grant and Buttrose (1978) outline propagation techniques for the related Sweet Quandong (*Santalum acuminatum*), and CSIRO and others have since refined these procedures (Wilson 1991). In addition, Hall *et al.* (1972) give specific recommendations for *S. lanceolatum* germination. Propagation of Northern Sandalwood meets the criteria for, and is in accordance with, the Draft Threatened Species Policy (Royal Botanic Gardens 1991) for ex situ plant conservation.

Wider Conservation Issues

Achievement of the conservation objective will protect the gene pool and southern limit of the species' Australian range. Conservation of Northern Sandalwood will also help protect associated flora and fauna communities. The rocky cliff faces of the Warby Range site support regionally significant reptile species, including Burton's Snake Lizard (*Lialis burtonis*), Rainbow Skink (*Carlia tetradactyla*), and Black Rock Skink (*Egernia saxatilis intermedia*) (LCC 1983). Peregrine Falcons (*Falco peregrinus*) also periodically breed in this area. The rare Bluish Bulbine-lily (*Bulbine glauca*) will benefit from actions at both the Warby Range and Mt Meg Bushland Reserve sites. Similarly, the regionally significant Currawang will benefit from protection at the Springhurst site; natural regeneration has been observed already. Remnant vegetation containing White Cypress-pine and Hooked Needlewood, which is depleted in Victoria, will benefit from the implementation of management actions at the Torrumbarry and Boundary Bend localities.

Protection of the Northern Sandalwood sites complements native vegetation retention legislation under the S16 amendment of the *Planning and Environment Act 1987*. Pest animal control proposed for the Warby Range site complements (and will be assisted by) the current implementation of the Warby Range and Mt Meg pest plant and animal control plan and Good Neighbour Policy.

Social and Economic Issues

There are no major social and economic issues influencing the achievement of the conservation objective. Indeed, positive social outcomes for a relatively low economic outlay should result.

Protection and enhancement actions on private land (e.g. Springhurst site) have been (and in future, will only be) implemented through voluntary co-operative agreements with landholders. Landholder awareness and voluntary participation in conservation efforts are essential if the objective on private land is to be achieved.

Relatively small areas, such as 0.3 ha at Springhurst, 1 ha at Torrumbarry, and 0.5 ha at Mt Meg, are affected by intended actions. Foregone grazing potential is minor in view of the small area and relatively low carrying capacity of the land involved. Provision of financial assistance for stock-proof fencing, as has already occurred at Springhurst, will substantially reduce (or eliminate) direct costs to landholders.

There is some potential for sand extraction at the Torrumbarry site, however, the operation is not considered viable given alternate sources with easier access and closer proximity to markets.

At the Boundary Bend site, alternative track development will protect the Northern Sandalwood and maintain suitable vehicular access for river users, with little expenditure.

The establishment of an easily accessible stand near the Briens Gorge picnic area will enhance public viewing opportunities and awareness of threatened flora issues within the Warby Range State Park. There will also be continuing opportunity for involvement by the North East Field Naturalists (NEFN) and Friends of the Warbys (FOW) in monitoring and management at this site.

The successful development of propagation techniques and further research into the species may, in decades to come, provide economic opportunities in horticulture, specialty timber products (eg wood turning) and essential oils. Up to \$60 kg for top quality fruit is being obtained from cultivation of the closely related Sweet Quandong and bacteriological properties within the kernel of this species show great medicinal potential (Wilson 1991). The species ability and apparent preference to grow on relatively poor quality sites e.g. sand and rocky hills, that generally offer low agricultural return, further enhance its potential. However, protection of wild stocks from commercial exploitation would be necessary.

Previous Management Action

Warby Range Population

- 1980 Cheal (NPS) reports on species (nine plants recorded) and recommends management actions.
- 1982 Feral goats eradicated. Northern Sandalwood included in Register of Significant Trees.
- 1985 Rabbit-proof tree guards erected around approx. 25 plants under 1m high. Rabbit control works within State Park increased.

- 1988 Additional guarding of root-suckers undertaken.
- 1990 FOW undertake survey, 63 plants recorded.
- 1991 Shoot cuttings forwarded for propagation to Royal Botanic Gardens, Melbourne. Various trials ultimately fail. Detailed survey conducted by NEFN.
- 1992 Drupes (about 100) first collected for seed storage and propagation. *Amyema miraculosum* specimen lodged with National Herbarium of Victoria. Consultation and site inspections with community groups including FOW and NEFN regarding future management undertaken.
- 1993 Drupes (30) collected and forwarded to RBGM.
- 1994-6 Extensive control program for rabbits and St Johns Wort (*Hypericum perforatum*) implemented. La Trobe University (Wodonga campus) undertakes pollination and seed germination trials.

Boundary Bend Population

- 1982 Northern Sandalwood nominated for inclusion in the Register of Significant Trees.
- 1990 Monitoring identifies a number of threats and ameliorating actions including rubbish removal and weed control initiated.
- 1995 Liaison with the Boundary Bend Committee of Management, Landcare Group and Primary school initiated regarding Northern Sandalwood protection.

Springhurst

- 1990 Voluntary agreement with landholder results in the entire stand being protected by stock and rabbit-proof fencing (0.3 ha) erected through Flora and Fauna Guarantee Incentive funds. Rabbit eradication and Red-ink Weed control conducted within fenced area.
- 1991 Shoot cuttings forwarded to RBGM on two occasions. Propagation attempts fail.
- 1992-5 Additional weed control conducted. Monitoring identifies extensive vegetative Northern Sandalwood recruitment (60 plants), following prolonged stock enclosure.

Torrumbarry

- 1991 Detailed survey relocates Northern Sandalwood population, first documented by Beauglehole (1986). Monitoring conducted and threatening processes identified (Woodward 1991).
- 1992 Landholder liaison initiated and management options discussed.
- 1994 Post-fire monitoring undertaken.

Mt Meg Flora and Fauna Reserve and Private Land Site

- 1994-5 Populations discovered and surveyed; landholder liaison initiated.

Intended Management Action

The responsibility for implementin the management actions rests with the following:

- Department of Natural Resources and Environment: Parks, Flora and Fauna (PFF); North East Region (NER) and North West Region (NWR);
- Boundary Bend Committee of Management (COM).

The following organisations will be asked to assist in implementing the actions:

- the local Landcare Group (LCG) and Primary School (PS) at Boundary Bend;
- Friends of Warby Range State Park Inc. (FOW);
- Wangaratta Chapter, Society for Growing Australian Plants (SGAP);
- Botany Group, North East Field Naturalists Inc. (NEFN);
- Royal Botanic Gardens, Melbourne (RBGM); and
- La Trobe University - Wodonga Campus (LTU).

Monitoring

1. Initiate or continue annual monitoring of all known Northern Sandalwood populations, and establish permanent vegetation quadrats and photographic points. Complete Victorian Rare or Threatened Population (VROTPop) forms.

Responsibility: NER and NWR, Warby Range and Mt Meg populations: cooperative project with FOW and NEFN

Survey

2. Conduct field surveys for additional Northern Sandalwood stands in analogous habitats near existing populations, particularly the Chesneyvale/Mokoan hills (primarily private land) in the vicinity of the Mt. Meg populations, and Springhurst hills.

Responsibility: NER and NWR and community groups - via Botanic Guardians scheme

Liaison

3. Maintain effective landholder liaison to, where possible, develop and implement voluntary co-operative agreements, including the provision of financial assistance, to protect stands on private land.

Responsibility: NER and NWR

Collection and Propagation

4. Collect, in line with Departmental guidelines on ex-situ propagation, seed for storage and propagation. Amounts to be collected should be consistent with the conservation objective and not substantially deplete natural seed-fall in any year. Collect cuttings, in the absence of seed production, for propagation where stand establishment is prescribed. Conduct trials to successfully develop techniques to propagate Northern Sandalwood from seed and cuttings (refer Research section also). See also variation listed for Springhurst below.

Responsibility: NER and NWR, LTU, RBGM, FOW, NEFN and SGAP

Critical Habitat

5. Determine and ensure the protection of the critical habitat for Northern Sandalwood.

Responsibility: NER

Warby Range State Park Rabbit and weed control

6. As required, conduct rabbit control works to ensure numbers are kept to an acceptable minimum (based on vegetation and rabbit monitoring). Integrate works as part of the State Park rabbit control program. Undertake control of Slender Thistle (*Carduus tenuiflorus*) and other weeds as required.

Responsibility: NER, FOW, NEFN, SGAP

Fencing

7. If rabbit numbers increase beyond acceptable levels, consider erecting a small rabbit enclosure to enclose approximately one-third of the Northern Sandalwood population (0.25 ha), to provide an objective basis for assessing grazing impacts and the effectiveness of rabbit control works. Monitor the need to reinforce half the enclosure to exclude kangaroos and wallabies, so that their impact can be assessed.

Responsibility: NER, FOW, NEFN, SGAP

Planting

8. Establish two additional stands, comprising 10 plants each, in analogous habitats within the State Park, e.g. 1 km further south from the existing stand on the eastern escarpment, and in the rocky scarp of Salisbury Falls. Plants raised from seed rather than those asexually reproduced from shoot cuttings are to be used. (Initially) protect seedlings by erecting tree guards or grazing enclosures.

Responsibility: NER, FOW, NEFN, SGAP

Visitor Impact

9. Preclude the development of general public access tracks to sites on steep slopes. Liaise with FOW, NEFN and other interest groups to regulate site visits, and ensure access is limited to the gentler approaches to prevent further degradation of the steeper, erosion prone slopes. Monitor visitor impact annually and review guidelines as necessary.

Responsibility: NER, FOW, NEFN, SGAP

Interpretation

10. Include information on Northern Sandalwood and its management in Park leaflets and Information Shelters. To preclude visitor induced soil erosion and vegetation damage, specific locality details will be withheld for sites on steep slopes.

Responsibility: NER, FOW, NEFN, SGAP

11. Establish a smaller, third stand within relatively easy access of the nearby picnic area, to facilitate improved visitor awareness regarding threatened flora conservation and interpretation programs.

Responsibility: NER, FOW, NEFN, SGAP

Management Plan

12. Include the conservation objective and management actions prescribed in this document in the Warby Range State Park Interim Management Plan.

Responsibility: NER, FOW, NEFN, SGAP

13. Enter locality information into the Regional Fire Protection Plan and where possible preclude wildfire from the site.

Responsibility: NER, FOW, NEFN, SGAP

Mt Meg Flora and Fauns Reserve and Adjoining Private Land Site

Pest Plants and Animals

14. Undertake works where required and provide incentives to assist the control of St Johns Wort on private land.

Responsibility: NER, in conjunction with landholder

Boundary Bend

Access

15. Relocate vehicular track away from the Northern Sandalwood stand. Rip unwanted tracks and erect vehicular barriers.

Responsibility: NWR, in conjunction with Boundary Bend COM, LCG and PS

Signposting

16. Erect 'Rare Plant Reserve' signs to increase public awareness, minimise accidental site damage and provide educational value.

Responsibility NWR, in conjunction with Boundary Bend COM, LCG and PS:

Revegetation

17. Erect 'Rare Plant Reserve' signs to increase public awareness, minimise accidental site damage and provide educational value.

Responsibility: NWR, in conjunction with Boundary Bend COM, LCG and PS

Weed and Rubbish Control

18. Undertake eradication programs for Boxthorn, Smilax Asparagus, Asparagus and Horehound, control other weeds as required, and remove rubbish from the site.

Responsibility:

Erosion Control

19. Monitor erosion and undertake necessary control works.

Responsibility:

Springhurst

Weed Control

20. Eradicate Red-ink Weed and control other weeds as required.

Responsibility: NER, in conjunction with landholder.

Propagation

21. If propagation of Springhurst seed or cuttings fail, trial transplanting one or two (initially, up to 10 if successful), small plants of vegetative (root sucker) origin.

Responsibility: NER, in conjunction with landholder.

22. Sugarloaf Hill Bushland Reserve - Establish a Northern Sandalwood stand, comprising at least 10 individuals of the Springhurst site origin, in an analogous rocky, northern scarp of the Reserve. The objective is to introduce plants from the Springhurst gene pool into a nearby area of public land (of similar geology and vegetation) that is managed for nature conservation. Erect tree guards or small grazing enclosures to exclude rabbits. Ensure boundary fencelines are maintained in a stock-proof condition and that illegal stock grazing is prohibited.

Responsibility: NER, in conjunction with landholder.

Torrumbarry

Liaison

23. Liaise with the landholder about protecting the Sandalwood stand. Encourage voluntary co-operative agreement and a conservation covenant.

Responsibility: NWR

Fencing

24. Erect, through voluntary agreement, stock and rabbit-proof fencing. Provide one-off financial incentives to assist with fencing costs. Consider providing assistance to enable protection of the remnant White Cypress-pine community by fencing the entire sandhill from stock-grazing.

Responsibility: NWR

Pest Plants and Animals

25. Conduct rabbit and weed eradication programs within the fenced area, and complementary control works outside.

Responsibility: NWR

Other Desirable Management Action

Research

26. Encourage research to determine:

- factors that influence, and successful techniques for, seed germination and propagation from cuttings;
- the level of genetic variability within and between each population, and compare with populations in other states;
- whether observed recruitment in the wild is solely from asexual root-suckering;
- host-parasite relationships and requirements from seedling to maturity;
- natural pollinating agents and the factors that influence fertilisation and fruit production;
- the impact of soil disturbance on the production of root-suckers;
- the impact of fire on Sandalwood survival and recruitment; and
- rates of nutrient translocation and other impacts of Fleshy Mistletoe parasitism on Northern Sandalwood.

Responsibility: NER, LTU, RBGM

Legislative Powers Operating Legislation

Catchment and Land Protection Act 1994 - provides for the integrated management and protection of catchments, participation of the community and a system of controls for noxious weeds and pest animals.

Conservation Forests and Lands Act 1987 - provides for the management of public land under the Act, the coordination of legislation administered by NRE, and the preparation of codes of practice.

Crown Land (Reserves) Act 1978 - provides for reserving areas as public land and for making a specific reservation status for existing public land.

Country Fire Authority Act 1958 - provides for fire protection and suppression in country areas and requires that authorities take practical steps for the prevention of fires.

Fences Act 1968 - provides guidelines for the control, maintenance and repair of dividing fences.

Flora and Fauna Guarantee Act 1988 - regulates the taking of listed biota and protected flora from the wild and provides for critical habitat protection. *Santalum lanceolatum* is protected flora under this Act.

Forests Act 1958 - provides for the granting of licences to take forest produce and the protection of native forest plants.

Land Conservation Act 1970 - provides for the reservation of Crown Land and the determination of uses.

National Parks Act 1975 - provides for the reservation and protection of parks.

Planning and Environment Act 1987 - provides for land-use controls and follow-up to Interim Conservation Order controls, and the establishment of covenants with landholders and local governments.

Victorian Conservation Trust Act 1972 - provides for the establishment of conservation covenants on land titles.

Licence/Permit Conditions

Permits for the collection of Northern Sandalwood seed, roots or foliage will be given only for work which will not jeopardise the achievement of the major conservation objective, and which is in accordance with the prescribed management actions.

Consultation and Community Participation

The NEFN and FOW have participated in monitoring work for many years. They have been consulted regarding proposed management directions and shall continue to be involved in the implementation and review of this Action Statement. Specifically, they will have the opportunity and be encouraged to participate in future monitoring, survey, restoration and planting works.

Community awareness of the species' presence, particularly in the Warby Range, has been generated by various publications, e.g. Costermans (1986) and various Park leaflets. The production of extension and interpretive

material will increase this awareness. Interpretive signposting at the Boundary Bend site will similarly provide educational value and provide an opportunity for on-going community participation, particularly involving the Boundary Bend COM, LCG and PS.

The Mallee, Goulburn and North-East Catchment and Land Protection Boards will be kept informed of the implementation of this Action Statement.

Liaison with, and provision of financial assistance to, the Springhurst site landholder has proved very successful. Ongoing consultation and assistance will occur with all landholders involved.

The National Trust of Australia (Victoria) has received two Northern Sandalwood nominations for inclusion to the Register of Significant Trees.

Implementation, Evaluation and Review

The Managers of NRE's North East and North West Regions, and the Parks, Flora and Fauna Division, shall be primarily responsible for coordinating and over-seeing implementation. Annual evaluation of the Action Statement will be the responsibility of Regional Flora and Fauna Coordinators.

Contacts

Management

Flora & Fauna Officers, NRE North East and North West Regions

Flora and Fauna Coordinator, NRE Wodonga

Chief Ranger (Murray PMA), Wodonga

Ranger-in-Charge, Warby Range State Park (including Mt Meg Flora and Fauna Reserve)

Biology

NRE Flora and Fauna Branch Staff of the Royal Botanic Gardens, Melbourne

Personal Communications

D. Cheal, botanist, University of Melbourne

A.W. Hall, RMB 4710 Glenrowan 3675

Pickering, G. Senior Catchment and Land Management Office - Eastern Mallee, NRE Swan Hill

I. Sluiter, formerly NRE North West Region, Mildura

N. Walsh, National Herbarium of Victoria, South Yarra

Compiler: Glen Johnson,
North East Region, NRE

Further information

Further information can be obtained from Department of Sustainability and Environment Customer Service Centre on 136 186.

Flora and Fauna Guarantee Action Statements are available from the Department of Sustainability and Environment website: <http://www.dse.vic.gov.au>

References

- Black, J.M. (1963) Flora of South Australia, Part II *Casuarinaceae* and *Euphorbiaceae*, SAGPO: Adelaide.
- Beauglehole, A.C. (1986) The Distribution and Conservation of Vascular Plants in the Murray Valley, Victoria. Victorian Field Naturalists Club Association, Portland.
- Brown, C. (1953) Trees of a Queensland Sheep and Cattle Station. *Walkabout* **19**(11):39-43.
- CNR (1994) Victorian Flora Species List (including vascular and non-vascular taxa). Flora Section, Department of Conservation & Natural Resources: Heidelberg.
- Cochrane, G.R., Fuhrer, B.A., Rotherham, E.R. and Willis, J.H. (eds) (1968) Australian Flora in Colour - Flowers and Plants of Victoria. p. 81. AH & AW Reed: Sydney.
- Costermans, L.F. (1986) Native Trees and Shrubs of south-eastern Australia. Revised edition. p. 170. Rigby Publishers: Sydney.
- Cheal, D.C. (1980) Rare and Endangered Plants in Parks No. 2 - *Santalum lanceolatum*. File 76/1696. Flora Survey Group, Resource Assessment Branch, Department of Conservation, Forests and Lands: Melbourne (unpubl.).
- Cunningham, G.M., Mulham, W.E., Milthorpe, P.L. and Leigh, J.H. (1981) Plants of Western New South Wales. p. 227. NSWGPO: Sydney.
- Garnet, J.T. (1967) The Warby Ranges. *Victorian Naturalist* **84**: 136-140.
- Garnet, J.T. (1974) The perpetuation of species - to be or not to be? *Victoria's Resources* **16**(3):21-26.
- Grant, W.J.R. and Buttrose, M.S. (1978) *Santalum* fruit. Domestication of the Quandong, *Santalum acuminatum* (R. Br.) A. DC *Australian Plants* **9**: 31--318.
- Hall, N., Boden, R. W., Christian, C.S., Condon, R. W., Dale, F. A., Hart, A.J., Leigh, J.H., Marshall, J.K., McArthur, A.G., Russell, V. & Turnbull, J. W. (1972) The Use of Tree and Shrubs in the Dry Country of Australia Pub. AGPS: Canberra.
- Land Conservation Council (1983) Report on the Murray Valley Area. Land Conservation Council. VGPO: Melbourne.
- Land Conservation Council (1989) Final Recommendations, Mallee Area (Review). VGPO: Melbourne.
- McDougall, K. (1989) The Re-establishment of *Themeda triandra* (Kangaroo Grass) : Implications for the Restoration of Grassland. Arthur Rylah Institute of Environmental Research, Technical Report No. 89. Department of Conservation, Forests and Lands: Melbourne.
- Race, D. and Stelling, F. (1987) Mistletoe Ecology in Melbourne's Bushland. Victorian College of Agricultural and Horticulture: Burnley (unpubl.)
- RBG (1991) Draft Threatened Species Policy. Royal Botanic Gardens: South Yarra.
- Willis, J.H. (1972) A Handbook to Plants in Victoria. Volume II: Dicotyledons. p. 65. Melbourne University Press: Carlton.
- Wilson, G. (1991) Sweet Quandong - a great new tree crop. *International Tree Crops* **1**(2): 4-6.
- Woodward, M. (1991) *Santalum lanceolatum* - Murphy Island, Torrumbarry. File C88-05. Bendigo office, Department of Natural Resources & Environment (unpubl.).